



**Univerzitet u Beogradu
Fakultet sporta i fizičkog vaspitanja**



Ministry of Education, Science and
Technological Development,
Republic of Serbia

**MEĐUNARODNA NAUČNA KONFERENCIJA
Efekti primene fizičke aktivnosti
na antropološki status dece, omladine i odraslih**

ZBORNİK RADOVA

BOOK OF PROCEEDINGS

**INTERNATIONAL SCIENTIFIC CONFERENCE
Effects of Physical Activity Application to
Anthropological Status with Children, Adolescents
and Adults**

Editors:

Dejan Suzović, Nenad Janković, Goran Prebeg and Marko Ćosić

University of Belgrade - Faculty of Sport and Physical Education

December 12th 2018, Belgrade, Republic of Serbia



Министарство просвете,
науке и технолошког развоја

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STATUS OF CHILDREN, ADOLESCENTS AND ADULTS

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DECE, OMLADINE I ODRASLIH

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Dear colleagues, participants of the Conference

We wish you a welcome to the Faculty of Sport and Physical Education of the University of Belgrade, which this year celebrating the anniversary, **80 years** since foundation. The first Faculty in this region celebrating anniversary also organizes an international scientific conference, which is traditionally organized on the occasion of the Faculty Day. The conference entitled “The Effects of Applying Physical Activity on the Anthropological Status of Children, Adolescents and Adults” has been organized since 2011 and this year has its 8th edition. The Ministry of Education, Science and Technological Development of the Republic of Serbia, the Ministry of Youth and Sports of the Republic of Serbia and the Olympic Committee of Serbia have supported the organization of the Conference as well as in previous years.

The conference enables interaction of all participants during formal sessions, presentations and exchange of new knowledge and results of scientific research in order to enrich modern analytical approaches in monitoring and application of physical activities. We also hope that during socializing in an informal ambience, participants will exchange ideas, enrich knowledge, and create new friendships.

According to the defined criteria, a large number of papers were reported within the thematic areas, and after the review, the Scientific Committee accepted 79 abstracts in Serbian and English language. The selected abstracts are arranged in 9 sessions for oral presentations and one poster session. In the preparation of the Book of Abstracts, distribution was done according to the thematic areas and the methodological structures of abstracts.

It is our great pleasure to inform you that at the Conference in the jubilee year of the Faculty, besides a large number of scientists, professors and students from Serbia, participate very significant number of our respected colleagues and colleagues from a large number of countries in the region and the European Union. A wide range of thematic areas contributed to interdisciplinary work by including research from related scientific fields and institutions.

We wish all authors the successful presentation of papers, active participation in the work of the Conference and acquiring new knowledge and exchange of professional and scientific experiences, with a pleasant stay in Belgrade, as well as at the Faculty of Sport and Physical Education of the University of Belgrade.

Presidents of the Scientific Committee of the Conference

Dejan Suzović, PhD, assoc. prof.

Nenad Janković, PhD, assoc. prof.

Poštovane kolegice i kolege, učesnici Konferencije

Želimo Vam dobrodošlicu na Fakultet sporta i fizičkog vaspitanja Univerziteta u Beogradu koji ove godine slavi jubilej, **80 godina** od nastanka. Matični fakultet na ovim prostorima slaveći jubilej organizuje i međunarodnu naučnu konferenciju, koja se tradicionalno održava povodom Dana fakulteta. Konferencija se pod nazivom: „Efekti primene fizičke aktivnosti na antropološki status dece, omladine i odraslih“ organizuje od 2011. i ove godine ima svoje 8. izdanje. Podršku organizaciji Konferencije ove, kao i prethodnih godina dali su Ministarstvo prosvete, nauke i tehnološkog razvoja Republike Srbije, Ministarstvo omladine i sporta Republike Srbije i Olimpijski komitet Srbije.

Konferencija omogućava interakciju svih učesnika tokom formalnih sesija, prezentacija i razmene novih saznanja i rezultata naučnih istraživanja sa ciljem obogaćivanja savremenih analitičkih pristupa u praćenju i primeni fizičkih aktivnosti. Takođe se nadamo da će se tokom druženja u neformalnoj atmosferi razmenjivati ideje i obogaćivati znanja ali i stvarati nova prijateljstva.

Prema definisanim kriterijumima, u okviru tematskih područja prijavljen je veliki broj radova, a nakon recenzija naučni odbor prihvatio je 79 sažetaka radova, na srpskom i engleskom jeziku. Odabrani radovi raspoređeni su u 9 sesija za usmene prezentacije i jednu poster sesiju. U pripremanju Zbornika sažetaka izvršeno je raspoređivanje radova prema tematskim oblastima i ujednačavanje metodoloških struktura radova.

Posebno nam je zadovoljstvo da Vas obavestimo da na Konferenciji u jubilarnoj godini Fakulteta pored velikog broja naučnika, profesora i studenata iz Srbije učestvuje i izuzetno značajan broj naših poštovanih koleginica i kolega iz velikog broja država regiona i Evropske unije. Širok spektar tematskih oblasti doprineo je interdisciplinarnosti radova uključivanjem istraživanja iz srodnih naučnih oblasti i institucija.

Svim autorima želimo uspešnu prezentaciju radova, aktivno učešće u radu Konferencije i sticanje novih saznanja i razmenu stručnih i naučnih iskustava, uz prijatan boravak u Beogradu, kao i na Fakultetu sporta i fizičkog vaspitanja Univerziteta u Beogradu.

Predsednici naučnog odbora Konferencije

Dr Dejan Suzović, van. prof.

Dr Nenad Janković, van. prof.

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Invited Lecture

Pozivna predavanja

FROM COMPLICATED BIOMECHANICS TO MEANINGFUL PRACTICE

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The application of biomechanics to the analysis of sports techniques includes different approaches from a deterministic (Chow et al., 2011) but also an ecological (Glazier et al., 2011) theoretical framework. A first level of analysis would be the performance analysis of a team or individual both in competition or training situation. The biomechanics laboratory team at the Technical University of Madrid has developed different methodologies for the two-dimensional analysis of the kinematics during competition in soccer (Mallo et al., 2010), triathlon (Cala et al., 2009) or swimming (Veiga et al., 2013; Perez-Tejero et al., 2017). Also, the analysis of the pacing strategies of open water swimmers has been examined during World Swimming Championships (Rodríguez and Veiga, 2017). A second level of analysis would be the analysis of segmental or the center of mass kinematics to describe how movements are performed. Usually, discrete measurement at key instants of the sport technique are detected even if it is more representative the analysis of continuous parameters along the movement execution. In this subject, the free-ware tool Kinovea (<https://www.kinovea.org/>) provide multiple possibilities for research and teaching with simple and accurate applications of several sport techniques. This resource has been extended with the development of the perspective analysis which allows to simulate the 2D-DLT techniques. A third level of analysis would be the analysis of the kinematics of one body landmark (usually joint center or segment) in relation to the movement of another body landmark. This represents the analysis of coordination which could allow a more in depth understanding of dynamics of sport techniques. Previous studies have examined the discrete analysis of coordination on the swimming techniques (Seifert, 2009) but few attempts have been developed to apply the continuous methods of analysis (like vector coding or relative phase analyses) to the sports techniques. These and other types of analyses as well as their applications and theoretical framework will be further discussed in the present lecture.

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OPTIMIZATION IN THE PREDICTION OF THE ONE-REPETITION MAXIMUM THROUGH MOVEMENT VELOCITY

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The one-repetition maximum (i.e., maximum load that can be lifted only one time; 1RM) is commonly used for evaluating an individual's maximal strength as well as for prescribing loads during resistance training sessions. However, since the direct determination of the 1RM may not be feasible or practical at all time points throughout the training cycle, alternative methods that can accurately estimate maximal strength through less physically demanding testing may be of benefit. Early research proposed different equations to estimate 1RM strength using the maximum number of repetitions performed before reaching muscular failure (i.e., "lifts-to-failure equations"). However, the accuracy of lifts-to-failure equations could be compromised by several factors (e.g., type of exercise, lifting tempo, subjects' training history, etc.) and its frequent use may interfere with the long-term development of explosive actions performance. Subsequently, contemporary methods that account for movement velocity at submaximal loads have received increased attention as less time consuming and less prone to fatigue method for predicting the exercise 1RM. General load-velocity relationship equations have been proposed to estimate the 1RM during a variety of resistance training exercises by recording the mean velocity of a single repetition performed with maximal intended velocity. However, since the use of general-load velocity relationships is associated with important drawbacks (i.e., exercise-specific, contraction-specific, device-specific, and subject-specific), it has been suggested that the individual load-velocity relationship should be considered for a more accurate estimation of the 1RM.

In this talk, I will present the results of different studies that have compared the reliability and validity of the different 1RM prediction methods (lifts-to-failure equations, general load-velocity relationship, and individual L-V relationship). Furthermore, a number of practical recommendations to maximize the accuracy in the prediction of the 1RM through movement velocity will be provided. Specifically, I will discuss the importance of several factors such as the type of velocity variable, regression model, measurement device, or magnitude and number of loads. Finally, the steps needed to quickly estimate the 1RM through the individual load-velocity relationship will be detailed: (i) setting of the exercise-specific velocity of the 1RM, (ii) recording of the mean velocity against two different external loads, and (iii) modelling of the individual load-velocity relationship and determining the 1RM as the load associated with the velocity of the 1RM.

“TO RESTORE THE MENTAL AND BODY HEALTH OF OUR PEOPLE AND TO STRENGTHEN HIS LIFE FORCE”: THE FORMATION OF THE YUGOSLAV STATE AND THE PHYSICAL/BODY CULTURE

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Introduction

The article deals with the centenary of the end of the First World War and the formation of the Yugoslav state on December 1st 1918, and the issue of the new state and the role of Physical Culture. The research topic is based on secondary sources, in particular the newspaper, and in the case of gymnastic Sokol organizations publications of their administrative bodies, that is Sokolski glasnik, which it can be considered as the primary source; otherwise the research makes it difficult for the modest primary archival material.

Discussion

During the second half of the nineteenth century, the Body or Physical Culture spread between the Slavs of the Austro-Hungarian Empire and the Serbs of the Kingdom of Serbia. From the amusement leisure activity it went through the process of socializing into a socially diversified societal activity with umbrella national organizations and inter-national and panslavic links, as well as the first international memberships. Parallel a compulsory subject of physical exercise or gymnastics was introduced in the school premises, whereby every school-age child was given the opportunity to meet at least the minimum with a cultural novelty. The well-born activity was temporarily interrupted by the Great War, and with its completion in November 1918 and the formation of the Yugoslav state, the physical-cultural organizations found themselves in a new situation within the general problems such as the organization of political life and question of constitution, war damage and renewal, the reorientation of the economy to the peacetime industry, demobilization and unemployment, battles for the borders, emigration from Italy's occupied territories.

The new time, the time of peace and the South Slavic merger and political recognition brought before them dilemmas and decisions on the way forward, especially the process of Yugoslavization and centralization of organisations, which started already in the beginning of 1919, the challenges of consolidating their activities among themselves and in the new political and cultural environment, and also entering the school milieu.

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**Methodical aspects of the
effects of physical activity
application in dance,
gymnastics and recreation**

Metodički aspekti primene
fizičke aktivnosti u plesu,
gimnastici i rekreaciji

ELEMENTS OF ARTISTIC GYMNASTICS AS BODY SHAPING EXERCISES IN GROUP FITNESS PROGRAMS

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Introduction

Scientific findings convincingly show that physical inactivity is one of the most potent health degradation factors (Vuori, 2004), and that every targeted systematically repeated physical activity is important in protection of health (Andrijasevic, 2000). Physical exercise should ensure the upright posture and good functioning of the organs (Jajcevic, 1997), so physical fitness can be seen as the ability to perform moderate to strong physical activities without excessive fatigue, ie. the ability developed by exercising due to which a person can carry out basic activities of daily life and spend leisure time actively (Trninc, 2006). Since habit leads to the need for movement, if developed, it will have an optimal effect (O'Sullivan, 2004; Tappe & Burgesson, 2004), on those activities for which, based on research in target groups, a positive attitude and acceptance is determined (Fras, 2002). Sports recreation is part of a wide area of recreation, whereby physical activation meets general human needs, maintenance and improvement of psychophysical abilities (Andrijasevic, 2010.) Group fitness programs are the most widespread form of sports recreation, and as systematically repeated recreational forms of exercise, they have positive effects on the transformation of the functional abilities of the organism and the change in body composition (McCord, Nichols & Patterson, 1989). Body shaping exercises are natural movements of individual parts of the body done in their basic or altered mechanical form with a goal of creation of habits for their daily application with the aim of developing general physical abilities and work potential, improving motor skills aimed at rational use of movement, and changing physical exterior and improving quality of locomotor apparatus (Tomic, 1975). In modern society, gymnastics, and especially acrobatics, exist in: education, competitive sport, other sports branches, other areas of sports activities and physical activities, kinesitherapy programs, and recreational forms of exercise (Zivcic & Kristicevic, 2008). Gymnastics as a physical activity is rich in diversity of movements and positions and promotes health, self-control and performance of movements with maximum precision, while gymnastics as a sport focuses on the development of individuality, and gymnasts make combinations of movements with arms and legs using seven basic steps: walking, running by swinging lower legs, split tuck jumping, low leg front reach, high leg front reach jumping forward or aside under 90°, jumping into a straddle position, jumping backward or aside (Pintar, Caput-Jogunica & Curković, 2006). In exercises on apparatuses and on floor, one insists on a beautiful and proper body position and beautifully shaped movements (Kyselovlcová & Tibenská, 2007; Broomfied, 2011). In today's society, body shaping exercises and artistic gymnastics are an integral part of education, sports activities, kinesitherapy programs, and recreational forms of exercise (Zivcic & Kristicevic, 2008).

As one of the most important roles in artistic gymnastics is the development of motor skills of coordination, strength, flexibility and balance (Badic, Zivcic Markovic, Sporis, Milanovic & Trajkovic, 2012) and since exercises that include functional movement of the body with topological order are selected as body shaping exercises, this research was carried out with the aim of determining the effects of the application of elements of artistic gymnastics, such as body shaping exercises, on body composition and mobility and the

stability of female respondents in order to find new ways of applying movable structures in group fitness programs.

Methods

The research was conducted on a sample of 42 female respondents of the mean age of 37 years +/- 6 months, (the experimental group consisted of 22, and a control group of 20 respondents). The experimental group respondents were subjected to group exercises, while respondents in the control group did not exercise some form of physical activity.

The program of exercises (Table 1) was designed according to the program implemented by Kristicevic, Milcic, Solja, Moznik, Zivcic Markovic (2016) and Trajkovic, Madic, Sporis, Aleksic-Veljkovic, Zivcic-Markovic (2016), and it is designed to improve muscle strength, flexibility and mobility, it lasted for eight weeks, during which the respondents practiced three times a week for 45 minutes, while the elements of artistic gymnastics such as a stand on the blades - a candle, a roll forward, a roll back, a roll forward with legs spread (straddle), a roll back with legs spread (straddle), a roll forward clear away, a roll back clear away, scale, small scale, hangings, planks, beam elements are applied according to the principle of application of body shaping exercises both for a certain time duration or number of repetitions depending on the nature of the exercise.

Each training was supervised by a artistic gymnastics trainer and a teacher of physical education, and it was conducted according to stages - the first phase included warming up by slow running and stretching and ending with a polygon with different types of movements, in the second phase elements of artistic gymnastics were used as body shaping exercises, where exercises are performed in two-, three- and four-quarters rhythm, depending on the week of training and part of the second training phase (in the initial weeks, a two-quarter rhythm was used in the first part of the second phase of training and three-quarters rhythm in the second part of the second phase of training, while in the final weeks, in the first part of the second phase of training a two-quarters or three-quarters rhythms were used and four-quarters rhythm in the second part of the second phase of training), while in the third phase of the training the focus was on restoring the normal level of emotional, mental and physiological body function and re-establishing the same condition of the respondents in which they were before the start of the training.

In the first part of the second phase of the training, the elements of artistic gymnastics were applied in the way that the body shaping exercises (according to the topographic regions of the body) are applied, and with the aim of corrective and preventive action on the locomotor apparatus, and in the second part of the second phase of training leaps aimed to increase the frequency of the heart at a higher level (which meets the principles of fitness training) and strengthening and stabilization of joints and soft structures of lower extremities. All exercises were verbally explained and demonstrated. The most commonly used methodological organizational form of work was work in groups of 3-5 (depending on the exercise and apparatus on which the exercise was performed) and frontal work. The respondents were divided into 4-5 groups and changed their place according to the number of repetitions or when the planned time for this exercise ends. The first, second B and the third phase of the training were conducted according to the program (Table 1) at each training with minimal changes in the type of jumps and stretching exercises without changing the load and intensity.

Table 1. Exercise program

		Goal: improving motor skills and health
FIRST STAGE OF TRAINING	Warming up	General warming up followed by a polygon with different types of movements carried out in the positions of lying on the back, elbow and side flanks, knee flanks, and lying with face on floor. Five rounds with a break of 20 seconds:
		<i>First training</i> <ul style="list-style-type: none"> leg front reach, leg abductions (lifting leg laterally) on the floor on elbows - 4 to 8 each leg leg abductions and raising legs on side, kneeling plank and facing floor - 5 to 10 repetitions
		<i>Second training</i> <ul style="list-style-type: none"> front and side split - 5 to 10 repetitions roll forward, roll back, roll forward with legs spread (straddle), roll back with legs spread (straddle), roll forward clear away, roll back clear away, candle, handstand - 5-10 repetitions each exercise
SECOND PART OF TRAINING A	Gymnastics (Acrobatics)	<i>Third training</i> <ul style="list-style-type: none"> variants of swing from lying position - 5-10 repetitions back and stomach planks - 30 sec to 90 sec on beam - grand battements, forward, side and back, scale, small scale - 5-10 repetitions different swings on bars, swings on pommel horse - 8 to 10 times for each leg
		Jumps
SECOND PART OF TRAINING B	Mini trampoline	Straddle and two foot jumps - 15-20 jumps
	THIRD PART OF TRAINING	Parallel bars
Stretching		5 minutes of stretching for muscle groups that were mainly included in the sessions

The effects of the program were established before and after the exercise program based on the assessment of the body composition (Body Composition Analyzer TANITA BC 418). The tested variables are: percentage of fatty tissue (FAT%), percentage of fatty tissue of left (FATla%) and right arm (FATra%), percentage of fatty tissue of left (FATll%) and right leg (FATrl%), and percentage of trunk fat FATtr%), and estimates of the level of mobility and stability based on the FMS method (*Functional movement screening*) (seven tests).

The statistical program SPSS 16,0 and the following statistical methods were used to obtain valid results: the basic descriptive statistics, the KS test-analysis of the normality of the results, the independent t-test analysis of the differences between the groups and the dependent t-test analysis of the differences within the group.

Results with discussion

Table 2 - Descriptive statistics of results of body composition and FMS initial measurement of both groups

experimental				control				
N	M	SD	KS test		N	M	SD	KS test
22	36.21	6.38	0.59	FATr1%	20	34.47	5.69	0.29
22	35.25	6.72	0.45	FATr2%	20	34.19	5.17	0.13
22	31.39	7.55	0.95	FATra%	20	28.57	6.17	0.43
22	32.22	7.83	0.87	FATla%	20	28.80	6.67	0.19
22	29.62	9.28	0.64	FATtr%	20	25.90	9.63	0.42
22	1.52	0.52	0.54	deep squat	20	1.61	0.51	0.54
22	1.52	0.52	0.70	step over hurdle	20	1.71	0.48	0.70
22	1.42	0.52	0.45	step forward in sagittal plane	20	1.49	0.52	0.45
22	2.15	0.83	0.54	active lifting of stretched leg	20	2.11	0.52	0.54
22	2.29	0.67	0.54	rotatory trunk stability	20	2.35	0.51	0.54
22	12.77	1.97	0.18	fmstotal	20	13.14	1.93	0.06

Legend: N - number of respondents, M - mean value, SD - mean value deviation, KS test - schedule normality test

Table 2 shows the results of the basic descriptive parameters in both groups of respondents at the initial measurement. The values of the KS test are significantly higher than 0.05, which allows further use of parametric statistics in the analysis of the results.

Table 3 - Results of an independent T-test, difference between the experimental and the control group at the initial measurement

	t	df.	sig.
FATdn%	1.09	41	0.312
FATln%	1.58	41	0.135
FATdr%	1.12	41	0.268
FATln%	1.49	41	0.142
FATtr%	1.70	41	0.096
deep squat	1.87	41	0.084
step over hurdle	1.63	41	0.121
active lifting of stretched leg	1.71	41	0.109
rotatory stability	1.94	41	0.072
step forward in sagittal plane	1.10	41	0.285
shoulders mobility	1.57	41	0.121
stability of trunk at push-up	0.54	41	0.428
fmstotal	1.22	41	0.301

Legend: t - value of t-test, df - degree of freedom, Sig. - statistical significance

Table 3 shows the results of an independent t-test that analyzed the difference between body composition results and mobility between the experimental and control group of the respondents. Significance values are significantly higher than 0.05, which proves that there is no statistically significant difference between the respondents of both groups at the initial measurement. This allows the exercise program to run smoothly, as all undesired effects that can affect the results of the experiment are excluded.

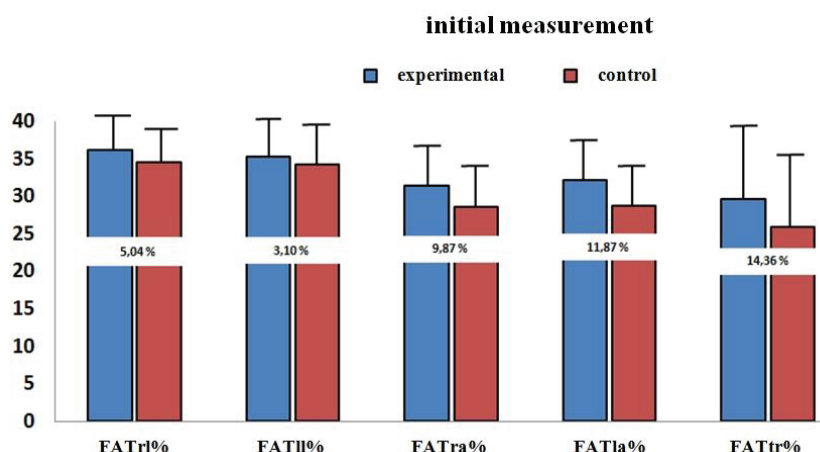


Diagram 1 - Differences between groups in the results of body composition measurements at the initial measurement

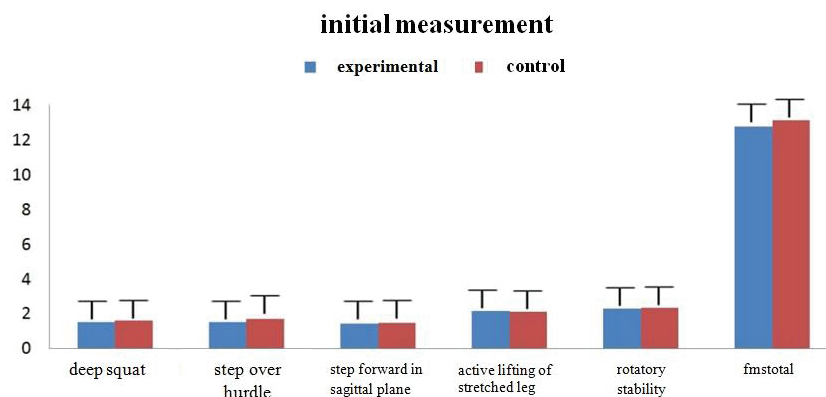


Diagram 2 - Differences between groups in the results of measuring the level of mobility and stability based on the FMS method at the initial measurement

Table 4 - Descriptive statistics of results of body composition and FMS final measurement of both groups

experimental				control				
N	M	SD	KS test		N	M	SD	KS test
22	35.62	5.80	0.53	FATr1%	20	33.67	5.95	0.27
22	34.73	6.19	0.34	FATI1%	20	33.70	5.38	0.17
22	30.47	7.40	0.97	FATra%	20	28.12	6.21	0.38
22	31.77	8.11	0.93	FATIa%	20	28.37	6.66	0.13
22	28.87	9.04	0.44	FATtr%	20	33.09	7.02	0.20
22	2.11	0.54	0.47	deep squat	20	1.55	0.53	0.47
22	1.84	0.76	0.37	step over hurdle	20	1.47	0.53	0.36
22	1.84	0.76	0.37	step forward in sagittal plane	20	1.42	0.52	0.48
22	2.55	0.69	0.55	active lifting of stretched leg	20	2.12	0.49	0.37
22	2.82	0.45	0.37	rotatory trunk stability	20	2.31	0.81	0.49
22	15.90	1.57	0.52	fmstotal	20	13.67	5.95	0.27

Legend: N - number of respondents, M - mean value, SD - mean value deviation, KS test - schedule normality test

Table 4 shows the results of the basic descriptive parameters in both groups of respondents at the final measurement. The values of the KS test are also significantly higher than 0.05, which allows further use of parametric statistics in the analysis of the results. By analyzing the average values of the initial and final measurement results, it can be concluded that there have been some changes in the experimental and control group of the respondents. After the exercise program, in the experimental group there was a decrease in all subcutaneous fat tissue values (fat right leg, fat left leg, fat left arm, fat right arm and fat trunk), as well as improved results that analyzed the level of mobility and stability based on the FMS method.

Table 5 - Results of independent T-test, difference between experimental and control group at final measurement

	t	df.	sig.
FATdn%	-3.09	41	0.012
FATln%	-3.58	41	0.005
FATdr%	1.12	41	0.268
FATln%	1.49	41	0.142
FATtr%	-2.70	41	0.036
deep squat	11.87	41	0.000
step over hurdle	8.63	41	0.000
active lifting of stretched leg	5.71	41	0.000
rotatory stability	12.94	41	0.000
step forward in sagittal plane	1.10	41	0.285
shoulders mobility	1.57	41	0.121
stability of trunk at push-up	0.54	41	0.428
fmstotal	14.22	41	0.000

Legend: t - value of t-test, df - degree of freedom, Sig. - statistical significance

Table 5 shows the results of an independent t-test, which analyzed the differences in the results of the final measurement between the two groups of respondents. Significance values indicate that a statistically significant difference was observed only in the results of the test that measured the mobility of trunk. Based on this, it can be concluded that the exercise program successfully influenced the increase in mobility in the experimental group. Although there was a decrease in the value of unwanted fat in certain segments in the experimental group, no statistically significant difference was found between the groups of respondents.

Between the groups at the final measurement, a statistically significant difference in the body composition variables was observed - percentage of fat tissue of right leg $t = -3,09$ $p = 0,012$, percentage of fat tissue of left leg $t = -3,58$ $p = 0,005$, percentage of fat tissue of trunk $t = -2,70$ $p = 0,036$ and in mobility and stability $t = 14,22$ $p = 0,000$ i.e. at four tests from the FMS tests complex: deep squat $t = 11,87$ $p = 0,000$, step over hurdle $t = 8,63$ $p = 0,000$; active lifting of stretched leg $t = 5,71$ $p = 0,000$ and rotatory trunk stability $t = 12,94$ $p = 0,000$). Based on the results obtained after the statistical analysis, it can be concluded that the application of the group fitness program had a positive effect, i.e. that the application of the elements of artistic gymnastics according to the principle of application of body shaping exercises, during eight weeks, led to a change in the percentage of fat tissue of the lower extremities and trunk and to the improvement of the mobility and stability of the female respondents.

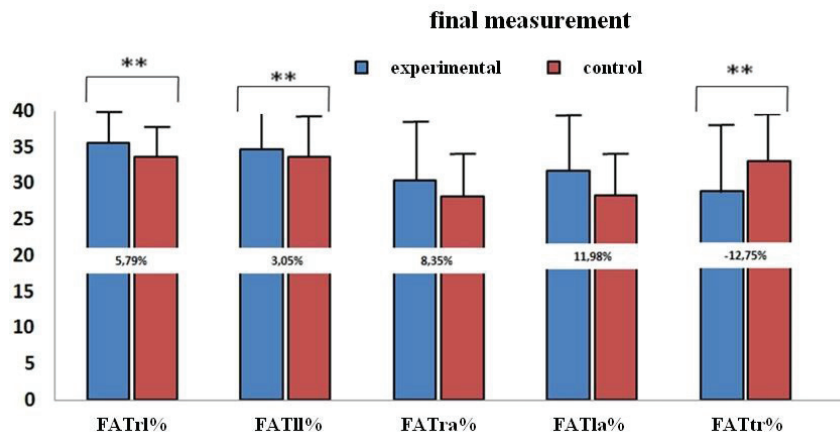


Diagram 3 - Differences between groups in results of body composition measurements at final measurement

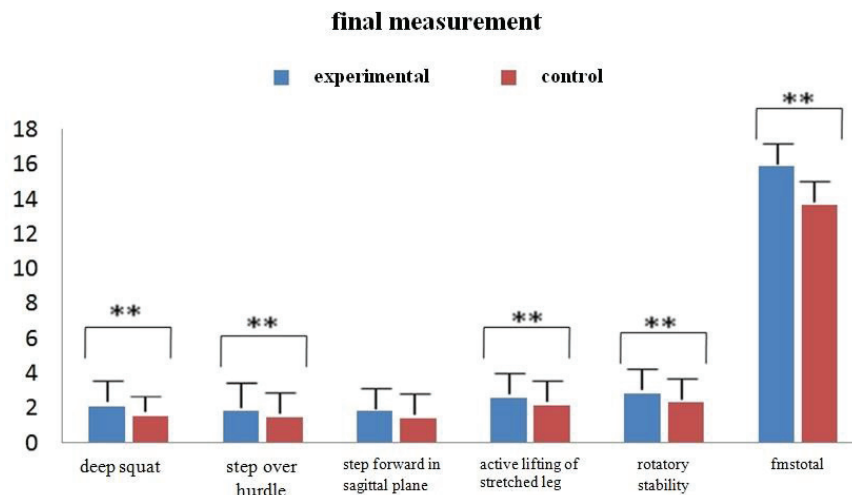


Diagram 4 - Differences between groups in the results of measuring the level of mobility and stability based on the FMS method at the final measurement

Table 4 - Results of the dependent T-test, the difference between the initial and final measurement of the body composition and FMS in the experimental group

	t	df.	sig.
FATr1% initial - FATr1% final	6.93	21	0.000
FATI1% initial - FATI1% final	2.06	21	0.050
FATra% initial - FATra% final	1.57	21	0.131
FATIa% initial - FATIa% final	1.62	21	0.120
FATtr% initial - FATtr% final	2.48	21	0.021
deep squat initial - deep squat final	2.72	21	0.019
step over hurdle initial - step over hurdle final	10.36	21	0.000
active lifting of stretched leg initial - active lifting of stretched leg final	2.81	21	0.019
rotatory stability initial - rotatory stability final	3.54	21	0.007
step forward in sagittal plane initial - step forward in sagittal plane final	1.77	21	0.100
shoulders mobility initial - shoulders mobility final	1.60	21	0.122
stability of trunk at push-up initial - stability of trunk at push-up final	1.21	21	0.320
FMS initial - FMS final	-11.14	21	0.000

Legend: t - value of t-test, df - degree of freedom, Sig. - statistical significance

By analyzing the results of the initial and final measurement in the experimental group using the dependent t-test, some conclusions were made. A statistically significant difference was found in the results of tests that measured the subcutaneous fat tissue of the upper extremities and trunk, while the results that measured the subcutaneous fat tissue of the lower extremities showed no statistically significant difference between the initial and final measurements. On the basis of these results, it can be assumed that the exercise program that used elements of artistic gymnastics in the form of body shaping exercises had more influence on the upper extremities and mobility, and less on the lower extremities. The conclusion is that if you would like to influence the complete body composition and mobility, the exercise program could be slightly corrected.

Within the experimental group at the final measurement a statistically significant difference in the variables was observed (fat right leg $t = 6,93$ $p = 0,000$; fat left leg $t = 2,06$ $p = 0,050$; fat trunk $t = 2,48$ $p = 0,021$; fms $t = -11,14$ $p = 0,000$; and on 4 tests from the FMS tests complex: deep squat $t = 2,72$ $p = 0,019$; step over hurdle $t = 10,36$ $p = 0,000$; active lifting of stretched leg $t = 2,81$ $p = 0,019$ and rotatory trunk stability $t = 3,54$ $p = 0,007$) while at tests: step forward in sagittal plane, shoulders mobility and stability of trunk at push-up no statistically significant difference was observed.

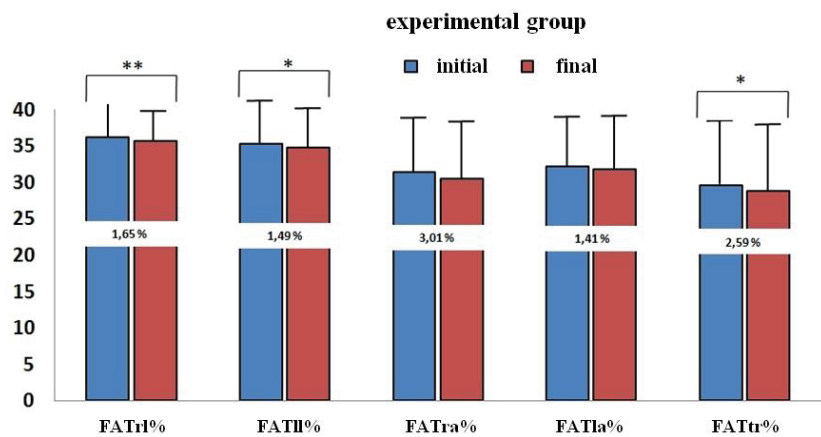


Diagram 5 - Differences between initial and final measurements of body composition results at the experimental group

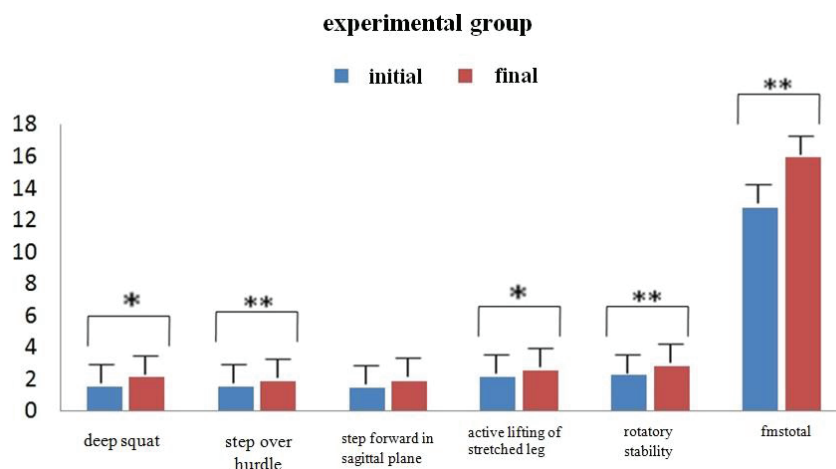


Diagram 6 - Differences between the initial and final measurement of the results of the mobility and stability level based on the FMS method at the final measurement

By definition, gymnastics is an aspect of rational, strictly defined, controlled and aesthetically shaped motor activities whose ultimate goal is to harmonize physical development, improve management and control of movement, develop coordination, muscle strength and mobility (Fulurija, Bjelica & Gojkovic, 2017). Gymnastics improves coordination through biotic motor skills: crawling, walking, running, rolling, rolling, climbing and descending, jumping on and off, rising, swinging and planking. as well as coordination, strength, flexibility and balance, and its contents must be implemented and understood as an integral, everyday way of exercising (Badic, Zivcic Markovic, Sporis, Milanovic & Trajkovic, 2012; Bucar-Pajek, Cuk, Kovac & Jakse, 2010). On the other hand, body shaping exercises are a means of preparing a locomotor apparatus for a more complex physical activity of a higher workload, creating a sense of space and proper performance of movement, and the habit of taking rational passive and relaxation positions. With proper stretching and strengthening, proper muscular activation and movement control are achieved (Kolba, 2004), and body shaping exercises applied as muscle strengthening exercises have the task of raising general physical fitness since the working ability and also the body posture depend on the muscular strength. This research has shown that the richness of various positions and movements, as well as the existing and newly constructed apparatuses in which all these movements and positions are performed, enable an appropriate exercise to be recommended to a person of any age, gender, body constitution, level of motor development (Madić, 2000 ; Madic, Popovic, & Tumin, 2009), because the application of the program designed for adolescents had a positive effect on the body composition and mobility of the female respondents of the mature age. In artistic gymnastics, exercises of strength and flexibility are carried out on various apparatuses, as they were also applied in this research, and flexibility is the ability to achieve the maximum amplitude of volitional movements in one or more joints (Hebbelinck, 1988; Hublely-Kozey, 1991; Liemhon, 1988) which contributes to better mobility. Elements of artistic gymnastics performed according to the principle of application of body shaping exercises, during eight weeks, resulted in a change in the percentage of fat tissues of the lower extremities and trunk and improved mobility and stability of the respondents as they were aimed at improving the functioning of the muscles that, due to activation, strengthen and lead to a reduction in fat, and since work does not cause muscle hypertrophy, flexibility of joints is improved, and consequently mobility is improved.

Programmed systemic exercises influence the transformation of the body composition of women (Fogelholm, Kukkonen-Harjula, & Oja, 1999), and in particular the reduction in body fat percentage in the organism (Siric, Prelcec and Brcic, 2005), which was shown in this research when talking about the percentage of trunk fat tissue, because the percentage of trunk fat tissue, and the percentage of lower extremities fat tissue is significantly reduced in respondents of the experimental group after the implementation of the fitness program. All changes in the abilities that are achieved through the use of the gymnastic program are a worthy fudament, as a movement experience, with great possibilities for implementation, both in life activities and other sports (Fulurija, Perovic, Gojkovic, Bjelica & Majstorovic, 2016), and when gymnastics programs are designed according to the principles of selecting and applying body shaping exercises then they can result in a change in body composition or improvement of some motor skills. This has also been shown in this research because the selection of a group fitness program, designed by experts and intended for beginners and focused on a comprehensive work of moderate intensity in sections of training dedicated to stretching and improving strength resulted in positive changes in female respondents. As such, it has proven to be a good recreational activity that can motivate for further engagement with some group or individual fitness programs, because motivation is the main determinant of defining the intensity and depth of involvement in sports and recreational activities.

Conclusion

Regular physical activity is very important for both men and women's health (US Department of Health and Human Services, 2008), with a recommendation that adults and elderly people actively participate in all aspects of physical activity of moderate intensity for at least 30 minutes daily in order to maintain mobility through the activity (World Health Organization, 2004). A correct understanding of what motivates people to participate in physical activities could provide guidelines for planning an exercise program that could have implications for health (Rogulj, Papic & Plesina, 2006), because physical activity improves the quality of life for both young and older adults (Joseph, Royse, Benitez & Pekmezi, 2014), and the selection of activities in line with the goal, age and gender involved results in positive effects. The application of elements of artistic gymnastics as body shaping exercises in the group fitness program of the middle-aged female population influenced the morphological characteristics and the improvement of the mobility of middle-aged female respondents, indicating the possibility of their wider application and dealing with movement activities that do not require high-intensity efforts and which have a positive impact on the quality of life of individuals.

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ELEMENTI SPORTSKE GIMNASTIKE KAO VJEŽBE OBLIKOVANJA U GRUPNIM FITNESS PROGRAMIMA

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Uvod

Naučna saznanja uvjerljivo pokazuju kako je tjelesna neaktivnost jedan od najjačih faktora narušavanja zdravlja (Vuori, 2004), te da je svaka ciljana sistemski ponovljena tjelesna aktivnost značajna u zaštiti zdravlja (Andrijašević, 2000). Tjelesno vježbanje bi trebalo osigurati uspravno držanje i dobro funkcionisanje organa (Jajčević, 1997), pa se tjelesni fitness može posmatrati kao sposobnost izvođenja umjerenih do snažnih tjelesnih aktivnosti bez pretjeranog umora tj. sposobnost koja se razvija vježbanjem zbog kojeg osoba može izvoditi osnovne aktivnosti svakodnevnog života i provoditi slobodno vrijeme na aktivan način (Trninić, 2006). Budući da navika dovodi do potrebe za kretanjem, ako se razvija, imaće optimalan učinak (O'Sullivan, 2004; Tappe & Burgeson, 2004), na one aktivnosti za koje se, na osnovu istraživanja kod ciljanih grupa, utvrdi pozitivan stav i prihvatanje (Fras, 2002). Sportska rekreacija dio je širokog područja rekreacije, pri čemu se tjelesnim aktiviranjem zadovoljavaju opšte ljudske potrebe, održavanje i unapređenje psihofizičkih sposobnosti (Andrijašević, 2010.) Grupni fitness programi najrašireniji su oblik sportske rekreacije, a kao sistemski ponovljeni rekreativni oblici vježbanja, imaju pozitivne efekte na transformacije funkcionalnih sposobnosti organizma i promjene sastava tijela (McCord, Nichols & Patterson, 1989). Vježbe oblikovanja su prirodni pokreti pojedinim dijelovima tijela izvedeni u njihovom osnovnom ili izmijenjenom mehaničkom obliku čiji je smisao stvaranje navike za njihovom svakodnevnom primjenom sa ciljem razvoja opštih fizičkih sposobnosti i radnog potencijala, usavršavanja motoričkih sposobnosti usmjerenih ka racionalnom korištenju pokreta te promjena fizičke spoljašnjosti i poboljšanje kvaliteta lokomotornog aparata (Tomić, 1975). U modernom društvu, gimnastika, a naročito akrobatika egzistira u: edukaciji, takmičarskom sportu, ostalim sportskim granama, drugim područjima sportskih djelatnosti i fizičkih aktivnosti, kineziterapijskim programima, te rekreativnom obliku vježbanja (Živčić & Krističević, 2008). Gimnastika kao tjelesna aktivnost bogata je raznovrsnošću kretanja i položaja i promovise zdravlje, samokontrolu te izvođenje pokreta s maksimalnom preciznošću, dok je gimnastika kao sport usmjerena na razvoj individualnosti, a gimnastičari prave kombinacije pokreta rukama i nogama pomoću sedam osnovnih koraka: hodanje, trčanje zabacivanjem potkoljenica, poskoci prednoženjem zgrčno, niska prednoženja, poskoci visokim prednoženjem naprijed ili u stranu pod 90°, poskoci u stav raskoračni, poskoci iskorakom nazad ili u stranu (Pintar, Caput-Jogunica & Ćurković, 2006). U vježbama na spravama i tlu insistira se na lijepom i pravilnom držanju tijela i lijepo oblikovanim pokretima i kretanju (Kyselovlcová & Tibenská, 2007; Broomfied, 2011). U današnjem društvu, vježbe oblikovanja i sportska gimnastika su sastavni dio edukacije, sportskih djelatnosti, kineziterapijskih programa, te rekreativnih oblika vježbanja (Živčić & Krističević, 2008).

Kako je jedna od najvažnijih uloga sportske gimnastike razvoj motoričkih sposobnosti koordinacije, snage, fleksibilnosti i ravnoteže (Badić, Živčić Marković, Sporiš, Milanović & Trajković, 2012) i kako su vježbe oblikovanja izabrane vježbe koje svojim sadržajem obuhvataju funkcionalno kretanje tijela topološkim redom, ovo istraživanje je provedeno sa ciljem utvrđivanja efekata primjene elemenata sportske gimnastike,

kao vježbi oblikovanja, na tjelesnu kompoziciju i mobilnost i stabilnost ispitanica radi iznalaženja novih načina primjene kretnih struktura u grupnim fitness programima.

Metod

Istraživanje je provedeno na uzorku od 42 ispitanice srednje životne dobi 37 godina +/- 6 mjeseci, (eksperimentalnu grupu je činilo 22, a kontrolnu 20 ispitanica). Ispitanice eksperimentalne grupe bile su podvignute grupnom obliku vježbanja, dok ispitanice kontrolne grupe nisu upražnjavale neki od oblika tjelesne aktivnosti.

Program vježbanja (tabela 1.) je dizajniran prema programu koji su primjenili Krističević, Milčić, Šolja, Možnik, Živčić Marković (2016) i Trajković, Madić, Sporiš, Aleksić-Veljković, Živčić-Marković (2016), a dizajniran je sa ciljem poboljšanja snage mišića, fleksibilnosti i mobilnosti, trajao je osam sedmica, tokom kojih su ispitanice vježbale tri puta sedmično po 45 minuta, a elementi sportske gimnastike kao stoj na lopaticama - svijeća, kolut naprijed, kolut nazad, kolut naprijed raznožno, kolut nazad raznožno, kolut naprijed sklonjeno, kolut nazad sklonjeno, vaga, mala vaga, visovi, upori, elementi na gredi primjenjivani su prema principu primjene vježbi oblikovanja i u određenom vremenskom trajanju ili broju ponavljanja u zavisnosti od prirode vježbe. Svaki trening je nadziran od strane trenera sportske gimnastike i nastavnik fizičkog vaspitanja, a provođen je prema fazama - prva faza je uključivala zagrijavanje sporim trčanjem i istezanjem i završavala sa poligonom sa različitim vrstama pokreta, u drugoj fazi primjenjivani su elementi sportske gimnastike kao vježbe oblikovanja, gdje su vježbe izvođenje u dvo-, tro- i četvoročetvrtinskom taktu u zavisnosti od sedmice vježbanja i dijela druge faze treninga (u početnim sedmicama korišten je dvočetvrtinski takt u prvom dijelu druge faze treninga i tročetvrtinski u drugom dijelu druge faze treninga, dok je u završnim semicama korišten dvočetvrtinski ili tročetvrtinski takt u prvom dijelu druge faze treninga i četvoročetvrtinski u drugom dijelu druge faze treninga), dok je u trećoj fazi treninga fokus bio na vraćanje normalnog nivoa emocionalne, mentalne i fiziološke tjelesne funkcije i ponovno uspostavljanje istog stanja ispitanika u kojem su bili prije početka treninga.

U prvom dijelu druge faze treninga primijenjeni su elementi sportske gimnastike na način kako se primjenjuju vježbe oblikovanja (prema topografskim regijama tijela) i sa ciljem korektivnog i preventivnog djelovanja na lokomotorni aparat, a u drugom dijelu druge faze treninga poskoci su imali svrhu podizanja frekvencije srca na viši nivo (čime se zadovoljavaju principi treninga u fitnessu) i na ojačavanje i stabilizaciju zglobova i mekih struktura donjih ekstremiteta. Sve vježbe su usmeno objašnjene i demonstrirane. Najčešće korišteni metodološki organizacijski oblik rada bio je rad u grupama od 3-5 (u zavisnosti od vježbe i sprave na kojoj je izvođena vježba) i frontalni rad. Ispitanice su bile podijeljene u 4-5 grupa i mijenjale su mjesto prema broju ponavljanja ili kada planirano vrijeme za tu vježbu završava. Prva, druga B i treća faza treninga provedena je prema programu (tabela 1.) na svakom treningu uz minimalne izmjene vrste skokova i vježbi istezanja bez promjena opterećenja i intenziteta.

Tabela 1. Program vježbanja

		Cilj: poboljšanje motoričkih sposobnosti i zdravstvenog stanja
I FAZA TRENINGA	Zagrijavanje	Opšte zagrijavanje praćeno poligonom sa različitim vrstama kretanja koja se izvode u pozicijama ležanja na leđima, uporima na laktovima i boku, uporu klečećem, ležanju licem prema tlu. Pet krugova sa pauzom od 20 sekundi: <i>Prvi trening</i> <ul style="list-style-type: none"> • prednoženja, odnoženja na tlu u uporu na laktovima - 4 do 8 svakom nogom • odnoženja i zanoženja na boku, u uporu klečećem i licem prema tlu - 5 do 10 ponavljanja <i>Drugi trening</i> <ul style="list-style-type: none"> • čeona i bočna špaga - 5 do 10 ponavljanja • kolut naprijed, kolut nazad, kolut naprijed raznožno, kolut nazad raznožno, kolut naprijed sklonjeno, kolut nazad sklonjeno, svijeća, stoj na rukama - 5-10 ponavljanja svaka vježba
	Gimnastika (Akrobatika)	<i>Treći trening</i> <ul style="list-style-type: none"> • varijante zamaha iz ležanja - 5-10 ponavljanja • izdržaji na leđima i trbuhu - 30 sec do 90 sec • na gredi -grand battements, naprijed, u stranu i natrag, vaga, mala vaga - 5-10 ponavljanja • različiti zamasi na pritkama, zamasi na konju s hvataljkama - 8 do 10 puta za svaku nogu
II DIO TRENINGA B	Poskoci Mini trampolina	Raznožni i sunožni poskoci na mekoj strunjači sa asistencijom -7 do 10 puta Poskoci raznožni, sunožni - 15- 20 poskoka
TREĆI DIO TRENINGA	Razboj Istezanje	Zamasi - duboki, zadnji, prednji - 3 serije po 5-8 zamaha 5 minuta istezanja za mišićne grupe koje su uglavnom bile uključene u sesije

Efekti programa utvrđeni su prije i nakon provođenja programa vježbanja na osnovu procjene tjelesne kompozicije (Body composition analyser TANITA BC 418) na osnovu varijabli - postotak masnog tkiva (FAT%), postotak masnog tkiva lijeve (FATlr%) i desne ruke (FATdr%), postotak masnog tkiva lijeve (FATln%) i desne noge (FATdn%), te postotak masnog tkiva trupa (FATtr%), i procjene nivoa mobilnosti i stabilnosti na osnovu FMS-metode (*Functional movement screening*) (sedam testova).

Za dobijanje valjanih rezultata primijenjen je statistički program SPSS 16,0 i sljedeće statističke metode: osnovna deskriptivna statistika, KS test-analiza normalnosti rezultata, nezavisni t-test-analiza razlika između grupa i zavisni t-test-analiza razlika unutar grupe.

Rezultati sa diskusijom

Tabela 2. Deskriptivna statistika rezultata kompozicije tijela i FMS-a inicijalno mjerenje obje grupe

eksperimentalna				kontrolna				
N	M	SD	KS test		N	M	SD	KS test
22	36,21	6,38	0,59	FATdn%	20	34,47	5,69	0,29
22	35,25	6,72	0,45	FATln%	20	34,19	5,17	0,13
22	31,39	7,55	0,95	FATdr%	20	28,57	6,17	0,43
22	32,22	7,83	0,87	FATln%	20	28,80	6,67	0,19
22	29,62	9,28	0,64	FATtr%	20	25,90	9,63	0,42
22	1,52	0,52	0,54	duboki čučanj	20	1,61	,51	0,54
22	1,52	0,52	0,70	korak preko prepone	20	1,71	,48	0,70
22	1,42	0,52	0,45	iskorak u sagitalnoj ravni	20	1,49	,52	0,45
22	2,15	0,83	0,54	aktivno podizanje opružene noge	20	2,11	,52	0,54
22	2,29	0,67	0,54	rotatorna stabilnost trupa	20	2,35	,51	0,54
22	12,77	1,97	0,18	fmsukupno	20	13,14	1,93	0,06

Legenda: N - broj ispitanika, M - srednja vrijednost, SD - odstupanje od srednje vrijednosti, KS test - test normalnosti rasporeda

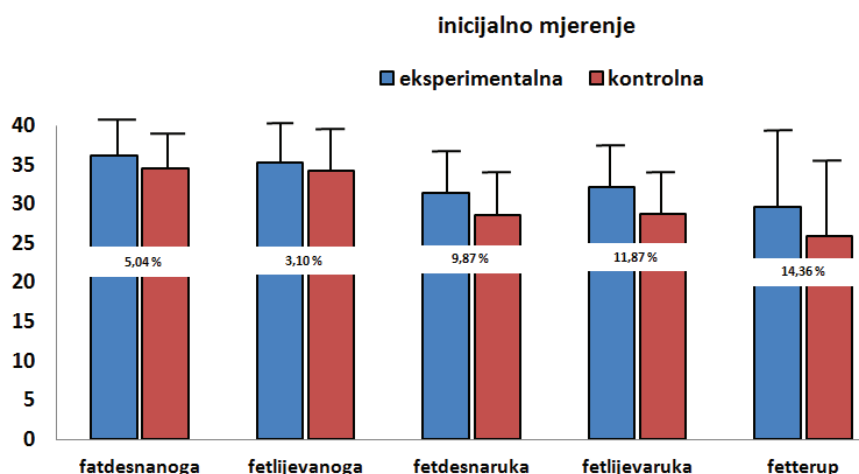
U Tabeli 2. su prikazani rezultati osnovnih deskriptivnih parametara kod obe grupe ispitanika na inicijalnom mjerenju. Vrijednosti KS testa su znatno više od 0,05, što omogućava dalju upotrebu parametrijske statistike u analizi rezultata.

Tabela 3. Rezultati nezavisnog T-testa, razlika između eksperimentalne i kontrolne grupe na inicijalnom mjerenju

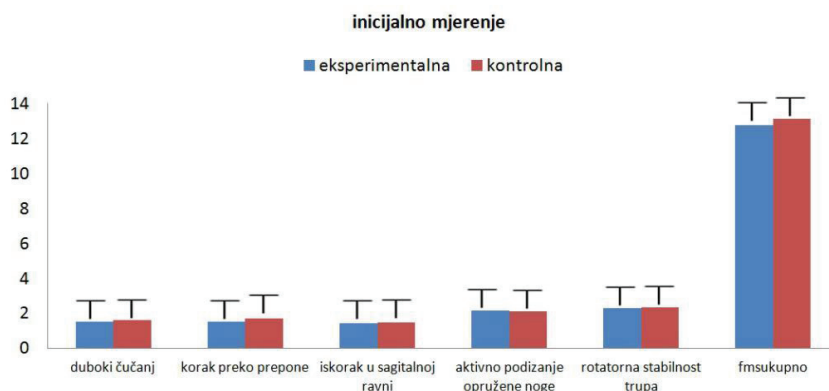
	t	df.	sig.
FATdn%	1,09	41	0,312
FATln%	1,58	41	0,135
FATdr%	1,12	41	0,268
FATln%	1,49	41	0,142
FATtr%	1,70	41	0,096
duboki čučanj	1,87	41	0,084
korak preko prepone	1,63	41	0,121
aktivno podizanje opružene noge	1,71	41	0,109
rotatorna stabilnost	1,94	41	0,072
iskorak u sagitalnoj ravni	1,10	41	0,285
mobilnost ramena	1,57	41	0,121
stabilnost trupa u skleku	0,54	41	0,428
fmsukupno	1,22	41	0,301

Legenda: t - vrijednost t-testa, df - stepen slobode, Sig. - statistička značajnost

U Tabeli 3. su prikazani rezultati nezavisnog t-testa koja je analizirala razliku između rezultata kompozicije tijela i pokretljivosti, između eksperimentalne i kontrolne grupe ispitanika. Vrijednosti signifikantnosti su znatno veće od 0,05 što dokazuje da između ispitanika obe grupe, na inicijalnom mjerenju, ne postoji statistički značajna razlika. Ovo omogućuje nesmetano provođenje programa vježbanja, jer su isključeni svi neželjeni efekti koji mogu uticati na rezultate eksperimenta.



Dijagram 1. Razlike između grupa kod rezultata mjerenja kompozicije tijela na inicijalnom mjerenju



Dijagram 2. Razlike između grupa kod rezultata mjerenja nivoa mobilnosti i stabilnosti na osnovu FMS-metode na inicijalnom mjerenju

Tabela 4 Deskriptivna statistika rezultata kompozicije tijela i FMS-a finalno mjerenje obje grupe

eksperimentalna				kontrolna			
N	M	S.D	KS test	N	M	S.D	KS test
22	35,62	5,80	0,53	20	33,67	5,95	0,27
22	34,73	6,19	0,34	20	33,70	5,38	0,17
22	30,47	7,40	0,97	20	28,12	6,21	0,38
22	31,77	8,11	0,93	20	28,37	6,66	0,13
22	28,87	9,04	0,44	20	33,09	7,02	0,20
22	2,11	0,54	0,47	20	1,55	0,53	0,47
22	1,84	0,76	0,37	20	1,47	0,53	0,36
22	1,84	0,76	0,37	20	1,42	0,52	0,48
22	2,55	0,69	0,55	20	2,12	0,49	0,37
22	2,82	0,45	0,37	20	2,31	0,81	0,49
22	15,90	1,57	0,52	20	13,67	5,95	0,27

Legenda: N - broj ispitanika, M - srednja vrijednost, SD - odstupanje od srednje vrijednosti, KS test - test normalnosti rasporeda

U Tabeli 4. su prikazani rezultati osnovnih deskriptivnih parametara kod obe grupe ispitanika na finalnom mjerenju. Vrijednosti KS testa su takođe znatno više od 0,05, što omogućava dalju upotrebu parametrijske statistike u analizi rezultata. Analizom prosječnih vrijednosti rezultata inicijalnog i finalnog

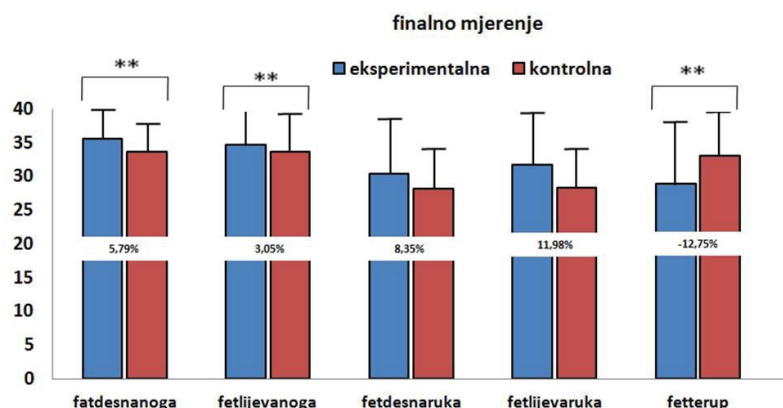
mjerenja, može se zaključiti da je došlo do određenih promjena kod eksperimentalne i kontrolne grupe ispitanika. Nakon provedenog programa vježbanja, kod eksperimentalne grupe je došlo do smanjenja svih vrijednosti potkožnog masnog tkiva (fet desna noga, fet lijeva noga, fet lijeva ruka, fet desna ruka i fet trupa), takođe i do poboljšanja rezultata koji su analizirali nivo mobilnosti i stabilnosti na osnovu FMS-metode.

Tabela 5. Rezultati nezavisnog T-testa, razlika između eksperimentalne i kontrolne grupe na finalnom mjerenju

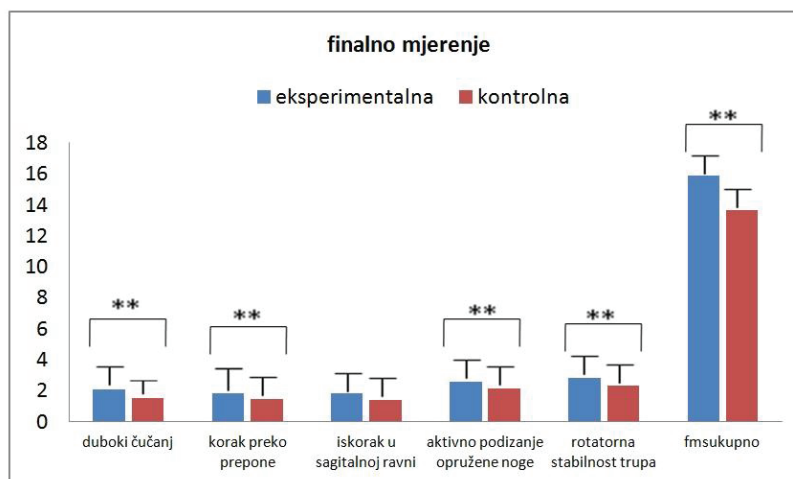
	t	df.	sig.
FATdn%	-3,09	41	0,012
FATln%	-3,58	41	0,005
FATdr%	1,12	41	0,268
FATln%	1,49	41	0,142
FATtr%	-2,70	41	0,036
duboki čučanj	11,87	41	0,000
korak preko prepone	8,63	41	0,000
aktivno podizanje opružene noge	5,71	41	0,000
rotatorna stabilnost	12,94	41	0,000
iskorak u sagitalnoj ravni	1,10	41	0,285
mobilitet ramena	1,57	41	0,121
stabilnost trupa u skleku	0,54	41	0,428
fmsukupno	14,22	41	0,000

Legenda: t - vrijednost t-testa, df - stepen slobode, Sig. - statistička značajnost

Tabela 5. pokazuje rezultate nezavisnog t-testa, koji je analizirao razlike u rezultatima finalnog mjerenja između obe grupe ispitanika. Vrijednosti signifikantnosti govore da je statistički značajna razlika primijećena samo kod rezultata testa koji je mjerio pokretljivost trupa. Na osnovu ovoga može se zaključiti da je program vježbanja uspješno uticao na povećanje pokretljivosti kod ispitanika eksperimentalne grupe. Iako je došlo do smanjenja vrijednosti neželjenog masnog tkiva na određenim segmentima kod ispitanika eksperimentalne grupe, nije se pokazala statistički značajna razlika između grupa ispitanika. Između grupa na finalnom mjerenju primijećena je statistički značajna razlika u varijablama kompozicija tijela – postotak masnog tkiva desna noga $t=-3,09$ $p=0,012$, postotka masnog tkiva lijeva noga $t=-3,58$ $p=0,005$, postotka masnog tkiva trupa $t=-2,70$ $p=0,036$ i u mobilnosti i stabilnosti $t=14,22$ $p=0,000$ tj. na četiri testa iz kompleksa testova FMS-a: duboki čučanj $t=11,87$ $p=0,000$, korak preko prepone $t=8,63$ $p=0,000$; aktivno podizanje opružene noge $t=5,71$ $p=0,000$ i rotatorna stabilnost trupa $t=12,94$ $p=0,000$). Na osnovu rezultata dobijenih nakon statističke analize može se konstatovati da je primjena grupnog fitnes programa imala pozitivan efekat, tj. da je primjena elemenata sportske gimnastike prema principu primjene vježbi oblikovanja, tokom osam sedmica dovela je do promjena postotka masnog tkiva donjih ekstremiteta i trupa i do poboljšanja mobilnosti i stabilnosti ispitanica.



Dijagram 3. Razlike između grupa kod rezultata mjerenja kompozicije tijela na finalnom mjerenju



Dijagram 4. Razlike između grupa kod rezultata mjerenja nivoa mobilnosti i stabilnosti na osnovu FMS-metode na finalnom mjerenju

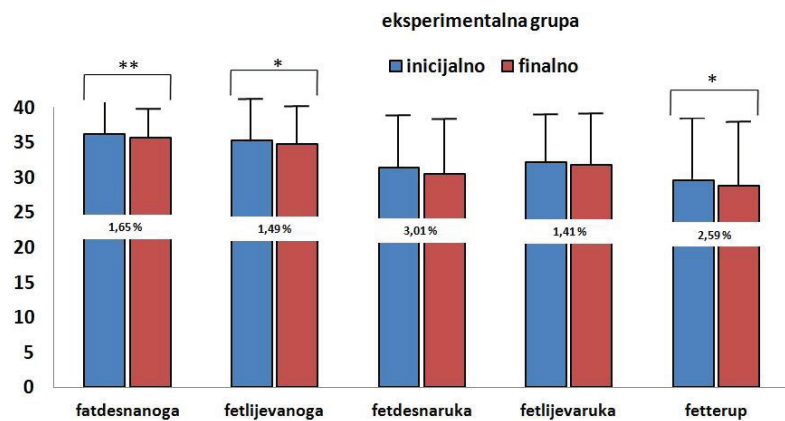
Tabela 4. Rezultati zavisnog T-testa, razlika između inicijalnog i finalnog mjerenja kompozicije tijela i FMS-a kod eksperimentalne grupe

	t	df.	sig.
FATdn% inicijalno - FATdn% finalno	6,93	21	0,000
FATln% inicijalno - FATln% finalno	2,06	21	0,050
FATdr% inicijalno - FATdr% finalno	1,57	21	0,131
FATlr% inicijalno - FATlr% finalno	1,62	21	0,120
FATtr% inicijalno - FATtr% finalno	2,48	21	0,021
duboki čučanj inicijalno- duboki čučanj finalno	2,72	21	0,019
korak preko prepone inicijalno- korak preko prepone finalno	10,36	21	0,000
aktivno podizanje opružene noge inicijalno- aktivno podizanje opružene noge finalno	2,81	21	0,019
rotatorna stabilnost inicijalno- rotatorna stabilnost finalno	3,54	21	0,007
iskorak u sagitalnoj ravni inicijalno- iskorak u sagitalnoj ravni finalno	1,77	21	0,100
mobilitet ramena inicijalno- mobilitet ramena finalno	1,60	21	0,122
stabilnost trupa u skleku inicijalno- stabilnost trupa u skleku finalno	1,21	21	0,320
FMS inicijalno - FMS finalno	-11,14	21	0,000

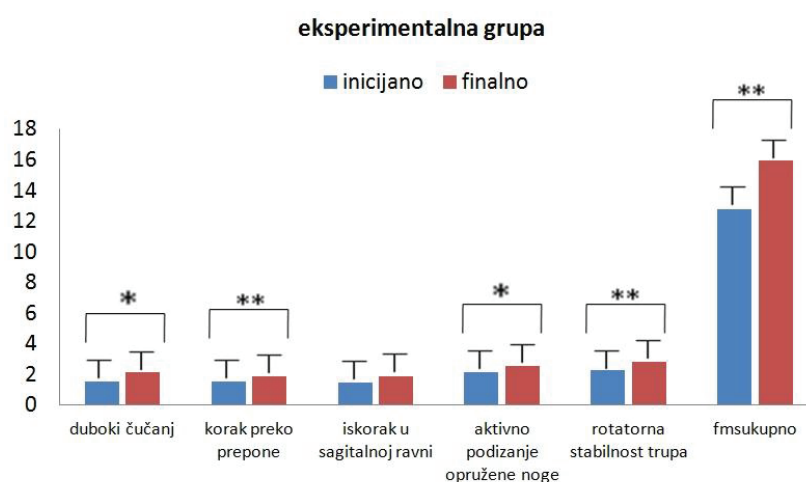
Legenda: t - vrijednost t-testa, df - stepen slobode, Sig. - statistička značajnost

Analizom rezultata inicijalnog i finalnog mjerenje kod eksperimentalne grupe pomoću zavisnog t-testa, došlo se do određenih zaključaka. Statistički značajna razlika se pokazala između rezultata testova koji su mjerili potkožno masno tkivo gornjih ekstremiteta i trupa, dok kod rezultata koji su mjerili potkožno masno tkivo donjih ekstremiteta nije utvrđena statistički značajna razlika između inicijalnog i finalnog mjerenja. Na osnovu ovih rezultata može se pretpostaviti da je program vježbanja koji je koristio elemente sportske gimnastike u vidu vježbi oblikovanja, više uticao na gornje ekstremitete i pokretljivost, a manje na donje ekstremitete. Zaključak je da ukoliko bi se željelo uticati na kompletnu kompoziciju tijela i pokretljivost, program vježbanja bi se mogao malo korigovati.

Unutar eksperimentalne grupe na finalnom mjerenju primjećena je statistički značajna razlika u varijablama (fet desna noga $t=6,93$ $p=0,000$; fet lijeva noga $t=2,06$ $p=0,050$; fet trupa $t=2,48$ $p=0,021$; fms $t=-11,14$ $p=0,000$; i na 4 testa iz kompleksa testova FMS-a: duboki čučanj $t=2,72$ $p=0,019$; korak preko prepone $t=10,36$ $p=0,000$; aktivno podizanje opružene noge $t=2,81$ $p=0,019$ i rotatorna stabilnost trupa $t=3,54$ $p=0,007$) dok na testovima: iskorak u sagitalnoj ravni, mobilnost ramena i stabilnost trupa u skleku nije primjećena statistički značajna razlika.



Dijagram 5. Razlike između inicijalnog i finalnog mjerenja rezultata kompozicije tijela kod eksperimentalne grupe



Dijagram 6. Razlike između inicijalnog i finalnog mjerenja rezultata nivoa mobilnosti i stabilnosti na osnovu FMS-metode na finalnom mjerenju

Po definiciji, gimnastika je vid racionalne, strogo određene, kontrolisane i estetski oblikovane motoričke aktivnosti čiji je krajnji cilj: skladan tjelesni razvoj, usavršavanje upravljanja i kontrole pokreta i kretanja, razvijanje koordinacije, mišićne snage i pokretljivosti (Fulurija, Bjelica & Gojković, 2017). Gimnastikom se poboljšava koordinacija kroz biotička motorička znanja: puzanje, hodanje, trčanje, kotrljanja, kolutanja, provlačenja, penjanja i silaženja, naskoke i saskoke, višenja, zamahe i upiranja. a takođe i koordinacija, snaga, fleksibilnost i ravnoteža, a njeni sadržaji se moraju provoditi i shvatiti kao sastavni, svakodnevni način vježbanja (Badić, Živčić Marković, Sporiš, Milanović & Trajković, 2012; Bučar-Pajek, Čuk, Kovač & Jakše, 2010). S druge strane, vježbe oblikovanja su sredstvo za pripremu lokomotornog aparata za složenije tjelesne aktivnosti većeg radnog opterećenja, koje stvaraju osjećaj za prostor i pravilno izvođenje pokreta i kretanja, i naviku zauzimanja racionalnih pasivnih i relaksacionih položaja. Uz pravilno istezanje i jačanje postiže se pravilna mišićna aktivacija i kontrola pokreta (Kolba, 2004), a vježbe oblikovanja primijenjene kao vježbe za jačanje mišića imaju zadatak da podignu opštu tjelesnu sposobnost s obzirom da od mišićne snage zavisi radna sposobnost ali i držanje tijela. Ovim istraživanjem pokazalo se da bogatstvo raznovrsnih položaja i kretanja, te postojećih i novokonstruisanih sprava na kojima se sva ta kretanja i položaji izvode, omogućavaju da se osobi bilo kog uzrasta, pola, tjelesne konstitucije, nivoa motoričkog razvoja, preporuča adekvatna vježba (Madić, 2000; Madić, Popović, & Tumin, 2009), jer je primjena programa osmišljenog za adolescente imala pozitivan efekat na tjelesnu kompoziciju i mobilnost ispitanica zrele životne dobi. U sportskoj gimnastici vježbe jačanja i fleksibilnosti provode se na različitim spravama, kako su se primjenjivale i u ovom istraživanju, a fleksibilnosti je sposobnost postizanja maksimalne amplitude voljnih kretanja u jednom ili više zglobova (Hebbelinck, 1988; Hublely-Kozey, 1991; Liemhon, 1988) koja doprinosi boljoj mobilnosti. Elementi sportske gimnastike izvođeni prema principu primjene vježbi oblikovanja, tokom osam sedmica doveli su do promjena postotka masnog tkiva donjih ekstremiteta i trupa i do poboljšanja mobilnosti i stabilnosti ispitanica jer su bili usmjereni na poboljšanje rada mišića koji usljed pokretanja jačaju i dovode do smanjenja masnog tkiva, a kako rad ne prouzrokuje hipertrofiju mišića dolazi do poboljšanja fleksibilnosti zglobova, a samim tim i poboljšanja mobilnosti.

Programirano sistemsko vježbanje utiče na transformaciju tjelesnog sastava žena (Fogelholm, Kukkonen-Harjula, & Oja, 1999), a posebno na smanjenje postotka tjelesne masti u organizmu (Širić, Prelčec i Brčić, 2005), a to se pokazalo u ovom istraživanju kada se govori o postotku masnog tkiva, jer je postotak masnog tkiva trupa, te postotak masnog tkiva donjih ekstremiteta značajno smanjen kod ispitanica eksperimentalne grupe nakon provođenja fitnes programa. Sve promjene sposobnosti koje se postižu primjenom gimnastičkog programa, zahvalan su fundament, kao kretno iskustvo, sa velikim mogućnostima za realizovanje, kako u životnim aktivnostima, tako i drugim sportovima (Fulurija, Perović, Gojković, Bjelica & Majstorović, 2016), a kada se programi gimnastike dizajniraju prema principima odabira i primjene vježbi oblikovanja onda mogu rezultirati promjena u kompoziciji tijela ili poboljšanjem neke motoričke sposobnosti. To se pokazalo i u ovom istraživanju jer je odabir grupnog fitnes programa, koji je dizajniran od strane stručnjaka i namijenjen početnicima i usmjeren na sveobuhvatan rad umjerenog intenziteta u dijelovima treninga posvećenih strečingu i poboljšanju snage rezultirao pozitivnim promjenama kod ispitanica. Kao takav, pokazao se kao dobra rekreativna aktivnost koja može motivisati za dalje bavljenje nekim grupnim ili individualnim fitnes programom, je motivacija je glavna odrednica definisanja intenziteta i dubine uključenosti u sportsko-rekreativne aktivnosti.

Zaključak

Redovna fizička aktivnost veoma je važna za zdravlje, kako muškaraca tako i žena (U.S. Department of Health and Human Services, 2008), sa preporukom da odrasli i starije osobe aktivno učestvuju u svim vidovima fizičke aktivnosti umjerenog intenziteta minimalno 30 minuta svakodnevno kako bi kroz aktivnost

održavale mobilnost (Svjetska zdravstvena organizacija, 2004). Pravilno razumijevanje onoga šta motiviše ljude da učestvuju u tjelesnim aktivnostima, moglo bi dati smjernice za planiranje programa vježbanja koji bi mogli imati implikacije na zdravlje (Rogulj, Papić & Plešina, 2006), jer tjelesna aktivnost poboljšava kvalitetu života kako kod mladih tako i kod starijih odraslih osoba (Joseph, Royse, Benitez & Pekmezi, 2014), a odabir aktivnosti usklađen sa ciljem, uzrastom i polom sa kojim se radi rezultira pozitivnim efektima. Primjena elemenata sportske gimnastike kao vježbi oblikovanja u grupnom fitnes programu ženske populacije srednje životne dobi uticao je na morfološke karakteristike i poboljšanje pokretljivosti ispitanica srednje dobi, što ukazuje na mogućnost njihove šire primjene i bavljenje kretnim aktivnostima koje ne zahtijevaju napore visokog intenziteta a koji imaju pozitivan učinak na kvalitet života pojedinaca.

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PERIODIZATION OF ENDURANCE DEVELOPMENT IN THE PREPARATION OF RECREATIONAL RUNNERS FOR THEIR FIRST HALF-MARATHON

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Introduction

Scientific findings from various areas related to the training process in general were previously used exclusively to help enhance the performance of professional athletes. Today it seems that not even recreation can do without them. Recreational running, for example, is becoming increasingly popular with people of diverse age groups, some of whom have never done any sport before, and with the increased levels of motivation observed in recreational runners today and ample opportunities to test one's abilities in a great number of long-distance races, their training is becoming increasingly similar to that of a professional athlete's. It so appears that a more serious approach and use of scientific knowledge concerning training load, recovery periods, body nutrition and hydration and their relationship is necessary in the field of recreation as well.

"Recreation includes either organized or spontaneous, individual or group exercises ... that take place with or without the involvement of recreation experts, ... either in the open or indoors, ... whose main goal is to enjoy the exercise itself, ... but the positive impact on the health of the person doing the exercise, and an awareness of the positive impact of such exercise on health, is present in those involved in recreational activities" (Stojiljković et al., 2012) Recreational running is an involvement in a physical activity – running – with the purpose to enjoy the exercise itself and also to help reduce the harmful effects of a sedentary lifestyle and improve one's physiological and psychological health and physical appearance. When referring to recreational running, we primarily think of it as a long run at a moderate intensity, which can last anywhere from a few dozen minutes (20-30 minutes) up to an hour or more (Stojiljković, 2005).

Running is a natural, innate pattern of movement (it does not have to be learned), its amount and intensity can be varied easily (since running is a cyclic activity), running trails are everywhere, and the equipment needed is not expensive (Stojiljković, 2005). A well-balanced running workout offers multiple benefits to a human body (Nikolic, 2003; Stojiljković, 2005; Stojiljković et al., 2012), such as:

- infectious diseases prevention;
- boosts the immune systems' resistance against malignant diseases;
- helps prevent and manage many endocrine disorders;
- improves the transport and exchange of oxygen and carbon dioxide in the body;
- improves cardiac efficiency, decreases arterial blood pressure and relieves myocardial ischemia;
- improves physical appearance and body weight regulation;
- helps fulfill other goals of recreation (pedagogical, sociological and psychological).

The benefits of running have been well-documented in a number of studies in our country (Stojiljković, 2003; Stojiljković et al., 2008; Stojiljković et al., 2009). Considering all the benefits, it can be said that running at a moderate intensity is a very effective means of improving aerobic endurance (synonyms: cardiorespiratory/cardiovascular) and is perhaps the best preventive agent/drug in the prevention/treatment of cardiovascular diseases (Stojiljković, 2005).

A well-balanced physical activity, often in the form of a running workout, results in the development of 'athlete's heart'. Athlete's heart is an exercise-induced phenomenon of heart muscle remodeling, whose degree depends on the intensity, duration and frequency of training, individual traits and genetic factors (Ćuk et al., 2018). However, it must be borne in mind that any physical activity, including running, carries with it potential health risks. A current critical issue in sports and sports medicine is sudden cardiac death, making it vital that anyone (be they an athlete or otherwise) who intends to start following a continuous workout program first undergoes a thorough medical examination. The physicians are expected to be trained in detecting difficult-to-diagnose pathological conditions (to be able to distinguish athletes' heart from pathological conditions) and to follow current recommendations in this area and thus contribute to the prevention of adverse events in sports and recreational activities (Ćuk et al., 2018).

Cardiorespiratory endurance is the ability of the circulatory and respiratory system to supply oxygen during sustained physical activity (The American College of Sports Medicine, 2017). The measure of aerobic capacity is maximum oxygen uptake – $VO_2\text{max}$ - the maximum oxygen content that an individual is able to consume by breathing in air during a maximum intensity cyclic activity over a period of several minutes. In practical terms, the consumption of oxygen is a measure of the ability of the body of a particular individual to convert inhaled air into energy (Jovanović, 1999). It can vary from 20mL/kg/min with a person living a sedentary lifestyle, up to 85mL/kg/min with a top-level athlete (Kibble & Halsey, 2013).

Running a half-marathon requires less preparation effort than running longer distances (marathons and ultramarathons), which makes it an increasingly popular form of recreation for people around the world. The minimum requirement to start preparing oneself for one's first half-marathon through the six-month program discussed in the present study is being able to run the distance of three kilometers continuously, regardless of the time taken to complete it. The program has been successfully completed by adults of different ages and of both sexes. A similar program has been used by several groups of recreational runners at the Belgrade Running Club (BRC).

In order for the body to function as a balanced whole and to prevent injuries and achieve the goal of the program, it is necessary that the preparation, in addition to distance running, also includes strength development exercises, running technique exercises, mobility enhancement exercises, recovery periods and proper nutrition and hydration (addressing these issues in depth, however, is beyond the scope of this study).

Method

This study relied on descriptive research and theoretical analysis methods. Its purpose is to offer a six-month training plan to prepare beginner runners for their first half-marathon while ensuring that the resources, methods and training loads for endurance development are in optimal relationship and adjusted according to the beginner runners' capabilities.

Intensity zones

In developing a quality aerobic endurance development program, four basic parameters, namely type, frequency, volume and intensity of training, should be taken into account first. Training intensity is the most important component of an endurance training plan (Stojiljković et al., 2012).

In running, intensity zones form the basis for a training program. Workouts essentially serve to get the runner's body into a certain intensity zone (by means of running at a certain pace) and later help it adapt to this type of effort.

It is recommended that beginners in aerobic endurance training start with exercises in intensity zones where aerobic metabolism use is moderate to high (but below maximum) while anaerobic processes are at a relatively low level. These are the zones below anaerobic threshold, which is around 85-90% of

maximum heart rate. There is also a lower limit of training intensities below which the effect of exercise is far less than optimal, and the majority of authors put it at 60% of maximum heart rate. It is recommended that exercise intensities for most absolute beginners be in the range of 60-85% of maximum heart rate (Stojiljković et al., 2012). High-intensity, short-distance runs (nearing maximum heart rate), which elevate lactate levels significantly, do not promote the efficiency of peripheral aerobic components and can have detrimental effects, as they can inhibit the development of aerobic enzymes (Arcelli & Canova, 2001), posing a risk of injury to beginners.

Table 1, which offers a division into five intensity zones relative to maximum heart rate, is a result of information obtained by the authors of the study from relevant literature and their field work. In the first four intensity zones, the energy required for activity is obtained primarily from aerobic sources, while the fifth is the anaerobic zone. Since the participants in the study were recreational runners, the half-marathon training periodization was based on aerobic workout, and only the first four intensity zones were used.

Table 1. Intensity Zones

	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5
Type of training	RECOVERY	LSD	TEMPO	INTERVALS	INTERVALS/SPRINT
Duration	20-30 min	60-180 min	30-60 min	20-40 min	from 3 sec up to 3 min
Goal	recovery	aerobic endurance development	specific endurance development	increasing anaerobic threshold	raising VO ₂ max and lactate tolerance
Heart rate	50-60%	60-70%	70-80%	80-85%	85-100%

The simplest way to determine anaerobic threshold of an average recreational runner is based on one's maximum heart rate. A beginner's anaerobic threshold pulse is around 80-85% of maximum heart rate, or 20-30 beats below. Another simple method, which involves the use of an HRM, is to run a distance of 5km at the maximum possible pace and then take 5% off the average heart rate recorded during the run and the result is the anaerobic threshold heart rate (Stojiljković et al., 2012).

Since, in most cases, beginner recreational runners do not have the necessary equipment to calculate their heart rate, the intensity zones in their workouts are determined according to subjective measures.

Training session

The basic building block of a training process is a single training session. It is the smallest relatively independent training unit of a complete structure with its own main goal, tasks, resources, methods and load (Koprivica, 2013).

In the proposed program, the beginner's warm-up lasts for 10-15 minutes (the duration depends on the outside temperature and the intensity in the main part of the training (Isurin, 2009)). It is performed by doing a complex of warm-up exercises for 5-10, followed by a 5-minute set of dynamic stretching exercises built around low skip.

Due to lack of experience, beginners usually start running a distance planned for the main part of a training session at a pace that they are unable to maintain to the end of their run. For this reason, it is insisted that they always start with an intensity below what they expect to be able to sustain, and then to gradually build up speed until they reach the prescribed pace. At the beginning of this part of the session, in the first 2-3km (while they are still fresh), their attention is drawn to the importance of running technique. The emphasis is on avoiding trunk oscillations in the vertical, reducing the impact force of foot-ground collision, trying to achieve maximum arm swing fluidity, avoiding contractions of the muscles that are not involved in the work or are only partially involved, avoiding excessively long strides and low step frequency (Canova &

Arcelli, 2001) and directing all the movements (hips, shoulders, arms, and legs) forward, i.e. in the direction of the motion (Galloway, 2003).

After completing the prescribed running distance, runners will their training session by walking at a normal pace. It facilitates speedier recovery and faster removal of lactate from the muscles (Bonen & Belcastro, 1976, according to Isurin, 2009). Following the main part of the training session, and walking for 2-3 minutes in order to gradually bring the heart rate lower, the session moves into 10-20 minutes of stretching. The duration of the last phase depends on training intensity, the available time the persons involved have and current weather conditions.

Microcycle

In this periodization, a microcycle covers a period of seven days. Since the periodization was developed for recreational runners who do not have too much free time at their disposal and most of whom often go to training sessions straight after work, there was a precise schedule and frequency of occurrence during the week for all workouts. They were held three times a week: Monday (7:00 pm) - Wednesday (7:00 pm) - Saturday (10:00 am) and lasted for 90 minutes. Such a schedule is vital to keep the runner well-organized.

From Week 1 to Week 7, all workouts occur in Zone 2. Starting from Week 7, the Monday and Wednesday workouts are in Zone 3 (except during recovery weeks, when running takes place in Zone 1) and they include running on hilly terrain and uneven surface, while the Saturday workouts remain in Zone 2. Uphill runs done continuously for a few quarters of an hour or repeatedly for several minutes each time facilitate development of muscles that would not normally develop on a flat surface at a similar intensity (the rebound phase of each foot strike requires greater force) (Arcelli & Canova, 2001). From Week 11, the Wednesday runs feature intervals in Zone 4. In Weeks 19 and 20, the second half of the Monday running distance is done in Zone 4.

The first three microcycles in the second through the fifth mesocycle involve progressive increases in training load (developmental microcycles), which is followed by a phase with decreases in load in order to help the runners regenerate. Increases in training load occur after this phase (Bompa, 2009). For this reason, the low-load phase is called the recovery microcycle.

As previously mentioned, the last two microcycles before the goal race (Weeks 21 and 22 of preparation) feature a reduction in the training load, which results in reduced training volume and increased intensity of training prior to competition (Mujika, 2009).

Mesocycle

A mesocycle is an intermediate length training cycle consisting of several smaller workout units – microcycles (Koprivica, 2013). Since the body of a beginner runner needs more time to adapt to the training loads, the first mesocycle in this study lasted for six weeks and it can be called the adaptation mesocycle. All training sessions in this mesocycle took place in Zone 2 in order to create a sound aerobic base from where to step up to higher levels (Verstegen & Williams, 2007). This means that the intensity was consistently between low and moderate, while the volume was gradually increasing. In the first mesocycle, it is very important that the runners run in a group, which was the case with this project. From the start of the second mesocycle (Week 7) to the end of the fifth (Week 24), each mesocycle (four in total) lasts for four weeks. The mesocycles from the second to the fourth are called developmental mesocycles, since their goal is to improve physical capabilities, primarily aerobic endurance. The fifth mesocycle is called the competitive mesocycle. It includes the largest running distance volume during the preparation: 103km. Most of the total running volume occurs in the first two weeks of this phase and in the race itself.

The mesocycle following the goal race is used for physical recovery. It is called the recovery mesocycle and lasts for two weeks.

Macrocycle

The macrocycle, or the large cycle, in this study includes six mesocycles of different duration. It is vital that the load curve in a macrocycle has a wavy shape, because the applied training loads do not produce effects immediately. After training, time is needed for the body to recover and fitness to increase up to the initial fitness level, which is surpassed in the period of supercompensation.

Table 2 shows a 24-week macrocycle for beginner recreational runners who were able to complete a three-kilometer distance in continuity at a low to moderate intensity before the start of the training process.

Table 2. Six-month macrocycle of training for the runners' first half-marathon

MC	MONDAY	WEDNESDAY	SATURDAY	Total km	
				per week	MSC
1.	3 x 1 km (Z2, 3min break - walk)	3 km (Z2)	4 x 1 km (Z2, 3min break - walk)	10	
2.	4 km (Z2)	4 x 800m (Z2, 2min break - walk)	4 km (Z2)	11.2	
3.	3 km (Z2)	4 x 800m (Z2, 1min break - walk)	5 km (Z2)	11.2	72.4
4.	4 km (Z2)	4 km (Z2)	5 km (Z2)	13	
5.	4 km (Z2)	3 km (Z2)	6 km (Z2)	13	
6.	4 km (Z2)	4 km (Z2)	6 km (Z2)	14	
7.	4 km uphill (Z3)	4 km (Z3)	8 km (Z2)	16	
8.	4 km (Z3)	5 km (Z3)	6 km (Z2)	15	
9.	4 km (Z3)	4 km (Z3)	10 km (Z2)	18	65
10.	4 km (Z1)	4 km (Z1)	8 km (Z2)	16	
11.	5 km uphill (Z3)	2 x 2km (Z4, 3min break - walk)	10 km (Z2)	19	
12.	5 km (Z3)	2 x 2km (Z4, 3min break - walk)	8 km (Z2)	17	74
13.	6 km (Z3)	2 x 2km (Z4, 3min break - walk)	12 km (Z2)	22	
14.	4 km (Z1)	4 km (Z1)	8 km (Z2)	16	
15.	5 km uphill (Z3)	2 x 3km (Z4, 2min break - walk)	14 km (Z2)	25	
16.	6 km (Z3)	2 x 3km (Z4, 2min break - walk)	test run 10 km	22	93
17.	8 km (Z3)	2 x 3km (Z4, 2min break - walk)	16 km (Z2)	30	
18.	4 km (Z1)	4 km (Z1)	8 km (Z2)	16	
19.	6 km (first 3km Z3, last 3km Z4)	3km+2km+1km (Z4, 2min break - walk)	12 km (Z2)	24	
20.	5 km brda (Z3)	3km+2km+1km (Z4, 2min break - walk)	18 km (Z2)	29	
21.	5 km (first 2.5km Z3, last 2.5km Z4)	2 x 2km (Z4, 2min break - walk)	12 km (Z2)	21	103
22.	4 km (Z1)	4 km (Z1)	21.1 km (half-marathon)	29	
23.	4 km (Z1)	4 km (Z1)	4 km (Z1)	12	
24.	6 km (Z1)	5 km (Z1)	8 km (Z2)	19	31

Legend: MC – microcycle; MSC – mesocycle; recovery microcycles.

The total volume of running through the mesocycles (shown in Table 2) was as follows:

- First: 72.4km (lasts for six weeks);
- Second: 65km (lasts for four weeks);
- Third: 74km (lasts for four weeks);
- Fourth: 93km (lasts for four weeks);
- Fifth: 103km (lasts for four weeks);
- Sixth: 31km (lasts for two weeks).

The number of workouts and runs per zone and their total in the macrocycle (72) and the running volume per zone and total running volume in the macrocycle (438.5km) are shown in table 3. It is noteworthy that almost half of all workouts were in Zone 2 and that almost 60% of the total running distance was covered in that zone: 261.5km (59.6%).

Table 3. Total number of workouts and volume per zone in the 24-week macrocycle

	Number of workouts (per zone)	Number of races	Volume in workouts (km)	Volume in races (km)
Z1	13		55	
Z2	33	2	230.4	31.1
Z3	13		70.5	
Z4	11		51.5	
Total	70	2	407.4	31.1
Workouts and races total: 72			Total distance (km): 438.5	

In developing aerobic endurance, two basic intensity methods, namely continuous and interval training, are applied to individual workouts. In the case of the beginner recreational runners in the attached periodization table, we relied mostly on the varying-progressive-continuous method (Koprivica, 2013), since it is insisted that inexperienced runners begin running a distance at a pace slower than what they may have planned and then accelerate to reach the intensity zone prescribed for the workout. This is done in order to allow the body to gradually and safely adapt to the running task and to minimize any adverse effects.

With the beginners in the present study, the interval method was used in lower zones to achieve a higher volume of training load and also to help the runners provide better subjective measures. For the most part, the progressive variation was used, where recreational runners follow the instructions given, running the first interval runs at a slower pace and gradually intensifying each subsequent interval. Duration of breaks as well as intensity is vital in determining the direction of the training work.

This macrocycle saw the use of incomplete and short breaks, which means that the next interval in a series begins under conditions of insufficient recovery (Koprivica, 2013). The breaks were used in Zones 2-4, and they were of the active type, i.e. simple low-intensity exercises were performed that facilitate recovery processes (Koprivica, 2013), such as walking and/or dynamic stretching of muscles that are under greater stresses during running (hamstrings, calves, etc.).

Results

The program described in this paper was conducted on a sample of 24 persons averaging 35 years of age. Before putting the program into action, the recreational runners who volunteered to participate in it underwent medical examinations and received a certificate from a sports medicine professional that they were capable of performing this kind of physical activity. The entire program of preparation was carried out under the supervision of the first-listed author of this paper in the period from November 2017 to April 2018. It was realized with the full participation of a total of 19 recreational runners (7 men and 12 women, averaging 35.68±8.69 years of age) and they all achieved the goal, completing the April 2018 Belgrade half-

marathon in predicted times, with no bad consequences whatsoever. Their times ranged from 1h 57min to 2h 30min; the average time was $2:12:30 \pm 10:20$, while the coefficient of variation was eight percent, which shows that the group was homogeneous and the prediction was accurate. The remaining five participants were frequently absent from workouts, mostly due to lack of free time and several minor injuries, and did not participate in the race.

Discussion

A long-run recreational runner's year of running can be divided into two six-month macrocycles. The goal race for each of the big cycles is a half-marathon and efforts are made to adjust the preparation for it according to the different capabilities of different individuals. It is vital to first set clear end goals for the macrocycles, and then the goals for the smaller cycles within them. In the case of the volunteers in this study, the first macrocycle lasted from November to April and the goal was completing the Belgrade half-marathon in April, while the second macrocycle lasted from April through fall, and its main goal was completing another half-marathon, in Serbia or abroad, in the September-October period.

Conclusion

The goal of the periodization of the six-month training process for the first half-marathon run of beginner recreational runners presented in this study is to facilitate the preparation, reduce the risk of injury and help the runners complete the goal race without undue stresses on their body. The plan was fully carried out as all the participants in the study successfully completed their first half-marathon (19 volunteers). The benefit of this project from a professional standpoint is that its training program, already proven in practice, can also be used to prepare other recreational runners for a half-marathon race. From an individual standpoint, perhaps the greatest benefit from the program to the recreational runners is that after successfully completing their first ever half-marathon run, they feel strongly motivated to make further progress and prepare for new races, which introduces regular physical activity into their everyday life.

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PERIODIZACIJA RAZVOJA IZDRŽLJIVOSTI U PRIPREMI REKREATIVACA ZA PRVI POLUMARATON

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Uvod

Naučna saznanja iz različitih oblasti koja su vezana za trenažni proces, ranije su se koristila isključivo za pripremu sportista. Danas se može reći da se ne mogu zaobići u rekreaciji, a samim tim ni u rekreativnom trčanju, koje postaje sve masovnije među ljudima različitog uzrasta, čak iako se nikada nisu bavili sportom. Usled porasta motivacije i mogućnosti da se oprobaju u mnogim trkama na duge staze, koje postaju sve popularnije, priprema rekreativaca sve više podseća na pripremu sportiste. Iz tog razloga je neophodan ozbiljniji pristup i korišćenje naučnih saznanja koja su povezana sa opterećenjem, oporavkom, ishranom, hidratacijom i njihovim međusobnim odnosom.

„Rekreacija ... obuhvata organizovano ili spontano, individualno ili grupno vežbanje, ... koje se odvija bez ili u prisustvu stručnjaka za rekreaciju, ... na otvorenom ili u zatvorenom prostoru, ... čiji je glavni cilj uživanje u samom vežbanju, ... ali je pozitivan uticaj na zdravlje vežbača, kao i svest o pozitivnom uticaju takvog vežbanja na zdravlje, prisutna kod vežbača koji učestvuju u rekreaciji“ (Stojiljković i sar., 2012). Rekreativno trčanje bi predstavljalo bavljenje fizičkom aktivnošću – trčanjem, zarad uživanja u samom vežbanju, ali takođe i radi smanjenja rizika od štetnih efekata sedentarnog načina života, kao i poboljšanja psihofizičkog zdravlja i izgleda. Kada se pominje trčanje u rekreaciji, misli se pre svega na dugotrajno trčanje umerenog intenziteta, koje traje od nekoliko desetina minuta (20–30min), pa do sat i više vremena (Stojiljković, 2005).

Trčanje je prirodan oblik kretanja (ne mora da se uči), obim i intenzitet mogu lako da se doziraju (jer je trčanje ciklična aktivnost), mesta za trčanje ima svuda, a oprema nije skupa (Stojiljković, 2005). Efekti pravilno doziranog treninga trčanja na organizam čoveka su višestruko pozitivni (Nikolić, 2003; Stojiljković, 2005; Stojiljković i sar, 2012):

- prevencija infektivnih bolesti;
- povećanje otpornosti organizma na maligna oboljenja;
- prevencija i kontrola mnogih endokrinih oboljenja;
- poboljšan transport i razmena kiseonika i ugljendioksida u organizmu;
- ekonomičniji srčani rad, smanjenje arterijskog krvnog pritiska i rasterećenja miokarda;
- poboljšanje fizičkog izgleda i regulisanje telesne mase;
- ostvarenje ostalih zadataka rekreacije (pedagoških, socioloških i psiholoških).

Pozitivni efekti trčanja dokazani su u više istraživanja kod nas (Stojiljković, 2003; Stojiljković i sar., 2008; Stojiljković i sar., 2009). Zbog svega navedenog, trčanje umerenim intenzitetom je vrlo efikasno sredstvo usavršavanja aerobne izdržljivosti (sinonimi: kardiorespiratorna / kardiovaskularna), što predstavlja najbolje preventivno sredstvo/lek, u prevenciji/lečenju kardiovaskularnih bolesti (Stojiljković, 2005).

Dobro dozirana fizička aktivnost, često u formi treninga trčanja, dovodi do formiranja sportskog srca. Sportsko srce je vežbanjem uzrokovan fenomen remodelovanja srčanog mišića, čiji stepen zavisi od intenziteta, trajanja i učestalosti treninga, individualnih osobina i genetskih faktora (Ćuk i sar., 2018). Mora

se ipak imati u vidu da svaka fizička aktivnost, pa i trčanje, potencijalno nosi sa sobom i određeni rizik po zdravlje. Aktuelno pitanje u sportu i sportskoj medicini je iznenadna srčana smrt u sportu i zbog toga je važno da sve osobe koje nameravaju da pristupe kontinuiranom programu vežbanja (sportisti, ali i rekreativci), treba da budu podvrgnuti ozbiljnom lekarskom pregledu. Od lekara se očekuje da budu edukovani da dijagnostikuju teško uočljiva patološka stanja (da razlikuju sportsko srce od patoloških stanja), prate aktuelne preporuke iz ove oblasti i time doprinesu prevenciji neželjenih događaja u sportu i rekreaciji (Ćuk i sar., 2018).

Kardiorespiratorna izdržljivost predstavlja sposobnost kardiovaskularnog i respiratornog sistema da snabdeva telo kiseonikom tokom kontinuirane fizičke aktivnosti (ACSM, 2017, str. 2). Mera aerobnih mogućnosti je maksimalna potrošnja kiseonika – VO_2max : maksimalna zapremina kiseonika koju je čovek sposoban da potroši udisanjem iz vazduha za vreme izvođenja ciklične aktivnosti maksimalnim intenzitetom u trajanju od nekoliko minuta. Praktično, potrošnja kiseonika je mera koja govori kakva je sposobnost tela određenog čoveka da udahnuti vazduh pretvori u energiju (Jovanović, 1999, str. 11). Ona može varirati od 20mL/kg/min kod osobe koja vodi sedentaran stil života, do 85mL/kg/min kod vrhunski utreniranog sportiste (Kibble & Halsey, 2013, str. 199).

Za trčanje polumaratona potrebno je manje odricanja nego za trčanje dužih distanci (maratona i ultramaratona), pa je ovo sve masovniji oblik rekreacije ljudi širom sveta. Minimalan uslov za početak sprovođenja šestomesečne pripreme za prvi polumaratona, opisane u radu, jesu istrčana tri kilometra u kontinuitetu, bilo kojom brzinom. Program su uspešno sprovodile odrasle osobe različitih uzrasta, oba pola. Sličan program se sprovodi u više grupa rekreativnih trkača u okviru Beogradskog trkačkog kluba (Belgrade Running Club – BRC).

Da bi telo funkcionisalo kao uravnotežena celina, kako bi se predupredile povrede i postigao cilj programa, potrebno je da priprema pored trčanja na distanci sadrži i: vežbe za razvoj snage, vežbe tehnike trčanja, vežbe za razvoj pokretljivosti, oporavak, kao i pravilnu ishranu i hidrataciju.

Metod

U radu je korišćen deskriptivni metod i metod teorijske analize. Cilj ovog rada jeste da se da predlog plana i programa treninga za prvi polumaratona, u trajanju od šest meseci, u kome će sredstva, metode i opterećenja za razvoj izdržljivosti, biti u optimalnom međusobnom odnosu, prilagođena početnicima u trčanju.

Zone intenziteta

Pri kreiranju kvalitetnog programa za razvoj aerobne izdržljivosti treba pre svega voditi računa o četiri osnovna parametra: vrsta, učestalost, obim i intenzitet vežbanja. Intenzitet vežbanja je najvažnija komponenta u planiranju i programiranju treninga izdržljivosti (Stojiljković i sar., 2012).

U trčanju, zone intenziteta su osnov na kome se gradi trenažni program. Suština treninga je u izlaganju organizma određenoj zoni intenziteta (trčanje određenim brzinama) i kasnije adaptacija na tu vrstu napora.

Za trening aerobne izdržljivosti kod početnika preporuka je da se vežba u zonama intenziteta u kojima su aerobni procesi angažovani umereno do značajno (ali ne maksimalno), dok su anaerobni procesi na relativno niskom nivou. To su zone ispod anaerobnog praga koji se nalazi na oko 85–90% maksimalne frekvencije srca. Postoji i donja granica intenziteta ispod koje je efekat vežbanja daleko manji od optimalnog, i ona je prema većini autora na 60% od maksimalne frekvencije. Za većinu apsolutnih početnika se preporučuje intenzitet vežbanja u rasponu od 60–85% od maksimalne frekvencije srca (Stojiljković i sar., 2012). Trčanja kratkih deonica visokog intenziteta (blizu maksimalnog), koja uključuju značajnu koncentraciju laktata, nisu efikasne za periferne aerobne komponente i mogu imati štetan efekat, jer mogu

sprečiti razvoj enzima aerobnog sastava (Arcelli i Canova, 2001), kao i povećati rizik od povreda kod početnika.

Analizom relevantne literature i stečenih znanja i iskustava autora u praktičnom radu, data je u tabeli 1 podela na pet zona intenziteta u odnosu na maksimalni puls. U prve četiri zone intenziteta se energija potrebna za rad dobija dominantno iz aerobnih izvora, dok peta predstavlja anaerobnu zonu. Pošto je reč o rekreativcima, periodizacija trenažnog procesa za polumaraton bazira se na aerobnom radu, te se zone intenziteta kreću od prve do četvrte.

Tabela 1. Zone intenziteta

	ZONA 1	ZONA 2	ZONA 3	ZONA 4	ZONA 5
tip treninga	OPORAVAK	LSD	TEMPO	INTERVALI	INTERVALI/SPRINT
trajanje	20-30min	60-180min	30-60min	20-40min	od 3sek do 3min
cilj	oporavak	razvoj aerobne izdržljivosti	razvoj specifične izdržljivosti	pomeranje granice anaerobnog praga	razvoj VO ₂ max i laktatne tolerancije
puls	50-60% od maksimuma	60-70% od maksimuma	70-80% od maksimuma	80-85% od maksimuma	85-100% od maksimuma

Najjednostavniji način određivanja anaerobnog praga za prosečnog rekreativca, jeste na osnovu maksimalnog pulsa. Puls na anaerobnom pragu se kod početnika nalazi na oko 80–85% od maksimalnog pulsa, ili 20–30 otkucaja ispod. Drugi jednostavan način koji podrazumeva korišćenje pulsmetra, jeste trčanje maksimalnom mogućom brzinom distance od 5km, a zatim se od prosečne frekvencije srca na distanci od 5km oduzme 5% i dobije se vrednost pulsa na anaerobnom pragu (Stojiljković i sar., 2012). Pošto rekreativci početnici u najvećem broju slučajeva nemaju potrebnu opremu za merenje pulsa, zone intenziteta su određene prema subjektivnom osećaju.

Pojedinačni trening

Osnovna jedinica trenažnog procesa je trening. To je najmanja relativno samostalna trenažna jedinica celovite strukture koja ima glavni cilj, zadatke, sredstva, metode i opterećenje (Koprivica, 2013). U predloženom programu zagrevanje vežbača početnika traje od 10–15 minuta (trajanje zavisi od spoljašnje temperature i intenziteta u glavnom delu treninga (Isurin, 2009)). Izvodi se tako što se najpre radi kompleks vežbi oblikovanja u trajanju od 5–10 minuta, a zatim se rade vežbe dinamičkog rastezanja u mestu i kretanju koje su povezane sa niskim skipom, u trajanju od 5 minuta.

Početnici najčešće deonicu koja je planirana u glavnom delu treninga započnu brže od tempa koji su u mogućnosti da održavaju do kraja. Iz tog razloga se insistira da intenzitet na početku bude uvek niži nego što očekuju da će moći da istrče određenu deonicu, a da se onda postepeno pojačava do predviđenog. Na početku ovog dela treninga se u prvih 2–3km (dok su odmorni) skreće pažnja trkačima na tehniku trčanja. Akcenat je na to da: izbegavaju vertikalne oscilacije trupa, smanje komponentu sudara stopala i podloge, nastoje da postignu maksimalnu tečnost pokreta ruku, izbegavaju kontrakcije mišića koji nisu uključeni u rad ili su delimično uključeni, izbegavaju preterano dugi korak i nisku frekvenciju koraka (Canova i Arcelli, 2001), sve pokrete (kukove, ramena, ruke i noge) usmeravaju ravno unapred, odnosno u smeru kretanja (Galloway, 2003).

U završnom delu treninga zastupljeno je hodanje nakon predviđene distance trčanja. Ovakva aktivnost omogućava lakši oporavak i bržu eliminaciju laktata iz mišića (Bonen & Belcastro, 1976, prema Isurinu, 2009). Nakon glavnog dela treninga, zatim hodanja 2–3 minuta kako bi se puls postepeno spustio na niže vrednosti, radi se 10–20 minuta rastezanja, u zavisnosti od intenziteta treninga, raspoloživog vremena vežbača i trenutnih vremenskih okolnosti.

Mikrociklus

Mikrociklus u ovoj periodizaciji obuhvata period od sedam dana. S obzirom da ova periodizacija podrazumeva vežbanje rekreativaca koji nemaju previše slobodnog vremena i najčešće dolaze na trening odmah nakon posla, svi treninzi su imali tačno određenu satnicu i učestalost u toku nedelje. Treninzi su održavani tri puta nedeljno: ponedeljak (19:00h) – sreda (19:00h) – subota (10:00h) i trajali su po 90 minuta. Ovakva satnica je neophodna radi dobre organizacije vežbača.

Od prve do sedme nedelje se svi treninzi rade u zoni 2. Od sedme nedelje se počinje sa trčanjem ponedeljkom i sredom u zoni 3 (osim u nedeljama oporavka, kada se trči u zoni 1) i primenjuju se trčanja po brdovitom terenu i neravnoj podlozi, dok se treninzi subotom i dalje rade u zoni 2. Trčanje po uzbrdici koje se izvodi kontinuirano u trajanju od nekoliko četvrtina sata ili ponavljajuće u trajanju od nekoliko minuta, utiče na razvoj mišića koji se ne bi razvili na ravnom, pri sličnom intenzitetu (faza odraza svakog koraka zahteva veću snagu) (Arcelli i Canova, 2001). Zatim se od jedanaeste nedelje, sredom, trče intervali u zoni 4. U devetnaestoj i dvadesetj nedelji se druga polovina distance ponedeljkomtrči u zoni 4.

Od drugog do šestog mezociklusa, prva tri mikrociklusa predstavljaju progresiju u opterećenju (razvojni mikrociklusi), nakon čega sledi mikrociklus smanjenja ili faza nižeg opterećenja, da bi se trkači regenerisali. Pобољшanje stepena treninga se događa nakon ove faze (Bompa, 2009). Iz tih razloga se ovaj ciklus naziva mikrociklusom oporavka.

Smanjivanje trenažnog opterećenja prati, kao što je već rečeno, poslednja dva mikrociklusa pred ciljanu trku (dvadeset prvu i dvadeset drugu nedelju pripreme) čime se postiže efekat smanjenog obima i povećanog intenziteta treninga do koga dolazi pre takmičenja (Mujika, 2009).

Mezociklus

Mezociklus je srednji ciklus treninga sastavljen od više manjih trenažnih jedinica – mikrociklusa. (Koprivica, 2013). S obzirom da je osobama koje prvi put počinju da trče potrebno više vremena da im se organizam adaptira na opterećenja, prvi mezociklus u okviru makrociklusa trajao je šest nedelja i može se nazvati mezociklusom adaptacije. U tom mezociklusu su se svi treninzi odvijali u zoni 2, kako bi se stvorila dobra aerobna baza od koje će se dalje ubrzavati do viših nivoa (Verstegen and Williams, 2007). To znači da je u prvom mezociklusu intenzitet konstantno nizak do umeren, dok se obim postepeno povećava. U prvom mezociklusu je vrlo važno da vežbači trče u grupi, što je i realizovano u ovom projektu. Od drugog (sedma nedelja) do kraja petog mezociklusa (dvadeset druga nedelja), svaki mezociklus (ima ih četiri) traje po četiri nedelje. Mezociklusi od drugog do četvrtog se nazivaju razvojni mezociklusi, jer im je cilj razvoj fizičkih sposobnosti organizma, prvenstveno aerobne izdržljivosti. Peti mezociklus se može nazvati takmičarskim mezociklusom. On obuhvata najveći obim trčanja u toku pripreme: 103km. Ukupni obim trčanja je veliki pre svega na račun prve dve nedelje kao i same trke. Cilj mezociklusa nakon ciljane trke jeste oporavak organizma, te se naziva mezociklusom oporavka i traje dve nedelje.

Makrociklus

Makrociklus, ili veliki ciklus, u ovom radu obuhvata šest mezociklusa različitog trajanja. U makrociklusu je neophodno primetiti valovitost dinamike opterećenja jer primenjena trenažna opterećenja ne daju odmah efekat. Razlog tome je što je organizmu potrebno vreme da se adaptira i oporavi do početnog nivoa, a onda i iznad njega.

U tabeli 2 je prikazan makrociklus u trajanju od 24 nedelje, za rekreativce početnike u trčanju, koji su na testu, pre početka trenažnog procesa, mogli da istrče niskim do umerenim intenzitetom, tri kilometra u kontinuitetu.

Tabela 2. Šestomesečni makrociklus treninga za prvi polumaraton

MC	PONEDELJAK	SREDA	SUBOTA	Ukupno km	
				nedeljno	MZC
1.	3 x 1 km (Z2, pauza 3min - hodanje)	3 km (Z2)	4 x 1 km (Z2, pauza 3min - hodanje)	10	
2.	4 km (Z2)	4 x 800m (Z2, pauza 2min - hodanje)	4 km (Z2)	11,2	
3.	3 km (Z2)	4 x 800m (Z2, pauza 1min - hodanje)	5 km (Z2)	11,2	72,4
4.	4 km (Z2)	4 km (Z2)	5 km (Z2)	13	
5.	4 km (Z2)	3 km (Z2)	6 km (Z2)	13	
6.	4 km (Z2)	4 km (Z2)	6 km (Z2)	14	
7.	4 km brda (Z3)	4 km (Z3)	8 km (Z2)	16	
8.	4 km (Z3)	5 km (Z3)	6 km (Z2)	15	
9.	4 km (Z3)	4 km (Z3)	10 km (Z2)	18	65
10.	4 km (Z1)	4 km (Z1)	8 km (Z2)	16	
11.	5 km brda (Z3)	2 x 2km (Z4, pauza 3min - hodanje)	10 km (Z2)	19	
12.	5 km (Z3)	2 x 2km (Z4, pauza 3min - hodanje)	8 km (Z2)	17	74
13.	6 km (Z3)	2 x 2km (Z4, pauza 3min - hodanje)	12 km (Z2)	22	
14.	4 km (Z1)	4 km (Z1)	8 km (Z2)	16	
15.	5 km brda (Z3)	2 x 3km (Z4, pauza 2min - hodanje)	14 km (Z2)	25	
16.	6 km (Z3)	2 x 3km (Z4, pauza 2min - hodanje)	kontrolna trka 10 km	22	93
17.	8 km (Z3)	2 x 3km (Z4, pauza 2min - hodanje)	16 km (Z2)	30	
18.	4 km (Z1)	4 km (Z1)	8 km (Z2)	16	
19.	6 km (prva 3km Z3, poslednja 3km Z4)	3km+2km+1km (Z4, pauza 2min - hodanje)	12 km (Z2)	24	
20.	5 km brda (Z3)	3km+2km+1km (Z4, pauza 2min - hodanje)	18 km (Z2)	29	
21.	5 km (prvih 2,5km Z3, poslednja 2,5km Z4)	2 x 2km (Z4, pauza 2min - hodanje)	12 km (Z2)	21	103
22.	4 km (Z1)	4 km (Z1)	21,1 km (polumaraton)	29	
23.	4 km (Z1)	4 km (Z1)	4 km (Z1)	12	
24.	6 km (Z1)	5 km (Z1)	8 km (Z2)	19	31

Legenda: MC – mikrociklus; MZC – mezociklus; mikrociklusi oporavka.

Ukupni obim trčanja po mezociklusima (datim u tabeli 2) iznosi:

- Prvi: 72,4km (traje šest nedelja);
- Drugi: 65km (traje četiri nedelje);
- Treći: 74km (traje četiri nedelje);
- Četvrti: 93km (traje četiri nedelje);
- Peti: 103km (traje četiri nedelje);
- Šesti: 31km(traje dve nedelje).

Broj treninga i trka po zonama i ukupno u makrociklusu (72), kao i obim po zonama i ukupno u makrociklusu (438,5km), prikazani su u tabeli 3. Karakteristično je da se skoro polovina svih treninga odvijala u zoni 2, kao i da je u istoj zoni istrčano gotovo 60% od ukupne kilometraže: 261,5km (59,6%).

Tabela 3. Ukupan broj treninga i obim po zonama u makrociklusu od 24 nedelje

	Broj trening (po zonama)	Broj trka	Obim na treninzima (km)	Obim na trkama (km)
Z1	13		55	
Z2	33	2	230,4	31,1
Z3	13		70,5	
Z4	11		51,5	
ukupno	70	2	407,4	31,1
Ukupno treninga i trka: 72			Ukupno km: 438,5	

U razvoju aerobne izdržljivosti, na pojedinačnim treninzima primenjuju se dva osnovna metoda opterećenja: kontinuirani i intervalni. Kod rekreativaca početnika u priloženoj periodizaciji, najviše se primenjivao kontinuirani promenljivi progresivni metod (Koprivica, 2013), jer se insistira da neiskusni trkači distancu započnu manjom brzinom od one koju su planirali, a zatim ubrzavaju do dostizanja zone intenziteta koja je u programu za taj trening. Ovo se radi kako bi dozvolili organizmu da se postepeno, najbezbednije uvede u trčanje i na taj način stvori najmanje štetnih efekata.

Intervalni metod kod rekreativaca početnika je upotrebljavan u nižim zonama radi postizanja većeg obima opterećenja, a boljeg subjektivnog osećaja trkača početnika. Najčešće je korišćen kao progresivna varijanta, gde rekreativci prema unapred datim instrukcijama, prvi interval trče manjom brzinom, a zatim, svaki sledeći interval postepeno pojačavaju. Trajanje pauze određuje, uporedo sa intenzitetom, usmerenost trenajnog rada.

U ovom makrociklusu su se koristile nepotpuna i skraćena pauza, koje podrazumevaju da se sledeći interval započinje u uslovima nedovoljnog oporavka (Koprivica, 2013). Pauze su se koristile u zonama 2–4. Prema karakteru, koristila se aktivna pauza, odnosno izvođenje jednostavnih vežbi, niskog intenziteta, koji podstiču procese oporavka (Koprivica, 2013), kao što su hodanje ili/i dinamičko rastezanje mišića koji su pod većim naporom u toku trčanja (zadnja loža, listovi, itd.)

Rezultati

Plan i program, koji je opisan u radu, je sproveden na uzorku od 24 osobe prosečne starosti oko 35 godina. Pre početka realizacije programa, rekreativci su nakon obavljenog pregleda, od sportskog lekara dobili potvrdu da su sposobni za ovu vrstu fizičke aktivnosti. Program je sproveden u periodu od novembra 2017. do aprila 2018. godine. Celokupan program pripreme je, pod rukovodstvom prvog autora ovog rada, realizovan sa 19 rekreativaca (7 muškaraca i 12 žena, prosečne starosti $35,68 \pm 8,69$ godina) i oni su ispunili cilj: istrčali su polumaraton u Beogradu u aprilu 2018 godine, u predviđenom vremenu, bez loših posledica. Raspon njihovih rezultata se kretao od 1h:57min do 2h:30min; prosečno vreme je bilo $2:12:30 \pm 10:20$; dok je koeficijent varijacije bio 8%, što nam govori da je grupa bila homogena. Ostalih petoro su imali dosta izostajanja u toku procesa pripreme, najčešće zbog nedostatka slobodnog vremena i nekoliko lakših povreda, te nisu učestvovali na trci.

Diskusija

Godina kod rekreativaca trkača na duge staze se može podeliti na dva makrociklusa u trajanju od šest meseci. Svaki od velikih ciklusa ima ciljanu trku u polumaratonu i težnja je da priprema za nju bude primerena osobama različitih sposobnosti. Važno je jasno odrediti krajnji cilj makrociklusa, a zatim i

pojedinačne ciljeve manjih ciklusa koji ga čine. U slučaju ispitanika u ovom radu, prvi makrociklus je trajao od novembra do aprila sa ciljem da se u aprilu istrči polumaraton u Beogradu, a drugi makrociklus od aprila do jeseni sa ciljem da se istrči još jedan od polumaratona u Srbiji ili inostranstvu koji se organizuju u periodu septembar – oktobar.

Zaključak

Planirano je da se datom periodizacijom trenažnog procesa za prvi polumaraton, u trajanju od šest meseci, rekreativcima početnicima olakša proces pripreme, smanji rizik od povreda i doprinese da se ciljana trka završi bez velikog opterećenja organizma. Plan je u potpunosti ispunjen, jer su svi rekreativci uspešno istrčali svoj prvi polumaraton (19 ispitanika). Korist od ovog projekta sa stručnog aspekta je u tome što se ovakav program vežbanja, koji je već proveren u praksi, može primeniti i sa drugim rekreativcima u cilju pripreme za polumaraton. Individualna korist za rekreativce koji su učestvovali u programu, jeste u tome što su oni nakon uspešno istrčanog prvog polumaratona, dodatno motivisani za dalje napredovanje i planiranje sledećih trka, što uvodi redovnu fizičku aktivnost u njihov svakodnevni život.

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EFFICIENCY OF THEORY AND METHODICS OF ARTISTIC GYMNASTICS TEACHING IN DIFFERENT ORGANIZATIONAL MODELS

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Introduction

Academic success, or academic achievement by Suzić (2005), involves mastering the academic curriculum through the teaching process in order to acquire academic education and a certain academic title. Academic achievement is important for both, students and universities. Competition of institutions in the higher education market has a constant tendency to increase academic performance in order to maintain or increase competitiveness (Dill and Soo, 2005). The most important predictors of academic achievements are preparation for academic education, academic discipline and quality of teaching (Breakthrough collaborative's research, 2009). On the other hand, the achievement of the university, the achievement of students and the academic resources of the university are the three most important criteria for ranking universities in terms of quality (Clarke, 2002). Another important factor in the success of the university, in addition to the quality of teaching, is its effectiveness. The tendency to increase teaching efficiency often leads to a reduction in grading criteria (Walsh, 2010). In Serbia, since the Bologna reform, an increase in the efficiency of study has been recorded, but it all leads to the conclusion that this is a consequence of the reduction of the grading criteria (Jarić and Vukasović, 2009). In order to improve the quality and efficiency of academic teaching, it is necessary to plan, organize and conduct teaching, based on the valorization of the effects of applied models of the organization.

On the subject Theory and methodic of artistic gymnastics, it is constantly striving to improve teaching quality and its efficiency. Based on the noted difficulties and shortcomings, especially from the Bologna reform, various measures are planned and implemented to improve the quality and efficiency of teaching, and their effects are monitored and valorized (Dabović, 2014; Kocic-Pajic, 2014; Radojević, Dabović, Grbović, 2011 Radojević, Grbović, Dabović, Vukašinović, 2010). The subject of the research is academic success on the practical teaching classes of Theory and methodic of artistic gymnastics in the context of increasing the quality of teaching and its efficiency. The aim of the research is to examine the differences in the academic performance of the last three generations of students in relation to the organizational model of practical teaching classes that they attended.

Methods

The success of mastering the program of practical classes on the subject in the last three generations of students was examined. The independent variable was an organization model of the practical teaching. In relation to the old organizational model of teaching, for which students were trained in the school year 2015/16 and 2016/17, a new model, by which students were taught in the school year 2017/18 contains four changes.

Teaching in the winter semester is concentrated in two blocks by two hours per week, so the 30-hour fund is realized during eight weeks. This change was introduced for three reasons. It was expected that the effects of practical teaching would be higher when it is held twice a week, instead of once as before. Expectations were made in terms of better technical and physical preparation, as a result of more frequent practicing and a greater amount of practicing per week. Also, it is expected that the entire fund of classes will be realized, which could not have been the case in the previous two school years, when in the winter

semester it was not possible to realize more than 13 blocks of practical instruction, that is, 26 out of 30 hours. Finally, it is expected that after the end of the classes, students will use the term by the end of the semester for training and taking the contents of the practical part of the exam from the fifth semester.

The second change concerned the earlier separation of practical classes for male and female students, from the winter semester. This was done to achieve the unification of the teaching process, based on the specificity of the male and female organism, primarily in the aspect of the strength properties.

The third change relates to the curriculum and practical work program. The arrangement of teaching units according to the new organizational model was changed in order to better adapt to the basic principles of the methodology of school artistic gymnastics training.

The fourth change was the extension of the voluntary exercise program. This measure was applied to encourage students to increase their engagement in teaching (Dabović, 2014). Students were not obliged to take voluntary exercises. In the exercise program for two older generations, there were 15 additional exercises. In the program for the youngest generation, besides these 15, there were 13 more additional exercises.

The success of mastering the program of practical classes is monitored by observing the seven dependent variables, which presented the level of content learning, expressed as a score of points won. Those are:

- **PRAKT5:** the sum of the points awarded on the assessment of the program of practical teaching of the fifth (winter) semester;
- **KOLOK6:** the sum of the points awarded on the assessment of the competence of individual exercises from the program of practical instruction in the sixth (summer) semester;
- **SAST6:** the number of points awarded on the assessment of the competency of test subjects from the program of practical instruction in the sixth (summer) semester;
- **PRAKT6:** the sum of the points awarded on the assessment of the overcome of the entire program of practical classes in the sixth (summer) semester;
- **OBAPR:** the sum of points awarded on the assessment of the overlap of the obligatory program of practical instruction in both semesters;
- **IZBPR:** the sum of the points awarded on the assessment of the overcoming of additional voluntary exercises;
- **SUMPR:** the sum of the points awarded on the assessment of the overcome of the entire program of practical teaching.

The success in mastering the program of practical classes was compared during the school year in whole and by parts.

The sample of respondents consisted of the male students of the last three generation, who attended the practical classes on the subject and passed the practical part of the exam during the school year. The subsample of the youngest respondents (generation 20178/18) made n=42 students. The subsample of the elderly (generation 2016/17) and oldest (generation 2015/16) respondents made n=45 students. The youngest generation of students attended classes according to the changed organizational model of teaching, which was designed in order to increase its quality. For the statistical analysis of data, the IBM SPSS 20 program was used. The central tendency of the results is represented by the arithmetic mean (AS), along with the standard error of the mean (SG). The variability of the results is represented by a minimum (MIN) and a maximum (MAX) value, a standard deviation (SD) and a coefficient of variation (KV). The statistical significance of the difference between the subunits was tested by a one-way variance analysis test (ANOVA).

Results with discussion

The basic descriptive parameters of the observed performance in whole, for all three groups of respondents were shown at Table 1. The highest performance for all variables, expressed by the median values of the points scored by whole, was achieved by the youngest generation of students who attended the school year 2017/18, according to the new organizational model. The least successful, according to the median values of the achieved points collected from the test unit of the winter semester (PRAKT5), were the respondents of the generation 2016/17. Also, in terms of success in mastering individual summer semester programs (KOLOK6), the least successful were the respondents of the generation 2016/17. By success in mastering exam compositions from the summer semester program (SAST6), the least successful were the respondents of the 2015/16 generation, but by success in mastering the entire summer semester program (PRAKT6), the least successful were however the respondents of the generation 2016/17. When watching the entire obligatory program (OBAVPR), also the winter and the summer semester program again the respondents of the generation 2016/17 were the least successful. This is also the case with the voluntary exercise program (IZBSUM), which proves that the respondents of the generation 2016/17 were the least successful when considering the entire program of practical classes (SUMPR).

Table 1. Basic descriptive parameters by groups

GEN		N	MIN	MAX	AS	SG	SD	KV
2015/16	PRAKT5	45	64.0	93.4	77.63	1.14	7.62	9.81
	KOLOK6	45	72.5	116.0	95.84	1.32	8.85	9.24
	SAST6	45	23.9	53.8	41.55	0.95	6.38	15.35
	PRAKT6	45	104.4	169.8	137.39	2.06	13.79	10.04
	OBAVPR	45	172.9	260.2	215.02	2.97	19.93	9.27
	IZBSUM	45	19.0	121.0	67.84	5.44	36.47	53.76
	SUMPR	45	194.9	377.1	282.86	7.45	49.99	17.67
2016/17	PRAKT5	45	64.5	90.0	75.74	1.14	7.67	10.13
	KOLOK6	45	70.2	113.2	92.40	1.76	11.79	12.76
	SAST6	45	28.0	51.1	42.49	0.86	5.80	13.64
	PRAKT6	45	102.5	164.0	134.89	2.52	16.91	12.54
	OBAVPR	45	167.0	253.8	210.64	3.60	24.15	11.47
	IZBSUM	45	19.2	112.9	63.26	4.36	29.27	46.27
	SUMPR	45	189.5	357.5	273.90	7.47	50.13	18.30
2017/18	PRAKT5	42	65.0	95.3	81.87	1.28	8.30	10.14
	KOLOK6	42	80.9	115.2	99.34	1.45	9.41	9.47
	SAST6	42	36.0	52.1	45.07	0.73	4.73	10.49
	PRAKT6	42	116.9	165.4	144.41	2.12	13.76	9.53
	OBAVPR	42	184.3	258.0	226.28	3.30	21.38	9.45
	IZBSUM	42	35.0	217.8	96.60	4.97	32.18	33.31
	SUMPR	42	238.6	471.7	322.89	7.40	47.98	14.86

The largest average sum of points earned by mastering voluntary exercises (IZBSUM) by the respondents of the 2017/18 generation is in fact partly the result of a larger number of voluntary exercises, which was one of the procedures to encourage students according to the new organizational model of teaching. When the success in mastering voluntary exercise programs is observed in percent (Table 2), the situation is different. It shows that the youngest generation achieved the smallest success. However, the reason for this is again a greater number of voluntary exercises in the program by which the youngest generation of students attended the classes. They have adopted a large number of voluntary exercises than the two older generations, but there are a greater number of voluntary exercises that they still have not been able to adopt. The same can be said for the sum of points won by mastering the entire program of practical classes (SUMPR). The most points, on this basis, were won by the youngest generation respondents.

However, when looking at the percentage share instead of collecting the points scored, the youngest generation has the worst result, and this difference is precisely the number of voluntary exercises in the program for which the youngest generation attended.

Table 2. Basic descriptive parameters by groups expressed in percentages

GEN		N	MIN	MAX	AS	SG	SD	KV
2015/16	PRAKT5	45	64.0	93.4	77.63	1.14	7.62	9.81
	KOLOK6	45	55.77	89.23	73.73	1.02	6.81	9.24
	SAST6	45	39.83	89.67	69.25	1.58	10.63	15.35
	PRAKT6	45	54.95	89.37	72.31	1.08	7.26	10.04
	OBAVPR	45	59.62	89.72	74.15	1.02	6.87	9.27
	IZBSUM	45	12.70	80.70	45.23	3.62	24.32	53.76
	SUMPR	45	44.30	85.70	64.29	1.69	11.36	17.68
2016/17	PRAKT5	45	63.5	90.0	75.30	1.18	7.92	10.52
	KOLOK6	45	54.00	87.08	71.08	1.35	9.07	12.76
	SAST6	45	46.67	85.17	70.82	1.44	9.66	13.64
	PRAKT6	45	53.95	86.32	71.00	1.33	8.90	12.53
	OBAVPR	45	57.24	87.52	72.48	1.25	8.41	11.60
	IZBSUM	45	12.80	75.30	42.17	2.91	19.52	46.29
	SUMPR	45	42.80	81.30	62.15	1.71	11.44	18.41
2017/18	PRAKT5	42	65.0	95.3	81.87	1.28	8.30	10.14
	KOLOK6	42	62.23	88.62	76.42	1.12	7.24	9.47
	SAST6	42	60.00	86.83	75.12	1.22	7.88	10.49
	PRAKT6	42	61.53	87.05	76.00	1.12	7.24	9.53
	OBAVPR	42	63.55	88.97	78.03	1.14	7.37	9.45
	IZBSUM	42	12.50	77.80	34.50	1.77	11.50	33.33
	SUMPR	42	41.90	82.80	56.65	1.30	8.42	14.87

Legend: GEN – generation.

Statistical significance of observed differences was determined by a one-way variance analysis test (ANOVA) and is shown in Table 3. The respondents of the youngest generation, who attended the new organizational model in the school year 2017/18, were significantly more successful than the respondents of the previous generation, who attended classes in the school year 2016/17, in all observed variables. In relation to the respondents of the 2015/16 generation, no statistically significant difference was found in the adoption of individual exercises from the summer semester program (KOLOK5), among the youngest generation respondents. According to all other variables, the youngest generation respondents were significantly more successful.

The statistical significance of the differences in the success of the adopting program of practical classes among the respondents of the two older generations was determined only for the adoption of separate exercises from the summer semester (KOLOK6), in which the respondents of the 2015/16 generation were more successful. In the other parts of the curriculum, there were no statistically significant differences between the respondents of these two groups.

Given Leven's (F) test values, which indicate that the assumption about the equality of variances among subunits is not met, even when the Games-Howell post hoc test is used, one possibility of one type error should be counted, that is, some differences may not be significant or at least not to the specified extent. This could mean that respondents of the youngest subsample may not significantly differ from the respondents of the two older generations of success. However, it can be even more certain that respondents of both elderly subsamples do not differ significantly among themselves.

Table 3. Games-Howell ANOVA post-hoc test

	2017/18 - 2015/16		2017/18 - 2016/17		2016/17 - 2015/16		Between groups	
	Mean diff	Sign	Mean diff	Sign	Mean diff	Sign	F	Sig.
SUM5	4.24	0.040	6.13	0.002	-1.89	0.474	6.88	.001
KOLOK6	3.50	0.182	9.66	0.000	-6.16	0.021	5.11	.007
SAST6	3.12	0.033	3.54	0.014	0.42	0.947	4.41	.014
SUM6	7.02	0.051	13.61	0.000	-6.59	0.130	4.71	.011
OBVSUM	11.26	0.035	15.65	0.005	-4.38	0.617	5.85	.004
IZBSUM	28.77	0.001	43.25	0.000	-14.49	0.102	13.06	.000
PRAKT	40.03	0.001	48.99	0.000	-8.96	0.674	11.99	.000

The data obtained by this research provide a limited opportunity to validate the effects of applying the latest organizational model of teaching in the subject Theory and methodic of artistic gymnastics. It may be to say with greatest caution that the applied organizational model, in a package with all the incentive measures it contains, provides conditions for students to better master the curriculum of practical classes than was previously the case. Positive results of encouraging students in teaching were also presented by previous research (Dabović, 2014; Suzić, 2005).

The disadvantage of this research is that it cannot be assumed which of the measures of incitement and to what extent led to improvement in the success of the adopting of practical teaching program on the subject. Also, the characteristics of subsample are not followed, in the sense that in some generations there may be more skilled and committed students, who are generally more successful than others. Without data, it can only be assumed that all three subsamples are composed of approximately equal general academic performance. Primarily because all three subsamples are the respondents who first attended the course, so respondents who, having obtained the condition for enrollment in the third year of study, have met roughly the same conditions that they could continue to access. In addition, the survey covered only the results achieved during one school year, in the same fund hours and under the same conditions of assessment or data collection, for all three sub-assignments. Therefore, the application of such organizational model can be recommended in teaching, not only on the subject Theory and methodic of artistic gymnastics, but also on other subjects that include practical teaching of the adoption of the technique and methodology of the selected sports branch.

In the next research, more attention should be paid to documenting the uniformity of the sample, as well as the differentiation of the results, and thus the effects of each individual incentive measure.

Conclusion

Observed organizational model of teaching in the subject Theory and methodic of artistic gymnastics, in which the lesson is concentrated by the increase of the weekly fund of classes, where the male and female departments have been separated, the order and composition of the teaching units and the increased fund of voluntary exercises have been changed, and in order to encourage students, the success of the program of practical teaching on the subject. On this basis, it can be recommended to work with students not only on the subject Theory and methodic of artistic gymnastics, but also on other related subjects. The observed organizational model should be further developed, and special attention should be paid to finding the possibility for its more precise and better differentiated valorization.

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EFIKASNOST NASTAVE TEORIJE I METODIKE SPORTSKE GIMNASTIKE U RAZLIČITIM MODELIMA ORGANIZACIJE

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Uvod

Akadska uspešnost, odnosno akademska postignuće po Suziću (2005), podrazumeva savladavanje akademskog nastavnog programa kroz proces nastave, u cilju sticanja akademskog obrazovanja i određenog akademskog zvanja. Akadska uspešnost je podjednako važna i studentima i univerzitetima. Nadmetanje institucija na tržištu visokog obrazovanja uslovljava stalnu težnju ka povećanju akademske uspešnosti, kako bi se održala ili povećala konkurentnost (Dill and Soo, 2005). Prema istraživanjima američke organizacije za pomoć studentima (Breakthrough collaborative's research, 2009), najvažniji prediktori akademske uspešnosti su priprema za akademska obrazovanje i kvalitet nastave. S druge strane, tri najznačajnija kriterijuma za rangiranje univerziteta po kvalitetu su postignuće univerziteta, postignuće studenata i akademske resursi univerziteta (Clarke, 2002). Pored kvaliteta nastave, drugi važan činilac uspešnosti univerziteta je njena efikasnost. Težnja ka povećanju efikasnosti nastave često dovodi do smanjenja kriterijuma ocenjivanja (Walsh, 2010). U Srbiji je, od Bolonjske reforme, zabeleženo povećanje efikasnosti studiranja, ali sve navodi na zaključak da je to posledica smanjenja kriterijuma ocenjivanja (Jarić i Vukasović, 2009). Da bi se kvalitet i efikasnost akademske nastave zaista unapredili, neophodno je temeljno isplanirati, organizovati i sprovesti nastavu, na osnovu valorizovanja efekata primenjenih modela organizacije.

Na predmetu Teorija i metodika sportske gimnastike, neprestano se teži unapređenju kvaliteta i efikasnosti nastave. Na osnovu uočenih poteškoća i nedostataka, naročito od Bolonjske reforme, planiraju se i sprovode razne mere za unapređenje kvaliteta i efikasnosti nastave, a njihovi efekti se prate i valorizuju (Dabović, 2014; Kocić-Pajić, 2014; Radojević, Dabović, Grbović, 2011; Radojević, Grbović, Dabović, Vukašinović, 2010). Predmet ovog istraživanja je valorizovanje efekata različitih modela organizacije praktične nastave na predmetu u odnosu na akademska uspešnost studenata u savladavanju nastavnog programa. Cilj istraživanja je ispitivanje razlika u akademskoj uspešnosti poslednje tri generacije studenata u odnosu na organizacioni model praktične nastave koju su pohađali.

Metod

Posmatrana je uspešnost poslednje tri generacije studenata u savladavanju programa praktične nastave na predmetu Teorija i metodika sportske gimnastike. Nezavisnu varijablu čini model organizacije praktične nastave. U odnosu na stari model organizacije nastave, po kom su praktičnu nastavu pohađali studenti u školskoj 2015/16. i 2016/17. godini, novi model, po kom su nastavu pohađali studenti u školskoj 2017/18. sadrži četiri izmene.

Nastava u zimskom semestru je koncentrisana u dva bloka po dva časa nedeljno, tako da je fond od 30 časova realizovan tokom osam nedelja nastave. Ova izmena je uvedena iz tri razloga. Očekivalo se da će efekti praktične nastave biti veći kada se ona održava dva puta nedeljno, umesto jednom kao do tada. Očekivanja su bila u pogledu bolje tehničke i fizičke pripreme, kao posledice učestalijeg vežbanja i većeg obima vežbanja nedeljno. Takođe, očekivano je da se čitav fond časova realizuje, što nije mogao biti slučaj u prethodne dve školske godine, kada se u zimskom semestru nije moglo realizovati više od 13 blok časova praktične nastave,

odnosno 26 od 30 časova. I na kraju, očekivano je da, po završetku nastave, studenti iskoriste termine do kraja semestra za uvežbavanje i polaganje sadržaja praktičnog dela ispita iz petog semestra.

Druga izmena se odnosila na razdvajanje praktične nastave za studentkinje i studente već od zimskog semestra. Time se želela postići unifikacija nastavnog procesa, polazeći od specifičnosti muškog i ženskog organizma, prevashodno po aspektu ispoljavanja snage.

Treća izmena se odnosi na plan i program rada praktične nastave. Raspored nastavnih jedinica je po novom modelu organizacije je izmenjen u cilju bolje prilagođenosti osnovnim principima metodike obučavanja školske sportske gimnastike.

Četvrta izmena je bila proširenje izbornog programa vežbi. Ova mera je primenjena radi podsticanja studenata na veće angažovanje u praćenju nastave (Dabović, 2014). Studenti nisu bili obavezni da polažu izborne vežbe. U programu izbornih vežbi za dve starije generacije bilo je 15 dodatnih vežbi. U programu za najmlađu generaciju, osim ovih 15, bilo je još 13 dodatnih vežbi.

Uspešnost savladavanja programa praktične nastave praćena je posmatranjem sedam zavisnih varijabli, kojima je predstavljen nivo savladanosti nastavnih sadržaja, izražen zbirom osvojenih bodova. To su:

- PRAKT5: zbir osvojenih bodova na ocenjivanju savladanosti programa praktične nastave petog (zimskog) semestra;
- KOLOK6: zbir osvojenih bodova na ocenjivanju savladanosti pojedinačnih vežbi iz programa praktične nastave u šestom (letnjem) semestru;
- SAST6: zbir osvojenih bodova na ocenjivanju savladanosti ispitnih sastava iz programa praktične nastave u šestom (letnjem) semestru;
- PRAKT6: zbir osvojenih bodova na ocenjivanju savladanosti celokupnog programa praktične nastave u šestom (letnjem) semestru;
- OBAVPR: zbir osvojenih bodova na ocenjivanju savladanosti celokupnog obaveznog programa praktične nastave u oba semestra;
- IZBPR: zbir osvojenih bodova na ocenjivanju savladanosti dodatnih izbornih vežbi;
- SUMPR: zbir osvojenih bodova na ocenjivanju savladanosti celokupnog programa praktične nastave.

Upoređena je uspešnost u savladanosti programa praktične nastave ukupno i po celinama u toku školske godine.

Uzorak ispitanika činili su studenti muškog pola poslednje tri generacije, koji su odslušali praktičnu nastavu na predmetu i položili praktični deo ispita u toku školske godine. Subuzorak najmlađih ispitanika (generacija 2017/18) činilo je $n=42$ studenata. Subuzorak starijih (generacija 2016/17) i najstarijih (generacija 2015/16) ispitanika činilo je $n=45$ studenata. Najmlađa generacija studenata pohađala je nastavu po novom, izmenjenom organizacionom modelu nastave, koji je osmišljen u cilju daljeg povećanja njenog kvaliteta i efikasnosti. Za statističku analizu podataka, korišćen je program IBM SPSS 20. Centralna tendencija rezultata predstavljena je aritmetičkom sredinom (AS), zajedno sa standardnom greškom procene aritmetičke sredine (SG). Varijabilnost rezultata predstavljena je minimalnom (MIN) i maksimalnom (MAX) vrednošću, standardnom devijacijom (SD) i koeficijentom varijabilnosti (KV). Statistička značajnost razlika između subuzoraka testirana je jednosmernim testom analize varijanse (ANOVA).

Analiza i obrada podataka u ovom istraživanju izvršena je u programu za statističku obradu podataka IBM SPSS 20. Centralna tendencija rezultata predstavljena je aritmetičkom sredinom (AS), zajedno sa standardnom greškom procene aritmetičke sredine (SG). Varijabilnost rezultata predstavljena je minimalnom (MIN) i maksimalnom (MAKS) vrednošću, standardnom devijacijom (SD) i koeficijentom varijabilnosti (KV). Statistička značajnost razlika između subuzoraka testirana je jednosmernim ANOVA testom. Statistička značajnost razlika po nastavnim celinama testirana je t-testom za zavisne uzorke.

Rezultati sa diskusijom

U Tabeli 1. prikazani su osnovni deskriptivni parametri posmatrane uspešnosti po celinama, za sve tri grupe ispitanika. Najveću uspešnost prema svim varijablama, izraženo srednjim vrednostima osvojenih poena po celinama, postigli su ispitanici najmlađe generacije studenata, koji su nastavu pohađali u školskoj 2017/18. godini, po novom organizacionom modelu. Najmanje uspešni, prema srednjim vrednostima zbira osvojenih poena iz ispitne celine zimskog semestra (PRAKT5), bili su ispitanici generacije 2016/17. Takođe, po uspešnosti u savladavanju programa pojedinačnih vežbi iz letnjeg semestra (KOLOK6), najmanje uspešni su bili ispitanici generacije 2016/17. Po uspešnosti u savladavanju ispitnih sastava iz programa letnjeg semestra (SAST6), najmanje uspešni su bili ispitanici generacije 2015/16, ali su po uspešnosti u savladavanju čitavog programa letnjeg semestra (PRAKT6), najmanje uspešni ipak, bili su ispitanici generacije 2016/17. Kada se posmatra čitav obavezni program (OBAVPR), dakle i program zimskog i program letnjeg semestra, ponovo su ispitanici generacije 2016/17. bili najmanje uspešni. Tako je i sa programom izbornih vežbi (IZBSUM), iz čega proističe da su ispitanici generacije 2016/17. bili najmanje uspešni i kada se posmatra čitav program praktične nastave (SUMPR).

Tabela 1. Osnovni deskriptivni parametri uspešnosti po grupama

GEN		N	MIN	MAX	AS	SG	SD	KV
2015/16	PRAKT5	45	64,0	93,4	77,63	1,14	7,62	9,81
	KOLOK6	45	72,5	116,0	95,84	1,32	8,85	9,24
	SAST6	45	23,9	53,8	41,55	0,95	6,38	15,35
	PRAKT6	45	104,4	169,8	137,39	2,06	13,79	10,04
	OBAVPR	45	172,9	260,2	215,02	2,97	19,93	9,27
	IZBSUM	45	19,0	121,0	67,84	5,44	36,47	53,76
	SUMPR	45	194,9	377,1	282,86	7,45	49,99	17,67
2016/17	PRAKT5	45	64,5	90,0	75,74	1,14	7,67	10,13
	KOLOK6	45	70,2	113,2	92,40	1,76	11,79	12,76
	SAST6	45	28,0	51,1	42,49	0,86	5,80	13,64
	PRAKT6	45	102,5	164,0	134,89	2,52	16,91	12,54
	OBAVPR	45	167,0	253,8	210,64	3,60	24,15	11,47
	IZBSUM	45	19,2	112,9	63,26	4,36	29,27	46,27
	SUMPR	45	189,5	357,5	273,90	7,47	50,13	18,30
2017/18	PRAKT5	42	65,0	95,3	81,87	1,28	8,30	10,14
	KOLOK6	42	80,9	115,2	99,34	1,45	9,41	9,47
	SAST6	42	36,0	52,1	45,07	0,73	4,73	10,49
	PRAKT6	42	116,9	165,4	144,41	2,12	13,76	9,53
	OBAVPR	42	184,3	258,0	226,28	3,30	21,38	9,45
	IZBSUM	42	35,0	217,8	96,60	4,97	32,18	33,31
	SUMPR	42	238,6	471,7	322,89	7,40	47,98	14,86

Najveći prosečan zbir poena, osvojenih po osnovu savladavanja izbornih vežbi (IZBSUM), od strane ispitanika generacije 2017/18, zapravo je jednim delom posledica većeg broja izbornih vežbi, što je bila jedna od mera podsticanja studenata po novom organizacionom modelu nastave. Kada se uspešnost u savladavanju programa izbornih vežbi posmatra u procentima (Tabela 2), situacija je drugačija. Sada ispitanici najmlađe generacije pokazuju najmanju uspešnost. Međutim, razlog tome je opet veći broj izbornih vežbi u programu po kom je nastavu pohađala najmlađa generacija studenata. Oni su usvojili veći broj izbornih vežbi nego obe starije generacije, ali je veći i broj izbornih vežbi koje nisu stigli da usvoje. Isto to se može reći i za zbir poena osvojenih po osnovu savladavanja celokupnog programa praktične nastave (SUMPR). Najviše poena po ovom osnovu osvojili su ispitanici najmlađe generacije. Međutim, kada se posmatra procentni udeo umesto zbira osvojenih poena, najmlađa generacija ima najslabiji rezultat, a tu razliku upravo čini veći broj izbornih vežbi u programu po kom je nastavu pohađala najmlađa generacija.

Tabela 2. Osnovni deskriptivni parametri uspešnosti po grupama izražene u procentima

GEN		N	MIN	MAX	AS	SG	SD	KV
2015/16	PRAKT5	45	64,0	93,4	77,63	1,14	7,62	9,81
	KOLOK6	45	55,77	89,23	73,73	1,02	6,81	9,24
	SAST6	45	39,83	89,67	69,25	1,58	10,63	15,35
	PRAKT6	45	54,95	89,37	72,31	1,08	7,26	10,04
	OBAVPR	45	59,62	89,72	74,15	1,02	6,87	9,27
	IZBSUM	45	12,70	80,70	45,23	3,62	24,32	53,76
	SUMPR	45	44,30	85,70	64,29	1,69	11,36	17,68
2016/17	PRAKT5	45	63,5	90,0	75,30	1,18	7,92	10,52
	KOLOK6	45	54,00	87,08	71,08	1,35	9,07	12,76
	SAST6	45	46,67	85,17	70,82	1,44	9,66	13,64
	PRAKT6	45	53,95	86,32	71,00	1,33	8,90	12,53
	OBAVPR	45	57,24	87,52	72,48	1,25	8,41	11,60
	IZBSUM	45	12,80	75,30	42,17	2,91	19,52	46,29
	SUMPR	45	42,80	81,30	62,15	1,71	11,44	18,41
2017/18	PRAKT5	42	65,0	95,3	81,87	1,28	8,30	10,14
	KOLOK6	42	62,23	88,62	76,42	1,12	7,24	9,47
	SAST6	42	60,00	86,83	75,12	1,22	7,88	10,49
	PRAKT6	42	61,53	87,05	76,00	1,12	7,24	9,53
	OBAVPR	42	63,55	88,97	78,03	1,14	7,37	9,45
	IZBSUM	42	12,50	77,80	34,50	1,77	11,50	33,33
	SUMPR	42	41,90	82,80	56,65	1,30	8,42	14,87

Statistička značajnost uočenih razlika, utvrđena je jednosmernim testom analize varijanse (ANOVA) i prikazana je u Tabeli 3. Ispitanici najmlađe generacije, koja je nastavu pohađala po novom organizacionom modelu, u školskoj 2017/18, značajno su bili uspešniji od ispitanika prethodne generacije, koja je nastavu slušala u školskoj 2016/17, po svim posmatranim varijablama. U odnosu na ispitanike generacije 2015/16, nije utvrđena statistički značajna razlika u usvojenosti pojedinačnih vežbi iz programa letnjeg semestra (KOLOK5), kod ispitanika najmlađe generacije. Po svim ostalim varijablama, ispitanici najmlađe generacije su bili značajno uspešniji.

Statistička značajnost razlika u uspešnosti usvajanja programa praktične nastave između ispitanika dve starije generacije, utvrđena je samo za usvojenost pojedinačnih vežbi iz letnjeg semestra (KOLOK6), u čemu su uspešniji bili ispitanici generacije 2015/16. U ostalim celinama programa praktične nastave, nije bilo statistički značajnih razlika između ispitanika ove dve grupe.

Obzirom na vrednosti Levenovog (F) testa, koje pokazuju da nije ispunjena pretpostavka o jednakosti varijansi među subuzorcima, čak i kada se koristi Games-Howell post hoc test, mora se računati na izvesnu mogućnost greške tipa jedan, odnosno da neke razlike možda nisu značajne ili bar nisu to u utvrđenoj meri. To bi moglo značiti da se ispitanici najmlađeg subuzorka možda i ne razlikuju značajno u tolikoj meri od ispitanika dve starije generacije po uspešnosti. Međutim, može se biti utoliko sigurniji da se ispitanici oba starija subuzorka ne razlikuju značajno među sobom.

Tabela 3. Games-Howell ANOVA post-hoc test

	2017/18 - 2015/16		2017/18 - 2016/17		2016/17 - 2015/16		Between groups	
	Mean diff	Sign	Mean diff	Sign	Mean diff	Sign	F	Sig.
SUM5	4,24	0,040	6,13	0,002	-1,89	0,474	6,88	,001
KOLOK6	3,50	0,182	9,66	0,000	-6,16	0,021	5,11	,007
SAST6	3,12	0,033	3,54	0,014	0,42	0,947	4,41	,014
SUM6	7,02	0,051	13,61	0,000	-6,59	0,130	4,71	,011
OBVSUM	11,26	0,035	15,65	0,005	-4,38	0,617	5,85	,004
IZBSUM	28,77	0,001	43,25	0,000	-14,49	0,102	13,06	,000
PRAKT	40,03	0,001	48,99	0,000	-8,96	0,674	11,99	,000

Podaci do kojih se ovim istraživanjem došlo, pružaju ograničenu mogućnost da se na osnovu njih valorizuju efekti primene najnovijeg organizacionog modela nastave na predmetu Teorija i metodika sportske gimnastike. Može se, sa najvećom merom opreza reći da primenjeni organizacioni model, u paketu sa svim merama podsticanja koje je sadržao, obezbeđuje uslove da studenti bolje savladaju program praktične nastave, nego što je to ranije bio slučaj. Pozitivni rezultati podsticanja studenata u nastavi, predstavljeni su i ranijim istraživanjima (Dabović, 2014; Suzić, 2005).

Nedostatak ovog istraživanja je u tome što se ne može pretpostaviti koja je od mera podsticanja i u kom obimu dovela do poboljšanja u uspešnosti usvajanja programa praktične nastave na predmetu. Takođe se ne prate karakteristike subuzoraka, u smislu da u nekoj od generacija možda ima više dobrih studenata, koji su generalno uspešniji od drugih. Bez podataka, može se samo pretpostaviti da sva tri subuzorka čine ispitanici približno jednake generalne akademske uspešnosti. Prvenstveno zbog toga što sva tri subuzorka čine ispitanici koji su prvi put slušali nastavu na predmetu, dakle ispitanici koji su, stekavši uslov za upis na treću godinu studija, ispunili približno jednake uslove da bi toj nastavi mogli pristupiti. Osim toga, istraživanjem su obuhvaćeni samo rezultati koji su ostvareni u toku jedne školske godine, u istom fondu časova i pod istim uslovima ocenjivanja, odnosno prikupljanja podataka, za sva tri subuzorka. Stoga se primena ovakvog organizacionog modela može preporučiti u nastavi, ne samo na predmetu Teorija i metodika sportske gimnastike, već i na drugim predmetima koji sadrže praktičnu nastavu usvajanja tehnike i metodike izabrane sportske grane.

U narednim istraživanjima bi trebalo više pažnje posvetiti dokumentovanju uniformnosti uzorka, kao i diferencijaciji rezultata, pa time i efekata svake pojedinačne mere podsticanja.

Zaključak

Posmatrani model organizacije nastave na predmetu Teorija i metodika sportske gimnastike, u kom je nastava koncentrisana povećanjem nedeljnog fonda časova, gde su odvojena muška i ženska odeljenja, izmenjen redosled i sastav nastavnih jedinica i povećan fond izbornih vežbi, a u cilju podsticanja studenata, pokazao je povećanje uspešnosti usvajanja programa praktične nastave na predmetu. Na osnovu toga se može preporučiti u radu sa studentima ne samo na predmetu Teorija i metodika sportske gimnastike, već i na drugim srodnim predmetima. Posmatrani organizacioni model treba dalje razvijati, a posebnu pažnju treba obratiti na iznalaženje mogućnosti za njegovu precizniju i bolje diferenciranu valorizaciju.

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STUDENT'S INTEREST IN PHYSICAL ACTIVITY

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Introduction

Student interests are diverse, depending on the individual, however what is in common to all students is motion. In order to satisfy the need for motion, which, due to today's way of living, is more and more neglected, students, regardless of orientation, should have regular physical activity during their studies.

Today's way of living is correlated to the advancement of technology, whereby students are enabled to sit down and fulfill obligations from home that they once had to get out of the house and walk a certain distance for. Regular physical activity is one of the key factors for a healthy life. It is impossible to list all the positive effects of physical activity, but no doubt some of them include health and lifestyle improvements, extended life expectancy and reduced risk of chronic non-communicable diseases, such as heart disease, blood vessels disease, diabetes, etc. (Ugarkovic, 1996).

In the relevant literature, cultural, social and economic factors that adversely affect health can be distinguished: 1. lack of physical activity; 2. stress; 3. low incomes and poverty; 4. inadequate medical and social care and poor availability of health and social services; 5. lack of low-cost recreational activities and non-existence of parks and gardens; 6. excessive smoking, consumption of alcohol and illicit drugs, practicing unsafe sex; 7. life in areas with high crime rates; 8. non-implementation of occupational safety measures; 9. poor living conditions, humidity, cold and insufficient living space; 10. lack of buying or preparation of healthy meals; 11. inadequate child care and inadequate socialization; 12. poor transport planning, inaccessibility of public transport; 13. unemployment; 14. consumption of "fast food" and other types of foods that are not healthy; 15. life in industrial areas with high risk of pollution, traffic congestion and poor air quality; 16. social isolation and social exclusion - life on the margins of the society, without the possibility of controlling one's own life; 17. long working hours, stressful or risky working conditions; 18. poor school and health education and lack of awareness about the health services availability (Gidens, 2005: 160). Therefore, the lack of physical activity is the main cause of a negative impact on health, according to Gidens.

Due to sedentary lifestyle students bodies literally "scream" for physical activity, however if students engage in physical activity, not only the improvement in the quality of their lives will be observed, but their time will be spent well on healthy habits. Acceptance of physical education as a merit is a significant indicator for determination of the degree for participation in programs that are designated as sports-recreational (Galić, 1995). Physical education from early years of school education plays a major role in this. If physical education in elementary and high schools is presented well by teachers, a positive image and attitude towards regular physical activity will build up among students, thus will result in continued engagement in it throughout the future. In today's world, it is quite justifiably considered that physical culture, as a product and function of social life and a specific domain of social practice, is a significant factor in economic, social and individual development that is directed towards the comprehensive development and totality of the manifestation of the human personality (Galić, 1995). Simplified, regular physical activity helps in better managing and completion of everyday tasks, and in doing so positively affects development, mood and the overall development of the personality.

Theoretical Framework

Definitions of Basic Terms

Physical activity implies any activity that in its basis has some form of physical movement, physical exercise and physical exercising, and the results of this activity depend on the individual itself and their affinity for it.

"Physical movement - Exercising is an individual human act by which the mechanical changes of one's own body, as a reality in themselves, in a specific human practice turn into value for someone" (Matić, 1998).

"The physical exercise, as a basic means and the basic method of physical education of pupils, is a specially selected movement activity which is primarily: a) a biological goal (reaching an optimal level of physical abilities) b) a pedagogical goal (acquiring motor information through the formation and improvement of exercise skills and habits)" (Višnjić, Jovanović & Miletić, 2004).

"Physical exercise, as a process of exercising, is an adaptive process that, by applying movable activities, that is, by systematic repetition of bodily exercises (as a complex neurophysiological and biomechanical process), causes positive changes in human capabilities from some primary - initial to desired - final state." (Višnjić, Jovanović & Miletić, 2004).

Interests

Interests are also a potential subject of several scientific disciplines: psychology (developmental, pedagogical, differential), sociology (sociology of leisure, sociology of youth, sociology of work) and pedagogy (narrative didactics). First of all, the interests, as well as all other values, are a characteristic of the human species, and are, in their very essence, humane; they are a complex and valuable product of a long organic matter evolution. (Pantić, 1980).

The interests themselves are part of every human being, and each person has diverse interests. As it is said, "Beauty is in the eye of the observer", the same can be said for the interests, that it depends on the "observer" itself, what we are interested in will refer exclusively to us, whilst someone else will find another interest more appealing.

As Dragomir Pantic (1980) says: "Interests are one form of (mostly terminal) values for which is characteristic a mind preoccupation with the favorite content and / or dealing with the selected activities."

The importance of interests is great. The interests alone show us the scope of students' affinity for some activities, jobs ... Based on these interests an image about that person can be created - what they like, what they are doing, how they spend their free time ... Pantic (1980) lists a number of characteristics related to interests:

- Interests are an important structural element of the personality
- Interests are a universal phenomenon because there is no personality that does not possess a particular interest structure
- The dilemma of interests is certainly one of the indicators of personality development and maturity
- Interests are part of an active human nature.
- Interests are relatively permanent dispositions and therefore mark the personality throughout life
- Interests play an important role in all stages of our life.

Students' interest alone in physical activity should be developed not from the period of college enrollment, but from their early childhood, from the first grade of elementary schools, where physical education is held firstly by teachers, then by professors of physical education, up to the point of college enrollment. Developed fondness for physical activity in students is highly influenced by teachers' proper and systematic work within the subject.

The contribution of physical education, especially educators and teachers, would be a proper and systematic work, thus resulting in childrens' and youth's acceptance of exercising as a value for themselves,

which is best reflected in the efforts to exercise, practiced exercises and in the persistence in exercising regularly. (Višnjić, Jovanović & Miletić, 2004).

Review of Select Previous Research

Of the researches that were concerned with students' interest, the following should be mentioned. A research conducted at the Faculty of Security Studies and the private Singidunum University in Belgrade, titled "Belgrade students' relationship with sports at the University" (Kordić & Babić, 2011). The research examined attitudes and behaviors of Belgrade students related to sports and determined the necessity level for organized sports activities and more active participation of Universities in the physical education of students. A conducted survey involved the students' information about the current state of sports at the University of Belgrade, their sporting behavior, their attitudes about sports, and the influence of sports on student life. The results of the questionnaire show that students highly value sporting activities, and that most of them are sporting actively and expect the support of the University for the development of sports culture in the form of new facility buildings and stimulation of the student's sporting behavior.

Regarding the very interests of Božo Bokan (1985), in his doctoral dissertation, he studied the interests of primary and secondary school pupils of 13 and 17 years of age, as well as the pedagogues of physical culture, in total 1648 subjects were examined. There were 127 physical education pedagogues included in the study, while the number of primary and secondary school pupils included was 1495. The respondents sample being questioned was determined by three regions of the SR Serbia: Belgrade, Kraljevo and South Morava, with cities, as typical representatives of these regions, (Belgrade, Čačak, Vranje). For several reasons, it wasn't possible to make a selection of schools within the region, ie. within their representatives – cities, based on the "random sample" criterion, so a "deliberate sample" was used, within a certain number of schools, a certain number of pupils were selected. A poll evaluated by students was a modified questionnaire used by Pantic (1981) in his research, which was taken to examine students' interest. The results of the research are as follows:

- An uneven scope of surveyed types of interest is observed among 13 year old male students. The most common interests are: sports and recreation (88.6%), travel (78.3%), humor (74.4%) and military interest (73.5%).
- Among 13 year old female students, a very uneven scope of surveyed types of interest is observed. The most popular interests are: travel (77.8%), sports and recreation (74.0%), home-economics (63.4%).
- An uneven scope of surveyed types of interest is also observed among the 17 year old male students. The most popular interests are: sports and recreation (84.8%), travel (84.1%), humor (76.7%).
- Among the 17 year old female students, the interests are quite diverse. The most popular interests are: travel (90.7%), sports and recreation (69.2%), humor (68.5%), home-economics (65.8%).

Dragomir Pantić (1980) in his study "Nature of Interest" very deeply studies the interests alone, primarily covering the interests of children and young people. Following a large number of definitions, Pantic staged a definition of the interest, as used in this paper, which reads: "Interests are one form of (mostly terminal) values for which is characteristic a mind preoccupation with the favorite content and / or dealing with the selected activities". What is also significant for this paper is that the author separates the term "interest" (attraction, appeal, affinity) from the term "interest" (advantage, benefit), citing a few differences between these two terms. In its paper, the author tried to reach the essence of the very nature of interest based on everything.

Dragomir Pantić, Snežana Joksimović, Borisav Džuverović and Velimir Tomanović (1981), in their book present us with the results of an empirical research on development, structure and effects of young people's interest in SR Serbia. The main issue of the research which authors used as a starting point, was formulated in the following way: What are the interests of young people in SR Serbia and what are the main

characteristics of the youth's interest? Within the questionnaire, evaluated by young people, 30 summarized scales (Likert's type) were used to measure the intensity of thirty kinds of interests. The sample of respondents included 3,000 subjects, ages 13, 17, 21 and 26, of both sexes, from Serbia. The results of the entire research are presented on more than a hundred pages, but here we will present only the most important results that will be in the function of our research.

Regarding the intensity and widespread interest, of 30 different interests, the following three have the greatest appeal in the overall sample: humor (83%), travel (80%), and sports and recreation (76%). When it comes to age-related variations in interest, it has been shown that three interests are highly quoted regardless of the age of the subjects, which are: interest in humor, travel, and sports and recreation. This led the authors to conclude that these three interests constitute an anthropological constant of youth.

Bojana Zdanski (1967) wished to determine how many students were interested in physical education, for some sports branches, and conducted a survey in the IX Belgrade Gymnasium. The survey included pupils of the third grade, 58 male and 72 female students.

The greatest interest among female students in relation to the following sporting branches was: gymnastics, basketball, horseback riding, skating, swimming, skiing ... The greatest interest among male students in relation to the following sports branches was: football, skiing, basketball, waterpolo ...

Tomislav Acković (1968) believes that the interest in some physical activity or the class of physical education depends on the education itself, therefore the teacher (pedagogue) of the physical education affects students' attitudes. The research was conducted in elementary schools, from fifth to eighth grade, on the territory of the municipality of Čukarica in Belgrade. 1852 students, of both sexes participated in the research. For the question, "What kind of exercise do you like most?" students answered the following:

- Boys: football, basketball, handball, volleyball, athletics ...
- Girls: basketball, handball, volleyball, athletics, gymnastics, swimming, shooting sports...

Problem and Subject of Research

Research problem: In addition to the above-mentioned researches, complex results on the interests of young people, especially students, are yet not obtained. An even smaller number of researches related to students' interest in physical activities exist, thus the reason for undertaking this research and contribution with additional knowledge about students' interests in physical activity.

Research subject is the students' interest with emphasis on interest in physical activity.

Aim and tasks of the research

The research aim is determination and examination of the interests of students, with emphasis on the interest of students in physical activity and determination of that interest's scope in relation to other students' interests.

Based on the defined goal, the following research tasks were determined:

- Testing and determination of all student interests for all areas of the survey,
- Testing and determination of the level of students' interest in physical activity,
- Establishing possible differences in interests in relation to gender,
- Examining whether students' interest in physical activity is related to practicing it.

Research methods

In this paper the descriptive analysis method was applied, and the data used for the analysis were collected using survey techniques. The survey used in the research was taken from the dissertation Bokan (1985), and is a modified questionnaire applied by Pantić (1981).

Research hypotheses

The following hypotheses have been formulated on the basis of a previously defined problem, subject, aim, and tasks of the research:

H1: It is assumed that students' interest are of a very broad spectrum,

H2: It is assumed that students' interest in physical activity is large, and that it falls into the category of most dominant interests,

H3: It is assumed that if the interest in physical activity is present, it involves regular engagement in physical activity,

H4: It is estimated that the interest in physical activity is higher in male students than in female students,

H5: It is assumed that interest in physical activity does not depend on the faculty major.

Respondents sample data

A total of 120 - 60 male and 60 female, first year students from various faculties in Belgrade, participated in the research. The survey was conducted during summer semester of the Academic year 2017/18 at the following faculties: Economics, Medicine, Stomatology, Teacher Education, Philology, Architecture, Law, Faculty of Dramatic Arts, Faculty of Transport and Traffic Engineering, Electrical Engineering and Faculty of Safety Studies. The survey was conducted by the author, with the help of the Student Parliaments of the abovementioned faculties.

Instruments, variables and test procedures

Survey research involved a questionnaire for students to evaluate. The questionnaire was taken from the dissertation Bokan, B. (1985), modified in relation to the original questionnaire made by Pantić, D. (1980, 1981). The survey was related to their interests in various fields of work. In total, there were 30 interests that students estimated to be on a scale from one to five, with ratings ranging from one (1) - I do not like it at all, to five (5) - I really like it. For each rating and explanation was provided directly in the survey. The survey consisted of five parts (ie. five different indicators) for students to evaluate: the major that attracts them most, the area of life with the strongest appeal, the activity, then the interest and ultimately evaluation of the list of words and impression that each word has on them. The whole survey included a total of 150 questions.

Once the overall results from all five parts of the survey are summarized, one can see how much someone is interested in some activity. The maximum rating would be 25, and the minimum overall rating is five.

Before the questionnaire begins, it is explained to the respondents that the questionnaire is anonymous, the survey results are used exclusively for research purposes and that it is of crucial importance that they give solemn responses to all the questions asked, thus contribute to further research related to this issue.

Variables: The student's interest in an activity was considered to depend on several variables, whether they are independent or dependent variables.

- Independent variables:
 - Year of study (all of the respondents were first year students)
 - Gender (male or female)
- Dependent variables:
 - Interests - thirty different interests that were in the survey

The interests covered by this research were the following: administration (office work), agriculture (life and work in the countryside), adventure (adventures, undertaking hazardous ventures of all kinds), biology (wildlife in general, preservation of the natural environment), manual manufacture (independent production of objects, using tools, doing repairs, etc.), home economics, show business, sports and recreation,

hedonism (fun passtime and enjoyment), hippie culture, socio-humanitarian knowledge, research, literature (reading of literature classics, writing and critics), hazardous interest (everything related to gambling and lottery), art, music, mathematics, politics (power, leadership, sociological influence, etc.), pedagogy (child care and upbringing of youth and adults, knowledge transfer, social work), exploration, travel, sex, humor, shop classes, theoretical (philosophy, scientific theories, problems of knowledge, logic and methodology), parenting, religion, economics, linguistics (the study of language and speech: quality, development, and rules; nourishment of retorics), military (army, army life, weapons, military techniques, war skills).

Statistical data processing

All results were processed using basic descriptive statistics. First of all, all 120 questionnaires were analyzed and checked if they were correctly filled, then data was entered into Microsoft Office Excel, where the basic parameters of descriptive statistics were calculated. The basic statistical parameters calculated for each question in the survey are: arithmetic mean (AS) and standard deviation (SD). The emphasis was on results related to the physical activity of students. For easier monitoring, respondents' evaluations are grouped and presented in Tables 1 and 2. The first evaluation group is "Positive share on the value scale" including ratings 4 and 5, second is the "Neutral share on the value scale" including rating 3 and third is "Negative share on the value scale" including ratings 1 and 2.

Research results and discussion

Interests of male students

From Table 1, it can be noted that the scope of interest with male students is very diverse. This extent of interest ranges from 91.2% for sports and recreational activities, to the least interest in religion, which amounts to 6.2%. Next to sports and recreational activities; sexual activities (87.1%), humor (81.1%) and travel (77.5%) are the most common interests for the majority. Regarding the rest of the group, in addition to religion, the least interest is in the hippie lifestyle (7.7%), but as it was already mentioned, the interests variegate and each individual has a "favorite" with regard to the very interest.

Table 1. Interests of male students for different interests from the survey

rank	Type of interest (m)	Positive share on the value scale (ratings 4 and 5)	Neutral share on the value scale (rating 3)	Negative share on the value scale (ratings 1 and2)	AS	SD
1	Sports and recreation	91.2	6.1	2.7	20	3.9
2	Sexual activities	87.1	8.2	4.7	20	3.5
3	Humor	81.1	10.1	8.8	17	3.1
4	Travel	77.5	15.2	7.3	18	3.3
5	Adventures	65.1	19.2	15.7	12	2.5
6	Administration	54.2	29.1	16.7	17	4
7	Military	53.2	33.1	13.7	18	3.5
8	Parenting	47.5	22.1	30.4	13	2.6
9	Research	45.7	23.1	31.2	17	3
10	Pedagogy	45.5	21.1	33.4	15	4
11	Shop Classes	43.2	31.4	25.4	15	3.3
12	Socio-humanitarian	42.3	21.1	36.6	16	3.7
13	Show business	41.1	13.1	45.8	11	3.5
14	Home economics	35.3	16.9	47.8	13	2.4
15	Economics	34.2	11.1	54.7	15	5.5
16	Literature	33.9	8.8	57.3	14	4.3
17	Manual Manufacture	32.1	18.2	49.7	14	4.3
18	Mathematics	29.1	22.1	48.8	13	4.5
19	Agriculture	27.3	19.8	52.9	11	3.7

20	Politics	25.4	11.2	63.4	15	3.9
21	Theoretical	25.1	12.3	62.6	14	3.5
22	Hedonism	22.2	8.1	69.7	12	2.8
23	Hazardous interests	22.1	9.2	68.7	12	2.5
24	Exploration	21.1	11.1	67.8	14	3.2
25	Biology	18.2	15.4	66.4	12	2.9
26	Linguistics	17.8	13.4	68.8	15	3.8
27	Music	16.7	11.1	72.2	13	4.3
28	Art	15.3	13.5	71.2	10	3
29	Hippie Culture	7.7	5.1	87.2	8	2
30	Religion	6.2	5.8	88	8	4.5

From Table 1 it can be observed that interests variegates. In every respect, sports and recreational interest dominates in comparison to others. Even though male students are more than interested in sports and recreational activities, there is a very small number of indifferent (6.1%) and even fewer ones who feel aversion (2, 7%) towards it.

Interests of female students

From Table 2 it can be observed that interests of female students variegates, as found in male students. The highest affinity is for travel (87.2%), followed by sports and recreational activities (78.2%). As for the least of interest, there are some similarities to male students - when it comes to religion it is (7.9%), as well as for the Hippie Culture (7.7%). However, what is low rated in female students, as opposed to male students, is interest in agriculture (7.8%). Today, female students are not so interested in land cultivation.

Table 2. Interests of female students for different interests from the survey

rank	Type of interest (f)	Positive share on the value scale (ratings 4 and 5)	Neutral share on the value scale (rating 3)	Negative share on the value scale (ratings 1 and 2)	AS	SD
1	Travel	87.2	5.2	7.6	18	3
2	Sports and recreation	78.2	6.7	15.1	19	4
3	Humor	67.2	10.6	22.2	17	3.7
4	Parenting	62.4	20.3	17.3	19	3.5
5	Sexual activities	60.3	11.7	28	18	4.3
6	Socio-humanitarian	58.2	23.2	18.6	19	4.4
7	Pedagogy	51.2	18.7	30.1	15	3.9
8	Show business	46.1	21.2	32.7	12	4.4
9	Research	45.3	17.2	37.5	16	2.8
10	Literature	43.2	28.1	28.7	13	4.1
11	Biology	36.2	17.2	46.6	12	3.8
12	Adventure	34.2	18.3	47.5	11	2.9
13	Home economics	34.2	19.1	46.7	13	3.4
14	Administration	33.7	17.7	48.6	13	6.7
15	Hedonism	32.1	25.6	42.3	17	2.9
16	Economics	29.1	21.1	49.8	11	5.9
17	Music	25.7	15.4	58.9	13	4.3
18	Linguistics	23.3	13.2	63.5	14	3.5
19	Mathematics	19.2	15.2	65.6	10	4.5
20	Theoretical	18.7	11.1	70.2	14	4.1
21	Art	17.7	11.1	71.2	10	3.4
22	Shop Classes	17.2	13.2	69.6	12	3.6
23	Politics	15.5	8.9	75.6	11	5
24	Manual Manufacture	12.1	7.2	80.7	10	3
25	Exploration	11.2	8.8	80	13	2.6
26	Military	9.1	5.5	85.4	9	3

27	Hazardous interests	8.2	2.7	89.1	11	3.1
28	Religion	7.9	5.6	86.5	12	4.4
29	Agriculture	7.8	5.1	87.1	8	2.4
30	Hippie Culture	7.7	4.1	88.2	7	1.7

From Table 2 it can be observed that in female students interests variegated, but unlike in male students, sports and recreational activity is not a dominant interest, but travel (87.2%). There is a very small number of indifferent (5.2%), as well as the least number, in relation to all occupations, of those who feel aversion (7.6%). Sports and recreational activity is, according to percentage, rated second for female students with (78.2%), and there is also a small number of indecisive respondents with (6.7%), and a "solid number" of those who are not interested in sports and recreational activity (15.1%).

Based on the summed results from table 1 and table 2, it can be concluded that physical activity is highly quoted with both sexes regardless of major. Of all the occupations included in the survey, physical activity received maximum rating with both sexes, which means that regardless of profession all students have a positive outlook on physical activity, except for few individuals.

Does the interest in physical activity also include regular physical activity?

Having acquired a high percentage of male students' (92.1%) and female students' (78.2%) interest in physical activity, comparison of these results with the results from another survey titled: "I'm actively engaged in some sport, recreation, (following sport events is not taken into account)" is applied. The goal is establishing a link between regular physical activity and interest in physical activity. The degree of correlation has shown that the connection between these two components is high. The degree of correlation for male students was 0.91, while for female students it was somewhat smaller, but also significantly high, 0.78.

As for female students, 78.2% are interested in physical activity, of which 90.4% regularly engage in some kind of physical activity of their own choice, 6.1% occasionally engage in physical activity, and 3.5% of them do not engage in physical activity, but are interested in it. What can not be concluded with this survey is the reason for their lack of physical activity, thus will be more precisely examined in some succeeding research.

A large number of male students, as much as 92.1% are interested in regular sports and recreational activities. Out of the total percentage, 91.3% of male students regularly engage in some kind of physical activity, 6.2% occasionally engage in physical activity, whilst a small number of students, 1.7% do not engage in physical activity, but are more than interested in it. The reason for their lack of physical activity can not be concluded on the basis of this research, thus will be more precisely examined in some succeeding research.

What can be concluded based on the results is that great interest in physical activity is closely related to regular physical exercise. By regular engagement in some kind of physical activity, all students expressed their positive interest in it alone. There are many ways to deal with the issue of regular physical activity in students, one of them being a quality introduction of physical education at faculties, however this as well will be more precisely examined in some succeeding research

Comparison of research results, with previous research

The results of this research indicate that interests of young people remained similar to those of twenty years ago. This is observed in comparison to the research carried out by Bokan B. (1985), as well as to the book "Interests of Young People" Pantić, Joksimović, Džuverović and Tomanović, (1981).

Analyzing the joint results by male and female students, three interests seem to be dominant, which are: travel, humor and sports and recreational activities. In addition to these three, another interest is as equally represented - sexual interest. This interest was also highly rated in the previous research, however not so highly rated as in this one. There are several reasons for why this interest is so highly rated. One of these reasons may be society changes and larger presence of more explicit content in the media. The real reasons

for this social situation can not be determined on the basis of this research, thus will be more precisely presented in some succeeding research.

Reviewing the surveys mentioned above, which were carried out twenty years ago, it can be noted that the interests of young people do not change much as the years go by. What remains same is that the interests of young people are still focused on travel, humor and sport, and sexual interest, that can be added to this group based on its high rank in this research. What is important for this paper is that sports-recreational interest is still at the very top of young people's interest. As stated in the book "Interests of young people", interest in holidays, humor and sport-recreational interest make an anthropological constant of youth. According to this research, the same can be concluded for the 21st century, where these three interests really make an anthropological constant of youth, while other interests change depending on social standards.

Conclusion

This paper examines the interests of male and female students from several faculties of the University of Belgrade. Regular physical activity is very important for students' health, otherwise much bigger problems arise. Regular physical activity also presents a prevention of various diseases and deformities that can occur among the student population. Regular engagement in physical activities enables students to easily bear with other obligations.

Based on the analysis of the students' interest of the University of Belgrade, it is noted that the interest in physical activity is high regardless of student major. Therefore, students should be provided with regular and easily accessible physical activity.

Based on the obtained research results, the following conclusions can be drawn regarding the postulated hypotheses:

Hypothesis 1 which reads: "It is assumed that students' interests are of a very broad spectrum." This hypothesis is confirmed, based on the presented results it is noted that interests of male and female students for all occupations are different, of a wide spectrum and dependent on individual preference.

Hypothesis 2, which reads: "It is assumed that students' interest in physical activity is large, and that it falls into the category of most dominant interests." This hypothesis is partially confirmed. When it comes to male students, this hypothesis is confirmed, due to physical activity being the most dominant interest, other interests following. As for female students, physical activity is not the most dominant interest, but a desire for travel, other activities following. Affinity for physical activity, however, is still highly ranked, second place.

Hypothesis 3, which reads: "It is assumed that if the interest in physical activity is present, it involves regular engagement in physical activity". The results indicated a high correlation between interest in engagement in physical activity and regular engagement in it, however this is probably the result of sampling, as for the poll being voluntary, mostly reported by students who are actively engaged in physical activity. In order to achieving greater objectification of the results it is necessary for the sample of respondents to be significantly increased.

Hypothesis 4, which reads: "It is estimated that the interest in physical activity is higher in male students than in female students." This hypothesis is also confirmed, the difference between two sexes being not so large, but not negligible either. With difference being 13%, it can also be concluded that interest in physical activity is similar for both sexes, with slight difference being in favor of the male sex.

Hypothesis 5, which reads: "It is assumed that interest in physical activity does not depend on the faculty major." This hypothesis is also confirmed. Regardless of the enrolled faculty, physical activity is highly quoted interest in both male and female students.

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INTERESOVANJE STUDENATA ZA FIZIČKU AKTIVNOST

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Uvod

Interesovanja studenata su različita, ona zavise od samoga pojedinca, ali ono što je zajedničko za sve studente je kretanje. Da bi zadovoljili svoju potrebu za kretanjem, koja je zbog današnjeg načina života sve više zapostavljena, studenti bez obzira na usmerenje bi trebalo da imaju redovnu fizičku aktivnost za vreme svoga studiranja.

Kada se kaže današnji način života misli se na napredak tehnologije, gde je studentima omogućeno da sedeći od kuće završe obaveze za koje su nekada morali da izađu iz kuće i ispešače određenu distancu. Redovna fizička aktivnost je jedan od ključnih faktora za zdrav život. Nemoguće je nabrojati sve pozitivne efekte fizičke aktivnosti, ali bez sumnje neki od njih su unapređenje zdravlja i načina života, produžuje očekivano trajanje života i smanjuje rizik od hroničnih nezaraznih bolesti, kao što su bolest srca, krvnih sudova, šećerne bolesti i slično (Ugarković, 1996).

U relevantnoj literaturi mogu se izdvojiti kulturni, društveni i ekonomski faktori koji negativno utiču na zdravlje: 1. nedostatak fizičke aktivnosti; 2. stres; 3. niska primanja i siromaštvo; 4. neodgovarajuća medicinska i socijalna briga i slaba dostupnost zdravstvenih i socijalnih usluga; 5. nedostatak jeftinih vidova rekreacije i nepostojanje parkova i vrtova; 6. prekomerno pušenje i alkohol, uzimanje nedozvoljenih lekova, neupražnjavanje bezbednog seksa; 7. život u oblastima sa visokom stopom kriminala; 8. nesprovođenje mera zaštite na radu; 9. loši uslovi stanovanja, vlaga, hladnoća i nedovoljan životni prostor; 10. ne kupuju se i ne pripremaju pravi obroci; 11. neadekvatna briga o deci i neodgovarajuća socializacija; 12. loše planiranje transporta, nedostupnost sredstva javnog prevoza; 13. nezaposlenost; 14. konzumiranje „brze hrane“ i ostalih vrsta namirnica loših po zdravlje; 15. život u industrijskim oblastima sa visokim rizikom od zagađenja, prometnim saobraćajnicama i lošim kvalitetom vazduha; 16. društvena izolacija i društven ekskluzij – život na marginama društva, bez mogućnosti kontrole sopstvenog života; 17. dugačko radno vreme, stresni ili rizični uslovi rada; 18. loše obrazovanje, loše zdravstveno obrazovanje i neobaveštenost o dostupnosti zdravstvenih usluga (Gidens, 2005: 160). Dakle, nedostatak fizičke aktivnosti je na pravom mestu negativnog uticaja na zdravlje, kako navodi Gidens.

Njihova tela zbog sedenternog načina života bukvalno „vape“ za fizičkom aktivnošću, a ako se studenti pokrenu ne samo da će poboljšati kvalitet života već će i kvalitetno trošiti svoje vreme na zdrave i ispravne navike. Prihvatanje fizičke kulture kao vrednosti značajan je indikator za određivanje stepena spremnosti za učešće u programima koji se označavaju kao sportsko-rekreativni (Galić, 1995). Veliku ulogu u tome igra i fizičko vaspitanje iz ranijeg školovanja. Ukoliko su nastavnici fizičkog vaspitanja u osnovnoj i srednjoj školi dobro radili sa svojim đacima „u njima“ su razvili pozitivan stav prema redovnoj fizičkoj aktivnosti i oni su posle školovanja samo nastavili da se bave onim što su naučili za vreme tog školovanja. U svetu se danas, sasvim opravdano smatra, da je fizička kultura, kao proizvod i funkcija društvenog života i posebna oblast društvene prakse, značajan činilac ekonomskog, socijalnog i individualnog razvoja koji je usmeren na svestran razvoj i totalitet ispoljavanja ljudske ličnosti (Galić, 1995). Što uprošćeno znači da redovna fizička aktivnost pomaže uspešnijem vođenju i završavanju svakodnevnih poslova, a pri tome utiče pozitivno na naš razvoj, naše raspoloženje, na celokupan razvoj naše ličnosti.

Teorijski okvir rada

Definicija osnovnih pojmova

Fizička aktivnost podrazumeva svaku aktivnost koja u svojoj osnovi ima neki vid telesnog kretanja, telesne vežbe i telesnog vežbanja, a rezultati te aktivnosti zavise od samog pojedinca i njegove volje za istom tom aktivnošću.

„Telesno kretanje – Vežbanje je pojedinačni ljudski čin kojim se mehaničke promene vlastitog tela, kao stvarnost po sebi, u konkretnoj ljudskoj praksi pretvaraju u vrednost za nekoga“ (Matić, 1998).

„Telesna vežba je, kao osnovno sredstvo i osnovni metod fizičkog vaspitanja učenika, specijalno odabrana kretna aktivnost kojoj je prvenstveno: a) biološki cilj (dostizanje optimalnog nivoa fizičkih sposobnosti) b) pedagoški cilj (sticanje motoričkih informisanosti putem formiranja i usavršavanja kretnih umenja i navika)“ (Višnjić, Jovanović & Miletić, 2004).

„Telesno vežbanje, kao proces primene telesnih vežbi, je adaptivni proces kojim se, primenom kretnih aktivnosti, odnosno putem sistematskih ponavljanja telesnih vežbi (kao složenog neurofiziološkog i biomehaničkog procesa), izazivaju pozitivne promene čovekovih sposobnosti od nekog početnog-inicijalnog do željenog-finalnog stanja“ (Višnjić, Jovanović & Miletić, 2004).

Interesovanja

Interesovanja su i potencijalan predmet nekoliko naučnih disciplina: psihologije (razvojna, pedagoška, diferencijalna), sociologije (sociologija slobodnog vremena, sociologija omladine, sociologija rada) i pedagogije (naručito didaktike). Pre svega interesovanja su, kao i sve druge vrednosti karakteristične za ljudsku vrstu, po svojoj biti humana; ona su složena i dragoceni proizvod duge evolucije organske materije (Pantić, 1980).

Sama interesovanja su deo svakog čoveka i u svakom tom čoveku se nalaze različita interesovanja. Kao što se kaže „*Lepota je u oku posmatrača*“ tako isto može da se kaže za interesovanja, da ona zavise od samog „posmatrača“, da će ono za šta smo mi zainteresovani biti vezano isključivo za nas, dok će za nekoga drugog biti zanimljivije neko drugo interesovanje.

Kako Dragomir Pantić (1980) kaže: „Interesovanja su jedan oblik (uglavnom terminalnih) vrednosti za koji je karakteristična zaokupljenost svesti omiljenim sadržajima i/ili bavljenje izabranim aktivnostima“.

Značaj interesovanja je veliki, jer sama interesovanja nam pokazuju sferu zainteresovanosti studenata za neke aktivnosti, poslove... I na osnovu tih interesovanja možemo da „stvorimo“ sliku o toj osobi, šta voli, čime se bavi, kako provodi slobodno vreme. Pantić (1980) navodi mnoštvo karakteristika vezanih za interesovanja:

- Interesovanja su važan strukturalni element ličnosti
- Interesovanja su univerzalni fenomen, jer nema ličnosti koja ne poseduje određenu interesnu strukturu.
- Razuđenost interesovanja je svakako jedan od pokazatelja razvijenosti i zrelosti ličnosti.
- Interesovanja su deo aktivne ljudske prirode.
- Interesovanja su relativno trajne dispozicije i zato obeležavaju ličnost u toku celog života.
- Interesovanja imaju značajnu ulogu u svim periodima našeg života.

Samo interesovanje studenata za fizičkom aktivnošću treba da se razvija ne od perioda upisa na fakultet, već od njihovog najranijeg detinjstva, sve od prvog razreda osnovnih škola, gde fizičko vaspitanje drže učiteljice i učitelji pa sve do profesora fizičkog vaspitanja koji predaju deci fizičko vaspitanje do polaska na fakultet. Oni utiču na to da njihovi đaci u tom životnom dobu zavole fizičku aktivnost pravilnim i sistematskim radom sa njima u okviru ovoga predmeta.

Doprinos fizičkog vaspitanja, posebno vaspitača, učitelja, nastavnika, bio bi u tome, da rade tako, da deca i omladina prihvate vežbanje kao vrednost za njih same, što se najbolje ogleda u njihovom nastojanju da vežbaju, realizovanom vežbanju i u istrajavanju da se to vežbanje redovno odvija. (Višnjić, Jovanović & Miletić, 2004).

Pregled dosadšnjih istraživanja

Od istraživanja koja su se bavila interesovanjem studenata, treba navesti sledeće radove.

Istraživanje koje je sprovedeno na Fakultetu Bezbednosti i privatnom fakultetu Singidunum u Beogradu i vrlo je slično ovome, a to je „Odnos beogradskih studenata prema sportu na univerzitetu“ (Kordić & Babić, 2011). Oni su odlučili da ispituju stavove i ponašanja beogradskih studenata povezane sa sportom i utvrde, da li postoji potreba kod studenata za organizovanim bavljenjem sportom i aktivnijim učešćem univerziteta u fizičkom vaspitanju studenata. Sprovedena je anketa u kojoj su se ispitali informisanost studenata o stanju sporta na Univerzitetu u Beogradu, njihovo sportsko ponašanje, njihove stavove o sportu te i uticaju sporta na studentski život. Rezultati upitnika govore o tome da studenti visoko vrednuju sportske aktivnosti, da je većina sportski aktivno i da očekuju podršku Univerziteta za razvoj sportske kulture u vidu izgradnje novih objekata i stimulisanje sportskog ponašanja studenata.

Što se tiče samih interesovanja Božo Bokan (1985) je u svojoj doktorskoj disertaciji proučavao interesovanja učenika i učenica osnovnih i srednjih škola uzrasta 13 i 17 godina, kao i pedagoge fizičke kulture, ukupno je bilo ispitano 1648 subjekata. Pedagoga fizičke kulture bilo je 127, dok je učenika i učenika iz osnovnih i srednjih škola bilo 1495. Uzorak koji se ispitivao bio je određen iz tri regiona SR Srbije: beogradski, kraljevački i južnomoravski, sa gradovima koji su bili njihovi tipični predstavnici (Beograd, Čačak, Vranje). Iz više razloga nisu bili u mogućnosti da u okviru regiona tj. njihovih predstavnika-gradova izvrše odabiranje škola na osnovu kriterijuma „slučajnog uzorka“, zato su koristili nameran uzorak, jer je uz određeni broj škola, odabran i određeni broj učenika. Anketa koju su popunjavali studenti je modifikovani upitnik koji je u svojim istraživanjima primenio Pantić (1981), koja je preuzeta kako bi se ispitala interesovanja studenata. Rezultati istraživanja su sledeći:

- Kod učenika trinaestogodišnjaka se zapaža neujednačen obim merenih vrsta interesovanja. Najpopularnija interesovanja kod njih su: sportsko-rekreativno (88,6%), interesovanje za putovanja (78,3%), interesovanje za humor (74,4%) i vojno interesovanje (73,5%).
- Kod učenika uzrasta 13. godina se isto zapaža veoma neujednačen obim merenih vrsta interesovanja. Najpopularnija interesovanja su: interesovanje za putovanja (77,8%), sportsko-rekreativno (74,0%), domaćinsko (63,4%).
- Kod učenika sedamnaestogodišnjaka takođe se zapaža neujednačen obim merenih vrsta interesovanja. Najpopularnija interesovanja su: sportsko-rekreativno (84,8%), interesovanje za putovanja (84,1%), interesovanje za humor (76,7%).
- Kod učenika uzrasta 17. godina su interesovanja veoma raznovrsna. Najpopularnija interesovanja su: interesovanje za putovanja (90,7%), sportsko rekreativno (69,2%), interesovanje za humor (68,5%), domaćinsko (65,8%).

Dragomir Pantić (1980) u svojoj studiji „Priroda interesovanja“ veoma studiozno proučava sama interesovanja, a pre svega je obuhvatio interesovanja dece i mladih. Nakon velikog broja definicija Pantić izvodi svoju definiciju interesovanja, koja je korišćena u ovome radu i glasi: „*Interesovanja su jedan oblik (uglavnom terminalnih) vrednosti za koji je karakteristična zaokupljenost svesti omiljenim sadržajima i/ili bavljenje izabranim aktivnostima*“. Ono što je takođe značajno za ovaj rad je to što autor razdvaja pojam „interes“ od pojma „interesovanja“ navodeći nekoliko razlika između ova dva pojma. Autor je u ovom radu pokušao da na osnovu svega rečenog dođe do suštine same prirode interesovanja.

Dragomir Pantić, Snežana Joksimović, Borisav Džuverović i Velimir Tomanović (1981), u svojoj knjizi nam daju rezultate empirijskog istraživanja razvoja, strukture i efekata interesovanja mladih u SR Srbiji. Osnovni problem istraživanja od koga su autori pošli formulisali su na sledeći način: Kakva su interesovanja mladih u SR Srbiji i koje su bitne karakteristike interesovanja omladine? U okviru upitnika koji su mladi popunjavali primenjeno je 30 sumacionih skala (Likertovog tipa) za merenje intenziteta trideset vrsta interesovanja. Uzrok ispitanika je sačinjavalo 3.000 subjekata, uzrasta 13, 17, 21 i 26 godina, oba pola, iz SR

Srbije. Rezultati celokupnog istraživanja su prikazani na više od sto stranica, ali ovde ćemo predstaviti samo najvažnije rezultate koji će biti u funkciji našeg istraživanja.

Što se tiče intenziteta i raširenosti interesovanja, od 30 različitih interesovanja, najveći obim zainteresovanosti na ukupnom uzorku imaju sledeća tri interesovanja: za humor (83%), za putovanje (80%), i sportsko-rekreativno (76%). Kada su u pitanju uzrasne varijacije interesovanja, pokazalo se da su tri interesovanja visoko kotirana bez obzira na uzrast subjekata, a to su: interesovanja za humor, za putovanja i za sport i rekreaciju. Ovo je autore navelo na zaključak da ova tri interesovanja čine antropološku konstantu mladosti.

Bojana Zdanski (1967) u želji da ustanovi koliko su učenici zainteresovani za fizičko vaspitanje, za pojedine sportske grane, sproveda je anketu u IX beogradskoj gimnaziji. Anketom su obuhvaćeni učenici i učenice III razreda i to 58 učenika i 72 učenice.

Najveće interesovanje kod učenika je bio prema sledećim sportskim granama: gimnastika, košarka, jahanje, klizanje, plivanje, skijanje... Najveće interesovanje kod učenika je bilo prema sledećim sportskim granama: fudbal, skijanje, košarka, vaterpolo...

Tomislav Acković (1968) smatra da interesovanje za neku fizičku aktivnost ili čas fizičkog vaspitanja zavise od samog vaspitanja, zbog toga ulogu treba da igra nastavnik (pedagog) fizičke kulture. Istraživanje je izvršio u osnovnoj školi, u razredima od petog do osmog, na teritoriji opštine Čukarica u Beogradu. Učestvovalo je 1852. učenika, oba pola. Oni su na pitanje „Koju granu telesnog vežbanja najviše voliš“ odgovorili sledeće:

- Dečaci: fudbal, košarka, rukomet, odbojka, atletika...
- Devojčice: košarka, rukomet, odbojka, atletika, gimnastika, plivanje, streljaštvo...

Problem i predmet istraživanja

Problem istraživanja: Pored navedenih istraživanja o interesovanjima mladih, još uvek nemamo kompleksne rezultate o interesovanjima mladih, a posebno o interesovanjima studenata. Još manji je broj istraživanja koja se odnose na interesovanja studenata za fizičke aktivnosti. Zato je preduzeto ovo istraživanje, kako bi se doprinelo dopunskim saznanjima o interesovanjima studenata za fizičke aktivnosti.

Predmet istraživanja je interesovanje studenata sa akcentom na interesovanje za fizičku aktivnost.

Cilj i zadaci istraživanja

Cilj istraživanja je da se utvrde i ispituju interesovanja studenata, da se akcent stavi na interesovanje studenata za fizičku aktivnost i da se utvrdi koliko je to interesovanje po obimu zainteresovanosti u odnosu na ostala interesovanja studenata.

Na osnovu definisanog cilja određeni su sledeći zadaci istraživanja:

- Da se proveru i utvrde sva interesovanja studenata za sve oblasti u anketi,
- Da se proveru i utvrdi na kom je nivou interesovanje studenata za fizičku aktivnost,
- Ustanoviti eventualne razlike u interesovanjima u odnosu na pol,
- Ispitati da li je interesovanje studenata za fizičku aktivnost povezano sa bavljenjem istom.

Metode istraživanja

U ovom radu je primenjen metod deskriptivne analize, a podaci koji su korišćeni za analizu su prikupljeni uz pomoć tehnike anketiranja. Anketa koja je korišćena u istraživanju preuzeta je iz disertacije Bokan (1985), a predstavlja modifikovani upitnik koji je primenio Pantić (1981).

Hipoteze istraživanja

Na osnovu predhodno definisanog problema, predmeta, cilja i zadatka istraživanja formulisane su sledeće hipoteze:

H1: Pretpostavlja se da je interesovanje studenata veoma širokog spektra,

H2: Pretpostavlja se da je interesovanje studenata za fizičku aktivnost velika, da spada u kategoriju najdominantnijih interesovanja,

H3: Pretpostavlja se da ukoliko je interesovanje za fizičku aktivnost veliko, da to podrazumeva i redovno bavljenje fizičkom aktivnošću,

H4: Pretpostavlja se da je interesovanje za fizičku aktivnost veće kod studenata nego kod studenkinja,

H5: Pretpostavlja se da interesovanje za fizičku aktivnost ne zavisi od fakulteta koji se studira.

Uzorak ispitanika

U istraživanju je učestvovalo ukupno 120 studenata prve godine sa različitih fakulteta u Beogradu, 60 studenata i 60 studentkinja. Anketiranje je obavljeno u letnjem semestru školske 2017/2018 godine na sledećim fakultetima: Ekonomski, Medicinski, Stomatološki, Učiteljski, Filološki, Arhitektonski, Pravni, Fakulteta dramskih umetnosti, Saobraćajni, Elektrotehnički, Fakultet bezbednosti i Više medicinske škole. Anketiranje je obavljao autor, uz pomoć studentskog parlamenta pomenutih fakulteta.

Instrumenti, varijable i postupak ispitivanja

U istraživanju je korišćena tehnika anketiranja, instrument- upitnik za studente koji su popunjavali na fakultetu koji pohađaju. Upitnik je preuzet iz disertacije Bokan, B. (1985), koji je bio modifikovan u odnosu na izvorni upitnik koji je sačinio Pantić, D. (1980, 1981). Anketa je bila vezana za njihova interesovanja u različitim oblastima rada. Ukupno je bilo 30 interesovanja koje je trebalo da studenti procene ocenom od jedan do pet. Gde je ocena 1-uopšte mi se ne dopada, a ocena 5-veoma mi se dopada. Za svaki broj koji su studenti zaokruživali imali su objašnjenje direktno u anketi. Anketa se sastojala iz pet delova (tj. pet različitih indikatora) gde su studenti trebali da procene: zanimanje koje ih najviše privlači, a onda oblast života koja ih privlači, pa zatim aktivnost, onda njihovo interesovanje i na kraju da ocene spisak reči kakav utisak ta reč ostavlja na njih. Ukupno u celoj anketi je bilo 150 pitanja.

Kada se saberu ukupni rezultati svih pet delova ankete može se videti koliko je ko zainteresovan za neku aktivnost. Maksimalna ocena bi bila 25, a minimalna ukupna zainteresovanost ocena pet.

Ispitanicima se pre početka popunjavanja upitnika objašnjava da je upitnik anoniman, da se rezultati istraživanja koriste isključivo u istraživačke svrhe i da je od velikog značaja da daju iskrene odgovore na sva postavljena pitanja i time doprinesu u daljem istraživanju vezanom za ovu problematiku.

Varijable: Pretpostavljalo se da interesovanje učenika za neku aktivnost može da zavisi od nekoliko varijabli bilo da su one nezavisne ili zavisne varijable.

- Nezavisne varijable:
 - Godina studija (svi studenti su bili prva godina studija)
 - Pol (muški i ženski)
- Zavisne varijable:
 - Interesovanja- trideset različitih interesovanja koja su bila u anketi

Interesovanja obuhvaćena ovim istraživanjem su bila sledeća: službeničko (za kancelarijske poslove), poljoprivredno (za život i rad na selu), avanturističko (za pustolovine, za preduzimanje opasnih rizičnih poduhvata svih vrsta), biološko (za živi svet uopšte, za očuvanje prirodne sredine), delatno-manuelno (za samostalnu izradu predmeta, uz primenu alata, vršenje opravki, itd.), domaćinsko, estradno, sportsko-rekreativno, hedonističko (za provod i uživanje), hipi, socijalno-humanitarno, istraživačko, književno (za čitanje vrednih knjiga van školske lektire, za pisanje i kritiku), hazardersko (za sve što je u vezi sa kockom i igrom na sreću), likovno, muzičko, matematičko, političko (za moć, rukovođenje, uticaj u društvu, itd.), pedagoško (za vaspitanje dece, omladine i odraslih, za prenošenje znanja, rad u školi), pronalazačko, za putovanja, seksualno, za humor, tehničko, teorijsko (za filozofiju, za naučne teorije, probleme saznanja, logiku i metodologiju), roditeljsko, religiozno, ekonomsko, verbalno-lingvističko (za proučavanje jezika i govora: odlika, razvoja, i pravila; negovanje besedništva), vojno (za vojsku, armijski život, oružje, vojnu tehniku, ratne veštine).

Statistička obrada podataka

Svi rezultati su obrađeni uz primenu osnovne deskriptivne statistike. Pre svega analizirano je svih 120 upitnika, provereno je da li su pravilno ispunjeni, a onda se počelo sa unošenjem podataka u program *Microsoft Office Excel*, gde su se računali osnovni parametri deskriptivne statistike. Osnovni statistički parametri koji su računati, za svako pitanje u anketi, su: aritmetička sredina (AS) i standardna devijacija (SD). Akcenat je bio na rezultatima vezanim za fizičku aktivnost studenata. Radi lakšeg praćenja odgovori ispitanika su grupisani i prikazani u tabelama 1 i 2. Prva grupa odgovora je nazavana „Pozitivni deo vrednosne skale odgovora“ (ocene 4 i 5), zatim je prikazan „Neutralni deo vrednosne skale odgovora“ (ocena 3) i na kraju je prikazan „Negativni deo vrednosne skale odgovora“ (ocene 1 i 2).

Rezultati i diskusija

Interesovanja studenata

Kod studenata može da se zapazi iz table 1, da je njihov obim interesovanja vrlo šarolik. Taj obim interesovanja se kreće od 91,2% za sportsko-rekreativnu aktivnost pa sve do najnižeg interesovanja za religiju koje iznosi 6,2%. Kod studenata najviše interesovanja pored sportsko-rekreativnih aktivnosti su za seksualne aktivnosti (87,1%), za humor (81,1%), putovanja (77,5). Što se tiče ostatka grupe najmanje interesovanja je, pored religije, za hipi stil života (7,7%), ali kao što je već rečeno interesovanja su šarolika i svaki pojedinac ima nekog svog „favorita“ što se tiče samih interesovanja.

Tabela 1. Interesovanja studenata za različita zanimanja iz ankete

rang	Vrsta interesovanja (m)	Pozitivni deo vrednosne skale odgovora (ocene 4 i 5)	Neutralni deo vrednosne skale odgovora (ocena 3)	Negativni deo vrednosne skale odgovora (ocene 1 i 2)	AS	SD
1	Sportsko-rekreativno	91,2	6,1	2,7	20	3,9
2	Seksualno	87,1	8,2	4,7	20	3,5
3	Za humor	81,1	10,1	8,8	17	3,1
4	Za putovanja	77,5	15,2	7,3	18	3,3
5	Avanturističko	65,1	19,2	15,7	12	2,5
6	Službeničko	54,2	29,1	16,7	17	4
7	Vojno	53,2	33,1	13,7	18	3,5
8	Roditeljsko	47,5	22,1	30,4	13	2,6
9	Istraživačko	45,7	23,1	31,2	17	3
10	Pedagoško	45,5	21,1	33,4	15	4
11	Tehničko	43,2	31,4	25,4	15	3,3
12	Socijalno-humanitarno	42,3	21,1	36,6	16	3,7
13	Estradno	41,1	13,1	45,8	11	3,5
14	Domaćinstvo	35,3	16,9	47,8	13	2,4
15	Ekonomsko	34,2	11,1	54,7	15	5,5
16	Književno	33,9	8,8	57,3	14	4,3
17	Delatno-manuelno	32,1	18,2	49,7	14	4,3
18	Matematičko	29,1	22,1	48,8	13	4,5
19	Poljoprivredno	27,3	19,8	52,9	11	3,7
20	Političko	25,4	11,2	63,4	15	3,9
21	Teorijsko	25,1	12,3	62,6	14	3,5
22	Hedonističko	22,2	8,1	69,7	12	2,8
23	Hazardersko	22,1	9,2	68,7	12	2,5
24	Pronalazačko	21,1	11,1	67,8	14	3,2
25	Biološko	18,2	15,4	66,4	12	2,9
26	Verbalno-lingvističko	17,8	13,4	68,8	15	3,8
27	Muzičko	16,7	11,1	72,2	13	4,3
28	Likovno	15,3	13,5	71,2	10	3
29	Hipi	7,7	5,1	87,2	8	2
30	Religiozno	6,2	5,8	88	8	4,5

Iz Tabele 1. se može videti da su interesovanja šarolika. U svakom pogledu sportsko rekreativno interesovanje dominira u odnosu na ostale, osim toga što su studenti i više nego zainteresovani za sportsko-rekreativne aktivnosti, veoma je i mali broj indiferentnih (6,1%) i još manji broj onih koji osećaju averziju (2,7%)

Interesovanja studentkinja

Iz Tabele 2. se može konstatovati da su interesovanja studentkinja šarolika, kao što je utvrđeno i kod studenata. One najviše afinitete imaju za putovanja (87,2%), a zatim sledi sportsko-rekreativna aktivnost (78,2%). Što se tiče najmanje zainteresovanosti ima nekih sličnosti kod studenata i studentkinja, kada je reč o religiji (7,9%), kao i stilu života hipi (7,7%), a ono što je nisko kotirano kod studentkinja, a nije kod studenata je poljoprivreda (7,8%), današnje studentkinje nisu toliko zainteresovane za obrađivanje zemlje.

Tabela 2. Interesovanja studentkinja za različita zanimanja iz ankete

rang	Vrsta interesovanja (m)	 Pozitivni deo vrednosne skale odgovora (ocene 4 i 5)	 Neutralni deo vrednosne skale odgovora (ocena 3)	 Negativni deo vrednosne skale odgovora (ocene 1 i 2)	AS	SD
1	Za putovanja	87,2	5,2	7,6	18	3
2	Sportsko-rekreativno	78,2	6,7	15,1	19	4
3	Za humor	67,2	10,6	22,2	17	3,7
4	Roditeljsko	62,4	20,3	17,3	19	3,5
5	Seksualno	60,3	11,7	28	18	4,3
6	Socijalno-humanitarno	58,2	23,2	18,6	19	4,4
7	Pedagoško	51,2	18,7	30,1	15	3,9
8	Estradno	46,1	21,2	32,7	12	4,4
9	Istraživačko	45,3	17,2	37,5	16	2,8
10	Književno	43,2	28,1	28,7	13	4,1
11	Biološko	36,2	17,2	46,6	12	3,8
12	Avanturističko	34,2	18,3	47,5	11	2,9
13	Domaćinstvo	34,2	19,1	46,7	13	3,4
14	Službeničko	33,7	17,7	48,6	13	6,7
15	Hedonističko	32,1	25,6	42,3	17	2,9
16	Ekonomsko	29,1	21,1	49,8	11	5,9
17	Muzičko	25,7	15,4	58,9	13	4,3
18	Verbalno-lingvističko	23,3	13,2	63,5	14	3,5
19	Matematičko	19,2	15,2	65,6	10	4,5
20	Teorijsko	18,7	11,1	70,2	14	4,1
21	Likovno	17,7	11,1	71,2	10	3,4
22	Tehničko	17,2	13,2	69,6	12	3,6
23	Političko	15,5	8,9	75,6	11	5
24	Delatno-manuelno	12,1	7,2	80,7	10	3
25	Pronalazačko	11,2	8,8	80	13	2,6
26	Vojno	9,1	5,5	85,4	9	3
27	Hazardersko	8,2	2,7	89,1	11	3,1
28	Religiozno	7,9	5,6	86,5	12	4,4
29	Poljoprivredno	7,8	5,1	87,1	8	2,4
30	Hipi	7,7	4,1	88,2	7	1,7

Iz tabele 2. se može videti da su interesovanja studentkinja takođe šarolika, ali za razliku od studenata kod njih ne dominira sportsko-rekreativna aktivnost, već dominira želja za putovanjem (87,2%), veoma mali broj indiferentnih (5,2%), kao i najmanji broj, u odnosu na sva zanimanja, onih koji osećaju averziju (7,6%). Sportsko-rekreativna aktivnost je druga kod studentkinja prema procentu zainteresovanosti sa (78,2%), takođe je i mali broj onih neodlučnih sa (6,7%), ali ima i „solidan broj“ onih koji nisu zainteresovani za sportsko-rekreativnu aktivnost (15,1%).

Na osnovu ukupnih rezultata iz tabele jedan i tabele dva, se može zaključiti da je fizička aktivnost visoko kotirana kod oba pola bez obzira na fakultet. Od svih zanimanja koja su se nalazila u anketi fizička aktivnost je kod oba pola najviše puta dobila maksimalnu ocenu, što znači da bez obzira na struku kojom se studenti bave svi oni gledaju pozitivno na fizičku aktivnost osim nekolicine pojedinaca.

Da li zainteresovanost za fizičkom aktivnošću podrazumeva i redovnu fizičku aktivnost?

Pošto se dobio visoki procenat zainteresovanosti studenata (92,1%) i studentkinja (78,2%) za fizičku aktivnost, upoređićemo te rezultate sa rezultatima iz ankete na pitanje koje je glasilo: „Aktivno se bavim nekim sportom, rekreacijom, (praćenje sportskih događaja ne uzima se u obzir)“. Utvrdićemo vezu između redovnog bavljenja fizičkom aktivnošću i zainteresovanosti za fizičku aktivnost. Stepenn korelacije je pokazao da je povezanost između ove dve komponente visoka. Stepenn korelacije za studente je iznosio 0,91, a za studentkinje je bio nešto manji, ali takođe značajno visok 0,78.

Što se tiče studentkinja 78,2% je zainteresovano za fizičku aktivnost, od tog broja čak 90,4% studentkinje se redovno bave nekom fizičkom aktivnošću u svojstvu sopstvene rekreacije, 6,1% studentkinja je reklo da se ponekada bavi fizičkom aktivnošću, a 3,5% studentkinja se ne bavi fizičkom aktivnošću, ali po njihovim odgovorima zaključujemo da su itekako zainteresovane za fizičku aktivnost, a koji je razlog njihovog nebavljenja fizičkom aktivnošću ne može da se zaključi ovom anketom, to će biti sprovedno tačnije ispitano u nekom narednom istraživanju.

Veliki broj studenata je reklo da je zainteresovano za redovnu sportsku-rekreativnu aktivnost čak 92,1%. Od ukupnog tog procenta zainteresovanosti 91,3% studenata se redovno bavi nekom fizičkom aktivnošću, 6,2% se bavi ponekad fizičkom aktivnošću, dok se mali broj studenata 1,7% ne bavi fizičkom aktivnošću, ali je i više nego zainteresovano za fizičku aktivnost. Koji je razlog njihovog ne bavljenja fizičkom aktivnošću ne možemo da zaključimo na osnovu ovoga istraživanja, već će to biti tema za neka naredna istraživanja.

Ono što se može zaključiti na osnovu rezultata je to da je visoka zainteresovanost za fizičku aktivnost veoma povezana sa redovnim fizičkim vežbanjem. I da bi verovatno redovno bavljenje nekom fizičkom aktivnošću kod svih studenata izrazilo njihovu pozitivnu zainteresovanost za nju samu. Postoji mnogo načina kojima bi se rešila redovna fizička aktivnost studenata, jedan od njih je i uvođenje nastave fizičkog vaspitanja na fakultetima, ali i tom temom ćemo se baviti nekim drugim istraživanjem.

Komparacija rezultata istraživanja, sa ranijim istraživanjima

Rezultati ovoga istraživanja nam pokazuju da su interesovanja mladih, ostala slična kao i pre dvadeset i više godina. To možemo da vidimo kada se ovo istraživanje uporedi sa istraživanjem koje je izvršio Bokan B. (1985), kao i sa knjigom „Interesovanja mladih“ Pantić, Joksimović, Džuverović i Tomanović, (1981).

Tri interesovanja su dominantna, kada se vide zajednički rezultati studenata i studentkinja, a to su: interesovanja za putovanjem, za humor i sportsko-rekreativna. Pored ova tri interesovanja pojavljuje se još jedno interesovanje koje skoro kao i ova tri interesovanja zastupljeno, a to je seksualno interesovanje. Ovo interesovanje je i u ranijim istraživanjima bilo u gornjoj polovini interesovanja, ali ne ovoliko visoko kotirano. Postoji više razloga zbog kojih je ovo interesovanje tako visoko kotirano. Jedan od tih razloga može da bude i taj što se društvo menja. Danas su u javnosti sve prisutniji eksplicitni sadržaji, to podiže gledanost televizije a novine se više kupuju. Pravi razlozi zbog čega je to tako ovo istraživanje ne može da pokaže, već će to pokazati neka druga istraživanja.

Kada se pogledaju istraživanja koja su gore navedena, koja su izvršena pre dvadeset i više godina može se primetiti da se interesovanja mladih mnogo ne menjaju godinama koje prolaze. Ono što je isto je to što su interesovanja mladih i dalje usresređena prema putovanju, humoru i sportu, sa tim što može da se doda ovoj grupi i seksualno interesovanje koje je u ovome istraživanju visoko kotirano. Ono što je bitno za ovaj rad je to da je sportsko-rekreativno interesovanje i dalje u samom vrhu interesovanja mladih. Kao što je rečeno u knjizi „Interesovanja mladih“ interesovanja za letovanja, za humor i sportsko-rekreativno interesovanje čine antropološku konstantu mladosti. To se prema ovome istraživanju isto može zaključiti u

21. veku gde ova tri interesovanja stvarno čine antropološku konstantu mladosti, dok se ostala interesovanja menjaju u zavisnosti od standarda u društvu.

Zaključak

U radu su istraživana interesovanja studenata i studentkinja sa nekoliko fakulteta Univerziteta u Beogradu. Redovna fizička aktivnost je veoma značajna za zdravlje studenata. Ukoliko to nije slučaj, pojavljuju se mnogo veći problemi. Redovna fizička aktivnost predstavlja i preventivu od različitih bolesti i deformiteta koje mogu da se jave u studentskoj populaciji. Redovno upražnjavanje fizičkih aktivnosti, omogućava studentima lakše podnošenje svih ostalih studentskih obaveza.

Na osnovu analize interesovanja studenata Univerziteta u Beogradu vidi se da je zainteresovanost za fizičkom aktivnošću velika bez obzira čime se studenti bave tj. šta studiraju. Zbog toga treba da im se omogući redovna fizička aktivnost kako bi svim studentima bila dostupna.

Na osnovu dobijenih rezultata istraživanja mogu se doneti sledeći zaključci u vezi postavljenih hipoteza:

Hipoteza 1 koja glasi: „Pretpostavlja se da je interesovanje studenata veoma širokog spektra“. Ova hipoteza je potvrđena jer se na osnovu prikazanih rezultata može videti da su različita interesovanja studenata i studentkinja za sva zanimanja, da su širokog spektra i da će od samog pojedinca zavisiti koje je interesovanje njemu/njoj najprivlačnije.

Hipoteza 2 koja glasi: „Pretpostavlja se da je interesovanje studenata za fizičku aktivnost velika, da spada u kategoriju najdominantnijih interesovanja“. Ova hipoteza je delimično potvrđena. Kada su u pitanju studenti ova hipoteza je potvrđena, jer je najdominantnije interesovanje vezano za fizičku aktivnost, a zatim za sva ostala interesovanja. Što se tiče studentkinja fizička aktivnost nije njihovo najdominantnije interesovanje već je to želja za putovanjem, a za njim idu ostale aktivnosti. Želja za fizičkom aktivnošću je ipak i dalje visoko kotirana na drugom mestu.

Hipoteza 3, koja glasi: „Pretpostavlja se da ukoliko je interesovanje za fizičku aktivnost veliko, da to podrazumeva i bavljenjem redovnom fizičkom aktivnošću“. Rezultati su pokazali visoku korelaciju između interesovanja za bavljenjem fizičkom aktivnošću i redovnog bavljenja istom, ali to je verovatno posledica uzorkovanja, jer je anketa bila dobrovoljna, pa su se uglavnom prijavili studenti koji se aktivno bave fizičkom aktivnošću. Kako bi se postigla veća objektivizacija rezultata potrebno je značajno povećati uzorak ispitanika.

Hipoteza 4, koja glasi: „Pretpostavlja se da je interesovanje za fizičku aktivnost veće kod studenata nego kod studentkinja“. Ova hipoteza je takođe potvrđena, ali razlika između dva pola nije ni velika, ali nije ni zanemarljiva. Ta razlika iznosi 13%, pa se takođe može zaključiti da su interesovanja za fizičkom aktivnošću slična kod oba pola, ali ipak postoji razlika u korist muškog pola.

Hipoteza 5, koja glasi: „Pretpostavlja se da interesovanje za fizičku aktivnost ne zavisi od fakulteta koji se studira“. Ova hipoteza je takođe potvrđena. Jer se bez obzira na fakultet koji se studira fizička aktivnost visoko kotira i kod studentkinja i kod studenata bez obzira koji oni fakultet studirali, fizička aktivnost je u samom vrhu interesovanja.

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DANCE COMPONENTS IN THE PHYSICAL EDUCATION SYLLABUS IN THE EDUCATIONAL SYSTEM OF THE REPUBLIC OF SERBIA

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Introduction

As an ability to express certain feelings, thoughts, events and imagination by means of movement, dance represents a physical activity contributing to the development and improvement of motor abilities, acquisition and improvement of motor skills and general inter-subject competence (aesthetical competence). The basic characteristic of dances is the fact that they create a possibility for influencing the mental and physical status components of a person by applying simple and complex movement structures to music. From a general perspective, dances represent highly appreciated “visual” art which falls into a group of programmes with artistic characteristics from the point of view of school system and teaching programmes.

In fact, dance has been a component of the Physical Education (PE) syllabi in many countries for quite a while. In Europe, this component has been present in primary and secondary schools in about 80% of educational systems with only 7% of the total PE class load being envisaged for realisation (UNESCO World-wide survey of school physical education – Final Report, 2013). Studies indicate that only a small number of PE classes actually cover dance, that it is primarily intended for junior pupils and quite often only for girls (Carli, 2004; Sanderson, 1996, 2001), and that students have limited opportunities to learn dancing and gain positive experience through aesthetic expression (Gard, 2003, 2006, 2008; Lundvall & Maivorsdotter, 2010; Sanderson, 1996, 2001). It mostly depends on the knowledge and competency of a PE teacher whether students shall have a chance to learn how to dance in classes or not (Godwin, 2010; Zavatto & Gabbei, 2008).

Research shows that dance, aerobic dance and other activities in which aesthetic element is dominant are very popular with female adolescents (Frömel & Bartosze-Wicz, 1998; Frömel, Formánková, & Sallis, 2002), and that dance is one of the five top activities female students practice in their leisure time (Harrell, Pearce, Markland, Wilson, Bradley, & McMurray, 2003). Dance provides students with the opportunity to express their ideas, feelings and attitudes (Purcell, 1994), and as a non-competitive activity, it has a significant role in self-observation present with female students (Daley & Buchanan, 1999). In addition to this, a significant role of dance components is also reflected in the emotional aspect and socialisation (Srhoj and Miletić, 2000), preservation of folk tradition and culture (Zrnzević, Jakušić, and Zrnzević, 2014), as well as the role in a multi-layered educational effect, including the national, social, aesthetic and health aspects (Srhoj and Miletić, 2000).

The aim of the research was to determine the place and role of dance programme components in the primary school physical education syllabus within the educational system of the Republic of Serbia by analysing the importance of dance for the development of students in different fields.

Method

Four physical education syllabi for primary schools have been analysed in this paper: Physical and Health Education Syllabus (1984), Physical Education Syllabus (1990), Physical Education Syllabus (2004), and Physical and Health Education Syllabus (2017). The syllabi have been analysed in relation to the following variables: *name, components, components depending on the gender, planned class load, instructions for the implementation of programme components and minimum educational requirements.*

Results

The analysis of four physical education syllabi for primary school regarding the dance components indicates that in the 1984 syllabus, dance was classified under the section of *Rhythmic Exercises and Folk Dances* for the first, second and third grade, and *Rhythmic Gymnastics and Folk Dance* (female pupils) for female pupils from the fourth to the seventh grade. There is no programme content covering dance in the eighth grade. In the syllabus from 1990, from the first to the third grade, the dance components are comprised under the section of *Rhythmic Exercises and Folk Dances*, and from the fourth to the eighth grade, under the section of *Rhythmic Gymnastics and Folk Dance* (female pupils). In the 2004 syllabus, the dance components in the first and second grade are classified under *Rhythmic Exercises and Folk Dances*, from the third to the fifth grade under *Rhythmic Gymnastics and Folk Dances*, while in the sixth and seventh grade, they could be found under the section of *Rhythmic Gymnastics, Ballroom Dance and Folk Games*¹ and in the eighth grade, under the section of *Rhythmic Gymnastics and Folk Dance*. Unlike all the previous syllabi, the Physical and Health Education Syllabus of 2017 classifies dance components into the section of *Rhythmic and Dance* (Table 1) for the fifth grade.

Table 1. Section title

Physical and Health Education Syllabus (1984)	Physical Education Syllabus (1990)	Physical Education Syllabus (2004)	Physical and Health Education Syllabus (2017)
Rhythmic Exercises and Folk Dances (1 st -3 rd)	Rhythmic Exercises and Folk Dances (1 st -3 rd)	Rhythmic Exercises and Folk Dances (1 st -2 nd)	
Rhythmic Gymnastics and Folk Dance (4 th -7 th)	Rhythmic Gymnastics and Folk Dance (4 th -8 th)	Rhythmic Gymnastics and Folk Dance (3 rd – 5 th)	Rhythmic and Dance (5 th)
		Rhythmic Gymnastics, Ballroom Dance and Folk Dances (6 th – 7 th)	
		Rhythmic Gymnastics and Folk Dance (8 th)	

Based on the analysis of the dance components, it is noticeable that certain dance or “kolo” was indicated within children’s folk dances or dances. In the 1984 syllabus, dances/”kolos” are in accordance with the social context of the time when they emerged (Table 2) so in both 1984 and 1990 syllabi, the dance components are the same for pupils attending the third grade. Starting from the fourth grade, in addition to proposed dances/”kolos”, elective “kolos” or “kolos” typical of the region where school is located are envisaged in all analysed syllabi (Table 2 and Table 3).

¹ The term “game” has been incorrectly used in Serbian language with the meaning of a dance, so from this moment on, “narodne igre” will be translated as “folk dances” throughout this paper.

Table 2. Dance components in 1984 and 1990 Physical Education Syllabi

Grade	Physical and Health Education Syllabus (1984)	Physical Education Syllabus (1990)
1 st	Children`s folk dances: <i>Pionirsko kolo, Devojčica platno beli.</i>	Dances: <i>Pionirsko kolo, Ja posejah lan.</i>
2 nd	Children`s folk dances: <i>Mi smo deca vesela, Crni kos.</i>	Dance steps: hop steps (hop step). Children`s folk dance: <i>Mi smo deca vesela, Crni kos.</i>
3 rd	Children`s folk dance: <i>Lepo ti je druga Tita kolo, Savila se bela loza vinova.</i>	Children`s folk dance: <i>Lepo ti je druga Tita kolo, Savila se bela loza vinova.</i>
4 th	“Kolos”: <i>Kozaračko, Srpsko, Druže Tito, Savila se bela loza vinova</i> , and two “kolos” from the region where school is situated.	Dances: <i>Srpsko, Tasino</i> , two “kolos” from the region where school is situated.
5 th	<i>Divna, Divna, Mlada partizanka, Tancuj, tancuj</i> and two “kolos” from the region where school is situated.	Dances: <i>Divna, Divna, Moravac</i> (basic dance entirety and the first variant), two dances from the region where school is situated.
6 th	<i>Davaj me majko mori, Envertita</i> , two “kolos” from the region where school is situated..	Dance: second variant of <i>Moravca</i> and its linking to the previous, <i>Kolo vodi Vasa.</i>
7 th	“Kolos”: <i>Žikino kolo, Borjano, Borjanke, Čardaš, Kolo vodi Vasa and Ruski tanec.</i>	Dance: <i>Polka, Vranjanka (Žikino kolo), Coko – coko</i> , a dance from the region where school is situated..
8 th	None	Dances: <i>Waltz, Tango, Dučec</i> , one contemporary dance (popular at that moment).

The 1990 and 2004 syllabi envisage social dances (Waltz and Tango) for students of the eighth grade, as well as one contemporary dance (Table 2), while the syllabus from 2017 envisages basic steps of social dances for the pupils of the fifth grade (Table 3). Also, it can be noted that the national dance *Moravac* is comprised in three physical education syllabi for primary school (1990, 2004, 2017). In addition to the abovementioned, it should be noted that the syllabus from 2004 offers significantly less dance components than previous syllabi of physical education, and they are more defined in the ethnocoreological field in which the school is located.

Table 3. Dance components in the 2004 and 2017 Physical Education Syllabi

Grade	Physical and Health Education Syllabus (2004)	Physical and Health Education Syllabus (2017)
1 st	Dances: <i>Ja posejah lan.</i> One „kolo“ of choice.	
2 nd	<i>Mi smo deca vesela.</i> One „kolo“ of choice.	
3 rd	<i>Savila se bela loza vinova.</i> One „kolo“ of choice.	
4 th	Serbian „kolo“. One „kolo“ from the region where school is situated.	
5 th	<i>Divna, Divna, Moravac</i> (first variant). One „kolo“ from the region where school is situated.	<p><i>Compulsory components</i> “Kolo” <i>Moravac</i>. “Kolo” from the region where school is situated. Basic steps of social dances.</p> <p><i>Recommended components</i> Basic variants of “kolo” from the region where school is situated.</p>
6 th	Dance steps: Waltz step (triple step) with and without a turn. Folk dances: the second variant of <i>Moravac</i> dance and linking with a previous variant, <i>Kolo vodi Vasa</i> and one dance from the region where school is situated.	
7 th	Dance: <i>Polka, Vranjanka</i> and one dance from the region where school is situated.	
8 th	Dances: <i>Waltz, Tango</i> , one contemporary dance (popular at that moment).	

The analysis of dance components in physical education syllabi in relation to gender indicates that components of the 1984 syllabus are envisaged for all pupils up to the fourth grade, and from the fourth grade to the seventh, only for female pupils, while they are not listed at all for the eighth grade. In the 1990 syllabus, dance components are intended for all pupils from the first to third grade, and from the fourth to eighth grade, only for female pupils. Unlike previous syllabi, the 2004 and 2017 syllabi envisage dance components for both male and female pupils.

The 1984, 1990 and 2004 syllabi do not envisage special class load for realisation of dance programme components, but they are realised within the framework of lessons that are planned for realisation of sports gymnastics programme components. The greatest novelty in physical education syllabi regarding the dance components is the foreseen framework class load for *Rhythmic and Dance* of 4 classes in the 2017 syllabus for the fifth grade (Table 4).

Table 4. Planned class load

Physical and Health Education Syllabus (1984)	Physical Education Syllabus (1990)	Physical Education Syllabus (2004)	Physical and Health Education Syllabus (2017)
None	None	None	4 classes

One of the major shortcomings of the analysed physical education syllabi is the lack of instructions for the realisation of dance components, which greatly influences the ultimate outcomes of their learning and implementation. On the other hand, the minimum educational requirements are defined in the analysed physical education syllabi (Table 5). Thus, in the 1984 syllabus, there are minimum educational requirements for all grades except for the first and eighth grade. The analysis of the 1990 syllabus indicates that there are minimum educational requirements for all grades, except for the fifth, while in the syllabus from 2004, they are not listed only for the first, second and third grade. Unlike the previous three syllabi, in the 2017 syllabus, there are no defined minimum educational requirements.

Table 5. Minimum educational requirements

Grade	Physical and Health Education Syllabus (1984)	Physical Education Syllabus (1990)	Physical Education Syllabus (2004)	Physical and Health Education Syllabus (2017)
1 st	None	None	None	
2 nd	Children`s folk dance: <i>Mi smo deca vesela</i> .	Children`s folk dance: <i>Mi smo deca vesela</i> .	None	
3 rd	Children`s folk dance: <i>Lepo ti je druga Tita kolo</i> .	Children`s folk dance: <i>Lepo ti je druga Tita kolo</i> .	None	
4 th	Dance one "kolo" to music or a song.	Dance one "kolo" to music or song.	"Kolo" from the region in which the school is situated.	
5 th	"Kolos": dance two "kolos" to music or a song.	"Kolos": dance two "kolos" to music or a song.	For male and female pupils: one "kolo" to music.	None
6 th	"Kolos": dance two "kolos" of choice to music or a song.	Dance one dance to music.	Dance one folk dance to music.	
7 th	"Kolos": dance <i>Kolo vodi Vasa</i> and <i>Čardaš</i> to music accompaniment or a song	Dance and "kolos": dance two dances to music accompaniment.	For male and female pupils: one "kolo" to music accompaniment.	
8 th	None	Dance <i>Waltz</i> and <i>Tango</i> to music.	Dance <i>Waltz</i> and <i>Tango</i> to music.	

Discussion

By analysing the previous physical education syllabi for primary school, the place and role of dance programme components in them can be seen. For this purpose, the following criteria were analysed in 1984, 1990, 2004 and 2017 physical education syllabi in terms of dance programme components: *name, components, components depending on the gender, planned class load, instructions for the implementation of programme components and minimum educational requirements*. In all analysed syllabi, dances are a mandatory component and they are related to the element of rhythmic gymnastics and they have different names (*Rhythmic Exercises and Folk Dances, Rhythmic Gymnastics and Folk Dance, Rhythmic Gymnastics, Ballroom Dance and Folk Dances**, and *Rhythmic and Dance*). The presence of dances in our physical education syllabi is in line with this tendency and in 80% of Europe's education systems (UNESCO Worldwide Survey of School Physical Education - Final Report, 2013).

The basic element in all components is the envisaged "kolos", as well as the possibility of choosing national "kolos" from the region where the school is situated. In some syllabi, the planned "kolos" are in line with the social context of the time in which the syllabus was developed. In addition, within the programme component of *folk dance*, the components of social dances are also included for senior pupils. Consequently, it can be concluded that the authors of the analysed physical education syllabi did not pay enough attention to the dance components, and that they used terms for dance components very "awkwardly". In fact, a "kolo", folk dance and folk games are not synonyms, but different components that reflect a single ethnic group, or folk tradition. Thus, folk game is a wider concept than a folk dance, and "kolo" is a circular formation in which a national dance is performed (national dances of Serbia are danced in the line – in "lesa", in a pair or in a triplet). On the other hand, in all analysed syllabi, the minimum representation of social dances is observed, which, according to their structure of steps and "dance story", are not appropriate for primary school pupils in terms of their age.

In the analysed syllabi, there is a tendency of presence of dance programme components both for male and female junior pupils, while there are no dance components in certain syllabi for senior pupils. Bearing in mind that dance gives pupils the opportunity to express their ideas, feelings and attitudes (Purcell, 1994), it is necessary to include both male and female pupils. Of the four syllabi, it is only in the Physical and Health Education Syllabus (2017) that four classes for the dance and rhythmic components are envisaged, which is 5.5% of the total annual class load. Also, although in most educational systems in Europe, dance components are included in the Physical Education Syllabus, only 7% of the total load is planned for realisation (UNESCO Worldwide Survey of School Physical Education– Final Report, 2013, 2013). A small number of lessons intended for dance components deprive the pupils of the opportunity to gain positive experience through dance and aesthetic expression (Gard, 2003, 2006, 2008; Lundvall & Maivorsdotter, 2010; Sanderson, 1996, 2001). Very often, dance components are planned only for junior pupils or just for girls (Carli, 2004; Sanderson, 1996, 2001).

The lack of instructions for the realisation of dance components, which would greatly assist teachers in their teaching planning, is the shortcoming of all four syllabi if we bear in mind that the realisation of dance classes depends on the knowledge and expertise of teachers of Physical Education (Godwin, 2010; Zavatto & Gabbei, 2008). Minimum educational requirements are defined in all syllabi (for example: *dance one "kolo"*), except in the 2017 syllabus which is characterised by outcome orientation (for example: *a student will be able to dance a "kolo"*). It is very important to comprehend the significance and role of dance in syllabi as well as its realisation through Physical Education classes, bearing in mind that dance is one of the activities that female pupils often do in their free time (Harrell, Pearce, Markland, Wilson, Bradley, & McMurray, 2003), and that it has an important role in their self-observation as a non-competitive activity (Daley & Buchanan, 1999).

Conclusion

Bearing in mind the importance of dance components in the development and improvement of motor skills, formation of a versatile personality, development of self-esteem and socialisation, the preservation of folk tradition and culture, as well as the general inter-subject competence (aesthetic competence), dance components have been included in the educational system of the Republic of Serbia. Based on the analysis of four Physical Education syllabi for the primary schools in the Republic of Serbia, it can be concluded that dance components have been included in all syllabi, but with minimal representation and connection with the components of rhythmic gymnastics.

One of the shortcomings of the syllabi is the inconsistency in the names of dance components and their exclusive connection with the components of rhythmic gymnastics, then the lack of the planned class load, as well as instructions for their immediate realisation. The lack of analysed syllabi is also reflected in the minimum representation of social dances, as well as the fact that the planned social dances, referred to only as dances in the syllabus, are not suitable for the age of primary school pupils either with their structure of steps or their "dance story". In addition, it can be concluded that there is a need to harmonise the prescribed dance components with contemporary dance trends, social changes, and the lifestyle of today's school population. Finally, we can say that more effort needs to be made in order to bring dances, as a specific activity, to the place they are entitled to in the physical education.

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SADRŽAJI PLESOVA U PROGRAMU FIZIČKOG VASPITANJA OBRAZOVNO-VASPITNOG SISTEMA REPUBLIKE SRBIJE

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Uvod

Plesovi kao sposobnost izražavanja određenih osećanja, misli, doživljaja i mašte posredstvom pokreta, predstavljaju fizičku aktivnost koja doprinosi razvoju i usavršavanju motoričkih sposobnosti, usvajanju i usavršavanju motoričkih veština i opštoj međupredmetnoj kompetenciji (estetička kompetencija). Osnovna karakteristika plesova je, da se primenom prostih i složenih kretnih struktura uz muziku, stvara mogućnost uticaja na komponente psihofizičkog statusa pojedinca. S opšte tačke gledišta, plesovi predstavljaju visoko cenjenu „vizuelnu“ umetnost, koja sa stanovišta školskog sistema i nastavnih sadržaja spada u grupu sadržaja s umetničkim karakteristikama.

Naime, ples je već duže vreme sadržaj u programima fizičkog vaspitanja u mnogim zemljama. U Evropi, u oko 80% obrazovnih sistema, ovaj sadržaj je zastupljen u osnovnim i srednjim školama, međutim samo 7% časova od ukupnog fonda časova fizičkog vaspitanja, predviđeno je za njegovu realizaciju (UNESCO World-wide survey of school physical education – Final Report, 2013). Studije ukazuju da je samo mali broj časova fizičkog vaspitanja namenjen plesu i to prvenstveno za učenike mlađih razreda i često samo za devojčice (Carli, 2004; Sanderson, 1996, 2001), kao i da učenici imaju ograničene mogućnosti da na časovima fizičkog vaspitanja uče ples i stiču pozitivna iskustva kroz estetsko izražavanje (Gard, 2003, 2006, 2008; Lundvall & Maivorsdotter, 2010; Sanderson, 1996, 2001). Da li će učenici dobiti priliku da uče ples na časovima, često zavisi od znanja i stručnosti nastavnika fizičkog vaspitanja (Godwin, 2010; Zavatto & Gabbei, 2008).

Istraživanja ukazuju da su ples, aerobni ples i druge aktivnosti u kojima je naglašena estetska komponenta veoma popularne kod adolescentkinja (Frömel & Bartosze-Wicz, 1998; Frömel, Formánková, & Sallis, 2002), i da je ples među prvih pet aktivnosti koje učenice upražnjavaju u slobodnom vremenu (Harrell, Pearce, Markland, Wilson, Bradley, & McMurray, 2003). Ples učenicima pruža priliku da izraze svoje ideje, osećanja i stavove (Purcell, 1994), a kao netakmičarska aktivnost ima značajnu ulogu u samoopažanju učenica (Daley & Buchanan, 1999). Pored navedenog, značajna uloga plesnih sadržaja ogleda se u emotivnoj sferi i socijalizaciji (Srhoj i Miletić, 2000), očuvanju narodne tradicije i kulture (Zrnzević, Jakušić, i Zrnzević, 2014), kao i uloge u višestrukom obrazovnom efektu, uključujući nacionalni, socijalni, estetski i zdravstveni aspekt (Srhoj i Miletić, 2000). Sagledavajući značaj plesa za razvoj učenika u različitim domenima, cilj istraživanja bio je da se utvrdi mesto i uloga programskih sadržaja plesova u programu fizičkog vaspitanja za osnovne škole obrazovno-vaspitanog sistema Republike Srbije.

Metode

U radu su analizirana četiri programa fizičkog vaspitanja za osnovnu školu: Program fizičkog i zdravstvenog vaspitanja (1984), Program fizičkog vaspitanja (1990), Program fizičkog vaspitanja (2004), i Program fizičkog i zdravstvenog vaspitanja (2017). Programi su analizirani u odnosu na sledeće varijable: *naziv, sadržaj, sadržaji u odnosu na pol, predviđeni fond časova, uputstvo za realizaciju programskih sadržaja i minimalni obrazovni zahtevi.*

Rezultati

Analiza četiri programa fizičkog vaspitanja za osnovnu školu, kada je u pitanju naziv sadržaja, ukazuju da se u programu iz 1984. ples nalazi pod nazivom *Ritmičke vežbe i narodni plesovi* za prvi, drugi i treći razred, a kao *Ritmička gimnastika i narodni ples* (učenice) za učenice od četvrtog do sedmog razreda. U osmom razredu ne postoji programski sadržaj iz plesa. Od prvog do trećeg razreda u program iz 1990. sadržaji plesa su pod nazivom *Ritmičke vežbe i narodni plesovi*, a od četvrtog do osmog *Ritmička gimnastika i narodni ples* (učenice). U programu iz 2004. plesni sadržaji u prvom i drugom razredu nazivaju se *Ritmičke vežbe i narodni plesovi*, zatim od trećeg do petog razreda *Ritmička gimnastika i narodni plesovi*, da bi u šestom i sedmom razredu bili nazvani *Ritmička gimnastika, ples i narodne igre*, a u osmom *Ritmička gimnastika i narodni ples*. Za razliku od ranijih programa, u programu Fizičkog i zdravstvenog vaspitanja iz 2017, plesni sadržaji se u petom razredu nazivaju *Ritmika i ples* (Tabela 1).

Tabela 1. Naziv sadržaja

Program fizičkog i zdravstvenog vaspitanja (1984)	Program fizičkog vaspitanja (1990)	Program fizičkog vaspitanja (2004)	Program fizičkog i zdravstvenog vaspitanja (2017)
Ritmičke vežbe i narodni plesovi (I-III)	Ritmičke vežbe i narodni plesovi (I-III)	Ritmičke vežbe i narodni plesovi (I-II)	
Ritmička gimnastika i narodni ples (IV-VII)	Ritmička gimnastika i narodni ples (IV-VIII)	Ritmička gimnastika i narodni ples (III -V)	Ritmika i ples (V)
		Ritmička gimnastika, ples i narodne igre (VI-VII)	
		Ritmička gimnastika i narodni ples (VIII)	

Na osnovu analize plesnih sadržaja uočava se, da su u mlađim razredima u okviru dečjih narodnih plesova ili plesova navedeni određeni ples, odnosno kolo. U programu iz 1984. plesovi/kola su u skladu sa društvenim kontekstom vremena u kojem je nastao (Tabela 2), te da su u programima iz 1984. i 1990. plesni sadržaji isti za učenike trećih razreda. U svim analiziranim programima, od četvrtog razreda pored predloženih plesova/kola, predviđena su i kola po izboru ili kola iz kraja u kome se škola nalazi (Tabela 2 i Tabela 3).

Tabela 2. Sadržaj plesa u programima fizičkog vaspitanja 1984. i 1990. godine

Razred	Program fizičkog i zdravstvenog vaspitanja (1984)	Program fizičkog vaspitanja (1990)
I	Dečji narodni ples: <i>Pionirsko kolo, Devojčica platno beli.</i>	Plesovi: <i>Pionirsko kolo, Ja posejah lan.</i>
II	Dečji narodni ples: <i>Mi smo deca vesela, Crni kos.</i>	Plesni koraci: dokoraci (dokorak). Dečji narodni ples: <i>Mi smo deca vesela, Crni kos.</i>
III	Dečji narodni ples: <i>Lepo ti je druga Tita kolo, Savila se bela loza vinova.</i>	Dečji narodni ples: <i>Lepo ti je druga Tita kolo, Savila se bela loza vinova.</i>
IV	Narodna kola: <i>Kozaračko, Srpsko, Druže Tito, Savila se bela loza vinova</i> , i dva narodna kola iz kraja u kojem se škola nalazi.	Plesovi: <i>Srpsko, Tasino</i> , dva kola iz kraja u kojem se nalazi škola.
V	<i>Divna, Divna, Mlada partizanka, Tancuj, tancuj</i> i dva narodna kola iz kraja u kojem je škola.	Plesovi: <i>Divna, Divna, Moravac</i> (osnovna igračka celina i prva varijanta), dve igre iz kraja u kojem se nalazi škola.
VI	<i>Davaj me majko mori, Envertita</i> , i dva kola iz sredine u kojoj se škola nalazi.	Ples: druga varijanta <i>Moravca</i> i povezivanje sa prethodnim delom, <i>Kolo vodi Vasa.</i>
VII	Narodna kola: <i>Žikino kolo, Borjano, Borjanke, Čardaš, Kolo vodi Vasa i Ruski tanec.</i>	Ples: <i>Polka, Vranjanka (Žikino kolo), Coko – coko</i> , jedna igra iz kraja u kojem se nalazi škola.
VIII	Nema	Plesovi: <i>Valcer, Tango, Dućec</i> , jedan savremeni ples (aktuelan u datom trenutku).

U programima iz 1990. i 2004. za učenike osmog razreda predviđeni su društveni plesovi (*Valcer* i *Tango*), kao i jedan savremen ples (Tabela 2), a u programu iz 2017. za učenike petog razreda osnovni koraci društvenih plesova (Tabela 3). Takođe, može se uočiti da je narodni ples *Moravac* zastupljen u tri programa fizičkog vaspitanja za osnovnu školu (1990, 2004, 2017). Pored navedenog treba napomenuti, da je u programu iz 2004. znatno manje ponuđenih plesnih sadržaja u odnosu na prethodne programe fizičkog vaspitanja, kao i da su sadržaji više definisani etnokoreološkim područjem u kojem se škola nalazi.

Tabela 3. Sadržaj plesa u programima fizičkog vaspitanja 2004. i 2017. godine

Razred	Program fizičkog i zdravstvenog vaspitanja (2004)	Program fizičkog i zdravstvenog vaspitanja (2017)
I	Plesovi: <i>Ja posejah lan.</i> Jedno kolo po izboru.	
II	<i>Mi smo deca vesela.</i> Jedno kolo po izboru.	
III	<i>Savila se bela loza vinova.</i> Jedno kolo prema izboru.	
IV	<i>Srpsko kolo.</i> Jedno kolo iz kraja u kojem se nalazi škola.	
V	<i>Divna, Divna, Moravac</i> (prva varijanta). Jedno kolo iz kraja u kojem se nalazi škola.	<i>Obavezni sadržaji</i> Narodno kolo <i>Moravac</i> . Narodno kolo iz kraja u kojem se škola nalazi. Osnovni koraci društvenih plesova. <i>Preporučeni sadržaji</i> Osnovne varijante narodnog kola iz kraja u kojem se škola nalazi.
VI	Plesni koraci: valcerov korak (trokorak) bez i sa okretom. Narodne igre: druga varijanta igre <i>Moravac</i> i povezivanje sa prethodnom varijantom, <i>Kolo vodi Vasa</i> i jedna igra iz kraja u kojem se nalazi škola.	
VII	Ples: <i>Polka, Vranjanka</i> i jedna igra iz kraja u kojem se nalazi škola.	
VIII	Plesovi: <i>Valcer, Tango</i> , jedan savremeni ples (aktuelan u datom trenutku).	

Analiza plesnih sadržaja u programima fizičkog vaspitanja u odnosu na pol ukazuje, da su sadržaji u programu iz 1984. predviđeni za sve učenike do četvrtog razreda, a od četvrtog do sedmog samo za učenice,

dok u osmom nisu navedeni. U programu iz 1990. sadržaji plesa su predviđeni za sve učenike od prvog do trećeg razreda, a od četvrtog do osmog razreda samo za učenice. Za razliku od prethodnih programa, programi iz 2004. i 2017. predviđaju plesne sadržaje kako za učenike, tako i učenice.

U programima iz 1984, 1990. i 2004. nije predviđen poseban fond časova za realizaciju programskih sadržaja plesova, već se oni realizuju u okviru fonda časova koji je planiran za realizaciju programskih sadržaja sportske gimnastike. Najveća novina za plesne sadržaje, u programima fizičkog vaspitanja, predstavlja predviđen okvirni fond za *Ritmiku i ples* od 4 časa u programu za peti razred iz 2017. godine (Tabela 4).

Tabela 4. Predviđeni fond časova

Program fizičkog i zdravstvenog vaspitanja (1984)	Program fizičkog vaspitanja (1990)	Program fizičkog vaspitanja (2004)	Program fizičkog i zdravstvenog vaspitanja (2017)
Nema	Nema	Nema	4 časa

Jedan od najvećih nedostataka analiziranih programa fizičkog vaspitanja predstavlja nepostojanje uputstva za realizaciju plesnih sadržaja, što u velikoj meri utiče na krajnje ishode njihovog učenja i sprovođenja. S druge strane, minimalni obrazovni zahtevi su definisani u analiziranim programima fizičkog vaspitanja (Tabela 5). Tako u programu iz 1984. minimalni obrazovni zahtevi postoje za sve razrede, osim za prvi i osmi razred. Analiza programa iz 1990. ukazuje da postoje minimalni obrazovni zahtevi za sve razrede, osim za peti, dok u programu iz 2004. nisu navedeni samo za prvi, drugi i treći razred. Za razliku od prethodna tri programa, u programu iz 2017. ne postoje definisani minimalni obrazovni zahtevi.

Tabela 5. Minimalni obrazovni zahtevi

Razred	Program fizičkog i zdravstvenog vaspitanja (1984)	Program fizičkog vaspitanja (1990)	Program fizičkog vaspitanja (2004)	Program fizičkog i zdravstvenog vaspitanja (2017)
I	Nema	Nema	Nema	
II	Dečji narodni ples: <i>Mi smo deca vesela.</i>	Dečji narodni ples. <i>Mi smo deca vesela.</i>	Nema	
III	Dečji narodni ples: <i>Lepo ti je druga Tita kolo.</i>	Dečji narodni ples: <i>Lepo ti je druga Tita kolo.</i>	Nema	
IV	Odigrati jedno kolo uz muziku ili pesmu.	Odigrati jedno kolo uz muziku ili pesmu.	Kolo iz kraja u kojem se nalazi škola.	
V	Narodna kola: uz muziku ili pesmu odigrati dva kola.	Narodna kola: uz muziku ili pesmu odigrati dva kola.	Za učenike i učenice: jedno kolo uz muziku.	Nema
VI	Narodna kola: uz muziku ili pesmu odigrati dva kola po izboru.	Odigrati jednu igru uz muziku.	Odigrati jednu narodnu igru uz muziku.	
VII	Narodna kola: uz muzičku pratnju ili pesmu odigrati <i>Kolo vodi Vasa i Čardaš.</i>	Ples i narodna kola: uz muzičku pratnju odigrati dva plesa.	Za učenike i učenice: jedno kolo uz muzičku pratnju.	
VIII	Nema	Odigrati <i>Valcer</i> i <i>Tango</i> uz muziku.	Odigrati <i>Valcer</i> i <i>Tango</i> uz muziku..	

Diskusija

Analizom dosadašnjih programa fizičkog vaspitanja za osnovnu školu može se sagledati mesto i uloga programskih sadržaja plesa u njima. U tu svrhu analizirani su programski sadržaji plesa u programima fizičkog vaspitanja iz 1984, 1990, 2004. i 2017. godine u odnosu na sledeće kriterijume: *naziv, sadržaj, sadržaji u odnosu na pol, predviđeni fond časova, uputstvo za realizaciju programskih sadržaja i minimalni*

obrazovni zahtevi. U svim analiziranim programima plesovi su obavezni sadržaj i povezani su sa sadržajima ritmičke gimnastike i pod različitim su nazivima (*Ritmičke vežbe i narodni plesovi, Ritmička gimnastika i narodni ples, Ritmička gimnastika, ples i narodne igre i Ritmika i ples*). Zastupljenost plesova u našim programima fizičkog vaspitanja je u skladu sa takvom tendencijom i u 80% obrazovnih sistema u Evropi (UNESCO World-wide survey of school physical education – Final Report, 2013).

Osnovni element u svim sadržajima su narodna kola koja su predviđena, kao i mogućnost izbora narodnih kola iz kraja u kojem se škola nalazi. U pojedinim programima predviđena kola su u skladu sa društvenim kontekstom vremena u kojem je program nastao. Pored toga, za učenike starijih razreda u okviru programskog sadržaja pod nazivom *narodni ples*, zastupljeni su i sadržaji društvenih plesova. Shodno navedenom, može se konstatovati da autori analiziranih programa fizičkog vaspitanja, nisu posvetili dovoljno pažnje plesnim sadržajima, te da su vrlo „nespretno“ nazivali predviđene plesne sadržaje. Naime, narodno kolo, narodni ples i narodna igra nisu sinonimi, već različiti sadržaji koji predstavljaju odraz jedne etničke grupe, odnosno narodne tradicije. Tako je igra širi pojam od plesa, a kolo kružna formacija u kojoj se pleše neki narodni ples (narodni plesovi Srbije se plešu i u lesi, paru i trojkama). S druge strane, u svim analiziranim programima uočava se minimalna zastupljenost društvenih plesova, koji shodno svojoj strukturi koraka i „plesnoj priči“ nisu primereni uzrastu učenika osnovne škole.

U analiziranim programima uočava se tendencija zastupljenosti programskih sadržaja plesova i za učenice i učenike u mlađim razredima, dok za učenike starijih razreda u pojedinim programima sadržaji plesova nisu predviđeni. Imajući u vidu da ples učenicima pruža priliku da izraze svoje ideje, osećanja i stavove (Purcell, 1994), neophodno je da njime budu obuhvaćeni učenici oba pola. Od četiri programa, samo u programu fizičkog i zdravstvenog vaspitanja (2017), predviđeno je četiri časa za realizaciju sadržaja plesa i ritmike, što iznosi 5,5% ukupnog godišnjeg fonda časova. Takođe, iako su u većini obrazovnih sistema u Evropi sadržaji plesova predviđeni programom fizičkog vaspitanja, samo 7% časova ukupnog fonda je planirano za njihovu realizaciju (UNESCO World-wide survey of school physical education – Final Report, 2013). Mali broj časova predviđen za sadržaje plesova ne pruža mogućnost da učenici kroz ples stiču pozitivna iskustva kroz estetsko izražavanje (Gard, 2003, 2006, 2008; Lundvall & Maivorsdotter, 2010; Sanderson, 1996, 2001), a često su sadržaji plesa planirani samo u mlađim razredima ili samo za devojčice (Carli, 2004; Sanderson, 1996, 2001).

Nepostojanje uputstva za realizaciju sadržaja plesova, koja bi nastavnicima značajno pomogla u njihovom planiranju nastave, predstavlja i nedostatak sva četiri programa ako se ima u vidu da realizacija časova plesa zavisi od znanja i stručnosti nastavnika fizičkog vaspitanja (Godwin, 2010; Zavatto & Gabbei, 2008). U svim programima su definisani minimalni obrazovni zahtevi (na primer: *odigrati jedno kolo*), osim u programu iz 2017. godine koji karakteriše orijentacija na ishode (na primer: *učenik će biti u stanju da igra narodno kolo*). Sagledavanje značaja i uloge plesa u programima, kao i njegova realizacija kroz nastavu fizičkog vaspitanja je veoma značajno, imajući u vidu da je ples među aktivnosti koje učenice često upražnjavaju u slobodnom vremenu (Harrell, Pearce, Markland, Wilson, Bradley, & McMurray, 2003), i da kao netakmičarska aktivnost ima važnu ulogu u njihovom samoopažanju (Daley & Buchanan, 1999).

Zaključak

Imajući u vidu značaj plesnih sadržaja u razvoju i usavršavanju motoričkih sposobnosti, formiranju svestrane ličnosti, razvoju samopoštovanja i socijalizaciji, očuvanju narodne tradicije i kulture, kao i opštoj međupredmetnoj kompetenciji (estetička kompetencija), plesni sadržaji su zastupljeni u obrazovno-vaspitanom sistemu Republike Srbije. Na osnovu analize četiri programa fizičkog vaspitanja za osnovnu školu Republike Srbije može se zaključiti, da su plesni sadržaji zastupljeni u svim programima, ali sa minimalnom zastupljenošću i povezanošću sa sadržajima ritmičke gimnastike.

Jedan od nedostataka programa je nedosljednost u nazivu plesnih sadržaja i njihova isključiva povezanost sa sadržajima ritmičke gimnastike, zatim nepostojanje predviđenog fonda časova, ali i uputstva za njihovu neposrednu realizaciju. Takođe, nedostatak analiziranih programa ogleđa se u minimalnoj zastupljenosti društvenih plesova, kao i činjenici da predviđeni društveni plesovi, u programu nazvani samo plesovi, shodno svojoj strukturi koraka i „plesnoj priči“, nisu primereni uzrastu učenika osnovne škole. Pored navedenog može se zaključiti, da postoji potreba usklađivanja propisanih plesnih sadržaja sa savremenim plesnim trendovima, društvenim promenama, kao i načinu života današnje školske populacije. Na kraju može se zaključiti da je neophodno uložiti više napora kako bi plesovi, kao specifična aktivnost, zauzeli mesto koje im u fizičkom vaspitanju pripada.

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REALIZATION RATE OF ARTISTIC GYMNASTICS PROGRAMME DETERMINED BY THE CURRICULUM ON PE CLASSES IN ELEMENTARY SCHOOL

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Introduction

Artistic gymnastics as a sport, which includes exercises that require a high level of physical strength, agility, coordination and flexibility (Bacciotti, 2017; Jemni, 2011), has a long and rich tradition. Even though it started developing as a sport discipline in the 19. century in the domain of Swedish and German exercise system, its roots are recognizable in the exercises that were used for various purposes even in ancient times. Acrobatic exercises were performed in ritualistic purposes in Egypt, health purposes in China, educational purposes in Athens and military purposes in Sparta (Caine, 2013). Artistic Gymnastics on apparatus today, is a competitive activity which includes exercises on parallel and uneven bars, balance beam, floor, still rings, pommel horse, high bar and vault in different disciplines for men and women artistic gymnastics (www.fig-gymnastics.com).

Elements from artistic gymnastics, like exercises on apparatus and floor, took an important place in the educational system with the goal of developing a healthy and able nation. Physical education curriculum is rich with the elements from artistic gymnastics in all grades of education. In the earliest stages of education, these exercises have a very stimulating effect on physical development, considering sensitive and critical phases of development of certain motoric skills (Guzhalovski, 1984; Viru, 1999). Curriculum includes exercises as: exercises on floor, jumping and vaulting, balancing exercises, hangs and supports on high bar, parallel and uneven bars, still rings and pommel horse (Radojević, 2011). Researches that were performed by Kamenka Zivic Markovic (2010) speak in the favor of applying gymnastic exercises in the lowest grades of education. By analyzing the curriculum from the first through fourth grade, she pointed out that 44.4% of the curriculum is made of gymnastic exercises. The conclusion was that artistic gymnastics as a basic sport, is very important in those periods, because the curriculum includes basic balancing exercises, hangs, supports, acrobatics and vaulting exercises, which all very positively affect the growth and development of student's organism. The research that was conducted by Aleksic and Mekic (2010), has also pointed out the positive effects of gymnastic exercises on the proper growth and development of static strength of female student's in the lower grades. The results confirmed that gymnastic exercises affect not only the strength, but all other motoric skills and abilities in general. Popvic (2010) has confirmed a positive influence of gymnastic exercises on the morphological status and coordination of female student's in the lower grades.

Through recent history, the curriculum has received numerous changes in the terms of number of classes and means of realization of PE classes, which resulted in lowering the rate of realization of gymnastic exercises on PE classes. Potential reasons are: lower number of classes, teacher's incompetence, uninterest of teacher's and student's for gymnastic exercises, lack of appropriate conditions for exercising, etc.

Ilic et al. (2012) conducted a research based on the preference of student's for including a chosen sport in the curriculum, showed that the student's are most interested in swimming, football, basketball, and volleyball. Gymnastics took place at the very end of the list which shows that the student's are not interested to do gymnastic exercises on PE classes.

The subject of this work is the realization rate of artistic gymnastic programme on PE classes in Elementary school.

The goal of this work was to determine the realization rate from artistic gymnastics programme, based on the teachers attitudes and opinions, and to look at the potential problems and reasons of possible low realization rate.

Method

A *Survey* research was conducted which purpose is to descriptively show some occurrence as well as describing the characteristics, attitudes and behaviour of the population (Ristic, 1995). This work points out the connection between how well the schools are equipped with the apparatus, competence and willingness of teachers and student's motivation.

Sample respondents

The sample respondents were 30 PE teachers from various Elementary schools from Belgrade, Smederevo, Pozarevac, Nis and Bor, chosen at random. All respondents had more than ten years of experience in the Elementary school and all of them willingly agreed to fill out a questionnaire.

Variable samples and measuring instruments

For the purpose of this research a questionnaire of fifteen questions was constructed. All questions were closed or combined type with two or more given answers. The data was gathered anonymously.

Data processing method

All variables were analyzed with standard descriptive procedures. Taking into account that all variables are of qualitative type (nominal or ordinal), the distribution frequency and its percentile value are shown. Microsoft Excel 2016 was used for processing the gathered data.

Results

Distribution frequency and percentile value of positive and negative answers for question number one (Question 1: „Do you consider that your schools has conditions for realization of gymnastic exercises?“), by given apparatus is given in the Table 1.

Table 1. Answers to the question: Do you consider that your school has conditions for realization of gymnastic exercises?

Apparatus	Mats for exercising on the floor		Vault		Uneven Bars		Parallel Bars		High Bar		Still Rings		Pommel Horse		Low Balance Beam and benches		High or middle Balance Beam		Miscellaneous apparatus	
	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO
F	30	0	25	5	8	22	16	14	10	20	14	16	9	21	28	2	19	11	17	13
%	100	0	83	17	27	73	53	47	33	67	47	53	30	70	93	7	63	37	57	43

Distribution frequency and percentile value of positive and negative answers for question number two (Question 2: „Are you in a position to plan setting up the gymnastic apparatus before the class?“), by given apparatus is given in the Table 2.

Table 2. Answers to the question: „Are you in a position to plan setting up the gymnastic apparatus before the class?“

Answer	Yes	I manage	School activities do not permit
F	8	17	4
%	26.7	56.7	13.3

Distribution frequency and percentile value of positive and negative answers for question number three (Question 3: „Are teachers in the lower grades in a position to realize the given artistic gymnastics programme? If not, include the reasons.“) can be seen in the Table 3.

Table 3. Answers to the question: „Are teachers in the lower grades in a position to realize the given artistic gymnastics programme? If not, include the reasons“.

Answer	Yes	No	Incompetence	No apparatus	Uninterest	Misunderstanding of the problem
F	13	17	13	9	4	3
%	43.3	56.7	76.5	52.9	23.5	17.6

Distribution frequency and percentile value of positive and negative answers for question number four (Question 4: „If you take a look at the artistic gymnastics programme from the first through the eighth grade, do you consider the exercises too hard for the students? Include the eventual reasons.“), can be seen in the Table 4.

Table 4. Answers to the question: „Are teachers in the lower grades in a position to realize the given artistic gymnastics programme? If not, include the reasons.“

Answer	Not hard	Hard	Lack of space	Lack of apparatus	Problems in the realization
F	19	1	2	7	1
%	63.3	3.3	6.7	23.3	3.3

Distribution frequency and percentile value of positive and negative answers for question number five (Question 5: „Based on your opinion, gymnastic exercises from the artistic gymnastics programme in the curriculum are:“), by grades.

Table 5. Answers to the question: „Based on your opinion, gymnastic exercises from the artistic gymnastics programme in the curriculum are:“

Grade	First through fourth			Fifth			Sixth			Seventh			Eight		
Answer	Acceptable	Easy	Hard	Acceptable	Easy	Hard	Acceptable	Easy	Hard	Acceptable	Easy	Hard	Acceptable	Easy	Hard
F	25	1	5	24	3	3	26	3	1	22	2	6	25	1	5
%	83.3	3.3	16.7	80	10	10	86.7	10	3.3	73.3	6.7	20	83.3	3.3	16.7

Distribution frequency and percentile value of positive and negative answers for question number six (Question 6: „Did you realise the exercises on the FLOOR?“), can be seen in the Table 6.

Table 6. Answers to the question: „Did you realise the exercises on the FLOOR?“

Grade	First through fourth			Fifth			Sixth			Seventh			Eight		
	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No
F	3	7	20	18	12	0	19	10	1	18	12	0	18	11	1
%	10	23.3	66.7	60	40	0	63.3	33.3	3.3	60	40	0	60	36.7	3.3

Distribution frequency and percentile value of positive and negative answers for question number seven (Question 7: „Did you realise the exercises on the VAULT?“), can be seen in the Table 7.

Table 7. Answers to the question: „Did you realise the exercises on the VAULT?“

Grade	First through fourth			Fifth			Sixth			Seventh			Eight		
	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No
F	5	4	21	13	15	2	15	13	2	15	12	3	15	13	2
%	16.7	13.3	70	43.3	50	6.7	50	43.3	6.7	50	40	10	50	43.3	6.7

Distribution frequency and percentile value of positive and negative answers for question number eight (Question 8: „Did you realise the exercises on the HIGH BAR?“), can be seen in the Table 8.

Table 8. Answers to the question: „Did you realise the exercises on the HIGH BAR?“

Grade	First through fourth			Fifth			Sixth			Seventh			Eight		
	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No
F	0	1	29	2	7	21	2	7	21	0	7	23	0	9	21
%	0	3.3	96.7	6.7	23.3	70	6.7	23.3	70	0	23.3	76.7	0	30	70

Distribution frequency and percentile value of positive and negative answers for question number nine (Question 9: „Did you realise the exercises on the PARALLEL BARS?“), can be seen in the Table 9.

Table 9. Answers to the question: „Did you realise the exercises on the PARALLEL BARS?“

Grade	First through fourth			Fifth			Sixth			Seventh			Eight		
Answer	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No
F	0	1	29	3	8	19	3	10	17	5	8	17	5	8	17
%	0	3.3	96.7	10	26.7	63.3	10	33.3	56.7	16.7	26.7	56.6	16.7	26.7	56.6

Distribution frequency and percentile value of positive and negative answers for question number ten (Question 10: „Did you realise the exercises on the POMMEL HORSE?“), can be seen in the Table 10.

Table 10. Answers to the question: „Did you realise the exercises on the POMMEL HORSE?“

Grade	First through fourth			Fifth			Sixth			Seventh			Eight		
Answer	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No
F	0	0	30	1	2	27	1	2	27	3	2	25	3	2	25
%	0	0	100	3.3	6.7	90	3.3	6.7	90	10	6.7	83.3	10	6.7	83.3

Distribution frequency and percentile value of positive and negative answers for question number eleven (Question 11: „Did you realise the exercises on the STILL RINGS?“), can be seen in the Table 11.

Table 11. Answers to the question: „Did you realise the exercises on the STILL RINGS?“

Grade	First through fourth			Fifth			Sixth			Seventh			Eight		
Answer	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No
F	0	1	29	4	9	17	4	9	17	6	10	14	6	10	14
%	0	3.3	96.7	13.3	30	56.7	13.3	30	56.7	20	33.3	46.7	20	33.3	46.7

Distribution frequency and percentile value of positive and negative answers for question number twelve (Question 12: „Did you realise the exercises on the UNEVEN BARS?“), can be seen in the Table 12.

Table 12. Answers to the question: „Did you realise the exercises on the UNEVEN BARS?“

Grade	First through fourth			Fifth			Sixth			Seventh			Eight		
Answer	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No
F	0	0	30	3	4	23	3	4	23	2	7	22	2	7	22
%	0	0	100	10	13.3	76.7	10	13.3	76.7	6.7	23.3	73.3	6.7	23.3	73.3

Distribution frequency and percentile value of positive and negative answers for question number thirteen (Question 13: „Did you realise the exercises on the BALANCE BEAM?“), can be seen in the Table 13.

Table 13. Answers to the question: „Did you realise the exercises on the BALANCE BEAM?“

Grade	First through fourth			Fifth			Sixth			Seventh			Eight		
	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No	Fully	Partially	No
F	7	6	17	16	13	1	16	13	1	13	16	1	13	14	3
%	23.3	20	56.7	53.3	43.3	3.3	53.3	43.3	3.3	43.3	53.3	3.3	43.3	46.7	10

Distribution frequency and percentile value of positive and negative answers for question number fourteen (Question 14: „Would you remove the gymnastic exercises that you marked as hard from the artistic gymnastic programme?“), can be seen in the Table 14.

Table 14. Answers to the question: „Would you remove the gymnastic exercises that you marked as hard from the artistic gymnastic programme?“

Answer	Yes	No
F	6	24
%	20	80

Based on this analysis, it can be concluded that most of the teachers would like to conduct the current artistic gymnastics programme, but that schools they work in, don't have the conditions for it.

Taking into consideration answers to the question number fifteen (open type question) and the teacher's comments (Question 15: „Would you remove any of the exercises or apparatus from the artistic gymnastics programme (name which and why)?“), the following can be concluded:

- 70% of the teachers wouldn't remove any apparatus but consider that the PE teachers should teach PE from the first through the fourth grade or from the third grade and onwards.
- 20% of the teachers would remove Pommel Horse from the programme because they consider that the arm and shoulder musculature of today's students is weak for performing exercises on this apparatus.
- 4% of the teachers would remove Vault because they think the students are afraid of jump over the Vault.
- 3% of the teachers would remove Still Rings and High Bar because on the classes that the exercises on these apparatus should be realized, the students don't realize the consequences if they are reckless and climb onto the apparatus without teacher's approval and surveillance.
- 3% of the teachers would remove Uneven Bars due to the lack of interest of female students for this apparatus.
- 80% of the teachers state that the apparatus they have in their schools is old and practically unusable. It is possible that the teachers in these schools do not realize the programme due to the increased risk of injury. One of the answers that state that is, that one of the teachers, while checking the safety of Still Rings on the class, pulled one of the rings and the belt that connects the Still Rings to the construction broke off.

Discussion

The conclusion that can be given based on the analysis of the question one, is that the schools are only partially equipped with gymnastic apparatus. Apparatus that the most schools have are mats, vault (low and high), low balance beam and Swedish benches. Half of the schools meet the conditions for realizing the programme on the Parallel Bars. Programme on the Uneven Bars, Pommel Horse and Still Rings is basically impossible to realize because in most of the schools they are non – existent. This indicates that a very small amount of Elementary schools in Serbia are equipped with hanging apparatus. It can be concluded from the teacher's comments that schools that do have the apparatus, after the schools working hours, they rent their gym to gymnastic clubs.

PE teachers should be allowed to set the gymnastic apparatus on time, so they can realize the programme on PE classes as well as their removal after the class (cycle) ends (Table 2).

PE teachers think that teachers in the lower grades are not trained well enough for realizing the artistic gymnastics programme from the first through the fourth grade (Table 3). That implies that the PE classes in the lower grades should be taught by PE teachers.

From the answers on question four, most of the teachers think that the programme is well thought and constructed and that the exercises are not hard for the students from first through eighth grade.

Analyzing the data from the question number five, it follows that teachers think that the artistic gymnastics programme for Elementary school is acceptable. Approximately 20% of the teachers stated that the content of artistic gymnastics programme in all grades of Elementary school is hard. This statement is fortified with the conclusion derived from the question four, where teachers think that artistic gymnastics programme is well thought and constructed.

Analyzing the data from the question number six, a conclusion is derived that from the first through the fourth grade of Elementary school, the exercises on the Floor are not realized in 66.7% of schools in Serbia, partially in 23.3% while only in 10% of the schools are not realized at all. This could be affiliated with the fact that the classes from the first through the fourth grade are not held by PE teachers. If the analysis of the question three is taken into consideration, it can be seen that 56.7% of respondents said that they think that the teachers in the lower grades are not trained enough to conduct the exercises from the artistic gymnastics programme. With further analysis of the questions, it is concluded that there is either complete or partial realization of the artistic gymnastics programme from the fifth through the eighth grades.

Analyzing the data from the question number seven, it can be concluded that the exercises on the Vault from first through the fourth grade are realized in a small number of schools. It can be also concluded that in the higher grades, they are partially or fully realized.

Analyzing the data from the question number eight, it can be concluded that the exercises on the High Bar are practically not realized at all in Elementary schools. 96.7% of the teachers do not realize them from the first through the fourth grade. In higher grades, they are partially realized in 30% of the schools while in 70% of schools are not conducted at all.

Analyzing the data from the question number nine, it can be determined that realization rate on Parallel Bars is non – existent from the first through the fourth grade. In higher grades it's slightly higher and goes from 10% to 16.7%. However, the rate of low realization is constant from the sixth to seventh grade with 56.7%. This slight increase in the rate of realization can be affiliated with the fact that the students in the higher grades are more motorically skilled and fitted for performing the exercises on the gymnastic apparatus.

Analyzing the data from the question number ten, it is shown that there is a low rate of realization of the artistic gymnastics programme. In the lower grades, the data is alarming because 100% of teachers said that the artistic gymnastics programme was not conducted. In the higher grades, there is a slight increase in

the rate of complete realization which is 10% and partial realization which is 6.7%. There is still a low rate of realization with 83.3% of not realizing the exercises from the artistic gymnastics programme. It can be said that the high rate of unrealisation is due to the lack of gymnastic apparatus in schools and some other factors that come from the teacher's attitudes towards artistic gymnastics.

Analyzing the data from the question number eleven, it can be determined that realization rate on Still Rings from the first through the fourth grade is really low or not been realized at all. In higher grades there is an increase in the rate of realization and it goes up to 46.7% which speaks of better rate of realization in the higher grades of Elementary school.

Analyzing the data from the question number twelve, there is no realization on Uneven Bars. There is an increase in the higher grades but it is negligible. 70% of the teachers didn't realize the exercises from the programme. Taking into consideration that teachers didn't conduct the programme in the lower grades it can be said that the students have a harder time catching up with missed exercises in the lower grades.

Analyzing the data from the question number thirteen, it is concluded that the realization rate on the Balance Beam is higher than the other apparatus in all grades. In the fifth and the sixth grade only 3.3% of the teachers were unable to realize the exercises on the Balance Beam.

Conclusion

The goal of this research was to determine the rate of realization and possible reasons why the current artistic gymnastics programme is not realized in the measure it is determined by the curriculum, based on the teachers attitudes and opinions.

The sample respondents were 30 PE teachers from various Elementary schools from Belgrade, Smederevo, Pozarevac, Nis and Bor, chosen at random.

Based on the analysis of the results, it is shown that the larger part of the artistic gymnastics programme, in all grades of Elementary school is not realized in the measure it was determined by the curriculum. The teachers stated that the reason for that were due to lack of apparatus in schools.

Based on the PE teachers opinions, the artistic gymnastics programme is not realized due to incompetence of lower grade teachers to conduct the exercises from the artistic gymnastics programme. On the other hand, some teachers think the reason is that the lower grade teachers do not have a gym available to them to conduct PE classes or they take the time determined for PE classes to catch up a class from another subject they may have missed.

Based on the analysis of the teachers answers it can be stated that there is a large amount of disinterest of students for doing gymnastics. From their experience, they stated that many of the students have a fear of doing exercises on gymnastic apparatus. The alarming information is that many of the students are relieved of the PE classes even though they don't have health related reasons to be so.

The teacher's disinterest can be derived from the fear of student's injury on PE classes. Even so, most of the teacher's (over 80%) show interest and willingness to conduct the artistic gymnastics programme but there are not adequate conditions to do so.

Main reasons for the current situation on PE classes, based on the teacher's opinions are: poor apparatus conditions in gyms, incompetence of lower grade teachers, disinterest of students and partially teachers. Deducted conclusions should be taken with a dose of reserve and should be further experimentally tested with some of the adequate statistic procedures. In further researches, lower grade teachers and a larger number of PE teachers should be included in the goal of gathering more valid and reliable data.

One of the basic tasks of PE is that they „get the knowledge for understanding the importance of Physical Education defined by this educational field“ (Radisavljevic, 2008). With the regard to the goal of

Physical Education, students and their parents as well, should be educated of the importance of Physical Education and its impact on proper growth and development, with the accent on gymnastic exercises.

The conclusion that can be derived based on the conducted questionnaire and teacher's comments, is that the problem might be alleviated by including PE teachers in the lower grades of elementary schools as well as including the manuals with illustrations of key exercises from the artistic gymnastics programme and instructions for guarding and assisting for easier learning process.

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STEPEN REALIZACIJE SADRŽAJA PROGRAMA SPORTSKE GIMNASTIKE NA ČASOVIMA FIZIČKOG VASPITANJA U OSNOVNOJ ŠKOLI

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Uvod

Gimnastika kao sportska grana, koja obuhvata izvođenje vežbi koje zahtevaju visok nivo fizičke snage, spretnosti, koordinacije i gipkosti (Bacciotti, 2017; Jemni, 2011), ima dugu i bogatu tradiciju. Iako je kao sportska disciplina počela da se razvija u 19. veku u okviru švedskog i nemačkog sistema vežbanja, njeni koreni se prepoznaju u vežbama koje su se u različite svrhe primenjivale još u antičko doba. Akrobatske vežbe izvođene su u obredne svrhe u Egiptu, u zdravstvene svrhe u Kini, u vaspitno - obrazovne svrhe u Atini i vojne svrhe u Sparti (Caine, 2013). Sportska gimnastika je danas takmičarska aktivnost, koja uključuje vežbanje i takmičenje na razboju (paralelni i dvovisinski), gredi, tlu, krugovima, konju sa hvataljakama, vratilu i preskoku, u odvojenim disciplinama muške i ženske sportske gimnastike (www.fig-gymnastics.com).

Sadržaji programa sportske gimnastike, naročito razvojne gimnastike kao što su vežbe na spravama i tlu, zauzeli su važno mesto i u školskom obrazovnom sistemu, sa ciljem razvijanja zdrave i sposobne nacije. Nastavni plan i program fizičkog vaspitanja je u velikom obimu obogaćen sadržajima iz vežbi na spravama i tlu u svim razredima. U najmlađem školskom uzrastu primena ovih sadržaja ima izrazito stimulirajući uticaj na razvoj motorike, s obzirom na senzitivne periode i kritične faze razvoja pojedinih motoričkih sposobnosti (Gužalovski, 1984; Viru, 1999). Nastavnim programom su obuhvaćeni sadržaji (Radojević, 2011), kao što su: vežbe na tlu, skakanja i preskakanja, vežbe ravnoteže, visovi i upori na vratilu, paralelnom i dvovisinskom razboju, krugovima, konju sa hvataljkama. U prilog značaja primene sredstava iz gimnastike u najmlađem školskom uzrastu govore i rezultati istraživanja Kamenke Živčić Marković (2010). Ona je analizirajući program celokupne nastave od prvog do četvrtog razreda, istakla da sadržaji iz sportske gimnastike čine 44.4% od ukupnog sadržaja nastavnog programa. Zaključak je bio da je gimnastika kao bazični sport veoma značajna u tom periodu, iz razloga što se u planu i programu za taj period nalaze osnove elemenata ravnoteže, visova i upora, akrobatike i preskoka, koji značajno podstiču pravilan rast i razvoj organizma učenika. Istraživanje koje su sprovedi Aleksić i Mekić (2010) ukazalo je na pozitivne efekte primene vežbi na spravama i tlu u nastavi fizičkog vaspitanja na razvoj statičke snage kod učenika mlađeg školskog uzrasta. Rezultati su ukazali da vežbe na spravama i tlu pozitivno utiču, ne samo na razvoj statičke snage, već i na razvoj svih motoričkih sposobnosti u celini. Popović (2010) je potvrdio pozitivan uticaj primene gimnastičkih sredstava na morfološki status i sposobnost koordinacije kod učenika osnovne škole.

Tokom bliske prošlosti obrazovni sistem je doživeo niz reformi u pogledu fonda časova i oblika realizacije nastave iz fizičkog vaspitanja, što je za posledicu imalo, između ostalog, smanjen stepen realizacije sadržaja iz programa razvojne sportske gimnastike, odnosno vežbi na spravama i tlu. Potencijalni razlozi su smanjen fond časova, uvođenje razredne umesto predmetne nastave, te stoga nedovoljna kompetencija nastavnika, nedovoljna motivacija i zainteresovanost nastavnika i učenika, nedostatak materijalno - tehničkih uslova za realizaciju programa vežbanja i dr.

Istraživanje koje su sprovedi Ilić i saradnici (2012), na temu preferencija učenika osnovnih škola za uvođenje izbornog sporta, pokazalo je da su učenici najviše zainteresovani za plivanje, a zatim za kolektivne

sportove, kao što su fudbal, košarka i odbojka. Gimnastika je zauzela mesto tek na kraju liste, što ukazuje da učenici nisu bili dovoljno zainteresovani za bavljenje sportskom gimnastikom na časovima fizičkog vaspitanja.

Predmet ovog rada je upravo realizacija sadržaja iz programa sportske gimnastike na časovima fizičkog vaspitanja u osnovnim školama.

Cilj rada bio je da se na osnovu mišljenja i stavova nastavnika utvrdi stepen realizacije sadržaja iz sportske gimnastike, kao i sagledaju potencijalni problemi i razlozi usled moguće nedovoljne realizacije.

Metode

Sprovedeno je *Survey* istraživanje, čija je svrha da deskriptivno prikaže neku pojavu, kao i deskripcija karakteristika, ponašanja i stavova u populaciji (Ristić, 1995). U ovom radu je upravo ukazano na stepen povezanosti između opremljenosti škola, stručnosti i volje nastavnika i motivisanosti učenika.

Uzorak ispitanika

Uzorak ispitanika predstavlja slučajni uzorak 30 nastavnika fizičkog vaspitanja iz različitih osnovnih škola u Beogradu, Smederevu, Požarevcu, Nišu i Boru. Svi ispitanici su imali više od 10 godina radnog staža u osnovnoj školi i svi ispitanici su pristali na dobrovoljno popunjavanje upitnika.

Uzorak varijabli i instrumenti merenja

Za potrebe istraživanja konstruisan je upitnik od petnaest pitanja. Sva pitanja su bila zatvorenog ili kombinovanog tipa sa ponuđena dva ili više odgovora. Podaci su prikupljeni anonimnim putem.

Metod obrade podataka

Sve varijable su analizirane standardnim deskriptivnim statističkim procedurama. Obzirom da su sve varijable u istraživanju kvalitativnog tipa (nominalne ili ordinalne), prikazana je distribucija frekvencija i njen procentualni odnos. Za obradu podataka korišćen je program Microsoft Excel 2016.

Rezultati

Frekvencija raspodele i procentni odnos potvrdnih i odričnih odgovora na prvo pitanje (Pitanje 1: „Da li smatrate da Vaša škola ima uslova za realizaciju nastave sprotske gimnastike?“), po ponuđenim spravama i rekvizitima, može se videti u tabeli 1.

Tabela 1. Odgovori na pitanje „Da li smatrate da Vaša škola ima uslova za realizaciju nastave vežbi na spravama i tlu?“

Odgovor	Sprava		Strunjače za vežbe na tlu i sprave		Preskok		Dvovisinski razboj		Paralelni razboj		Vratilo		Krugovi		Konj sa hvataljkama		Niska greda, klupe		Visoka ili srednja greda		Pomoćne sprave	
	DA	NE	DA	NE	DA	NE	DA	NE	DA	NE	DA	NE	DA	NE	DA	NE	DA	NE	DA	NE	DA	NE
F	30	0	25	5	8	22	16	14	10	20	14	16	9	21	28	2	19	11	17	13		
%	100	0	83	17	27	73	53	47	33	67	47	53	30	70	93	7	63	37	57	43		

Frekvencija raspodele i procentni odnos potvrdnih i odričnih odgovora na drugo pitanje (Pitanje 2: „Da li ste u mogućnosti da planirate postavljanje sprava za realizovanje vežbi na spravama i tlu? “), po ponuđenim spravama i rekvizitima, može se videti u tabeli 2.

Tabela 2. Odgovori na pitanje „Da li ste u mogućnosti da planirate postavljanje sprava za realizovanje vežbi na spravama i tlu?“

Odgovor	Da	Snalazim se	Aktivnosti škole ne dozvoljavaju
F	8	17	4
%	26,7	56,7	13,3

Frekvencija raspodele i procentni odnos potvrdnih i odričnih odgovora na treće pitanje (Pitanje 3: „Da li su učiteljice/učitelji u mogućnosti da realizuju predviđen program vežbi na spravama i tlu? Ako nisu, navedite razloge.“), može se videti u tabeli 3.

Tabela 3. Odgovori na pitanje „Da li su učiteljice/učitelji u mogućnosti da realizuju predviđen program vežbi na spravama i tlu? Ako nisu, navedite razloge.“

Odgovor	Da	Ne	Nedovoljna osposobljenost	Nema sprava	Nezainteresovanost	Nerazumevanje problema
F	13	17	13	9	4	3
%	43,3	56,7	76,5	52,9	23,5	17,6

Frekvencija raspodele i procentni odnos odgovora na četvrto pitanje (Pitanje 4: „Ukoliko posmatrate program vežbi na spravama i tlu od prvog do osmog razreda OŠ, dakle iz razreda u razred, da li smatrate da su zadaci suviše teški za učenike? Navedite eventualne razloge.“), može se videti u tabeli 4.

Tabela 4. Odgovori na pitanje „Ukoliko posmatrate program vežbi na spravama i tlu od prvog do osmog razreda OŠ, dakle iz razreda u razred, da li smatrate da su zadaci suviše teški za učenike? Navedite eventualne razloge.“

Odgovor	Nisu teški	Teški	Nedostatak prostora	Nedostatak sprava	Problem u realizaciji
F	19	1	2	7	1
%	63,3	3,3	6,7	23,3	3,3

U tabeli 5 data je frekvencija raspodele i procentni odnos odgovora na peto pitanje (Pitanje 5: „Prema vašem mišljenju sadržaji vežbi na spravama i tlu u programu fizičkog vaspitanja su:“), po razredima.

Tabela 5. Odgovori na pitanje „Prema vašem mišljenju sadržaji vežbi na spravama i tlu u programu fizičkog vaspitanja su:“

Razred	Prvi do četvrti			Peti			Šesti			Sedmi			Osmi		
Odgovor	Prihvatljiv	Laki	Teški	Prihvatljiv	Laki	Teški	Prihvatljiv	Laki	Teški	Prihvatljiv	Laki	Teški	Prihvatljiv	Laki	Teški
F	25	1	5	24	3	3	26	3	1	22	2	6	25	1	5
%	83,3	3,3	16,7	80	10	10	86,7	10	3,3	73,3	6,7	20	83,3	3,3	16,7

U tabeli 6 data je frekvencija raspodele i procentni odnos odgovora na šesto pitanje (Pitanje 6: „Da li ste realizovali zadatke na TLU?“).

Tabela 6. Odgovori na pitanje „Da li ste realizovali zadatke na TLU?“

Razred	Prvi do četvrti			Peti			Šesti			Sedmi			Osmi		
	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne
F	3	7	20	18	12	0	19	10	1	18	12	0	18	11	1
%	10	23,3	66,7	60	40	0	63,3	33,3	3,3	60	40	0	60	36,7	3,3

U tabeli 7 data je frekvencija raspodele i procentni odnos odgovora na sedmo pitanje (Pitanje 7: „Da li ste realizovali zadatke na PRESKOKU?“), po razredima.

Tabela 7. Odgovori na pitanje: „Da li ste realizovali zadatke na PRESKOKU?“

Razred	Prvi do četvrti			Peti			Šesti			Sedmi			Osmi		
	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne
F	5	4	21	13	15	2	15	13	2	15	12	3	15	13	2
%	16,7	13,3	70	43,3	50	6,7	50	43,3	6,7	50	40	10	50	43,3	6,7

U tabeli 8 data je frekvencija raspodele i procentni odnos odgovora na osmo pitanje (Pitanje 8: „Da li ste realizovali zadatke na VRATILU?“), po razredima.

Tabela 8. Odgovori na pitanje: „Da li ste realizovali zadatke na VRATILU?“

Razred	Prvi do četvrti			Peti			Šesti			Sedmi			Osmi		
	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne
F	0	1	29	2	7	21	2	7	21	0	7	23	0	9	21
%	0	3,3	96,7	6,7	23,3	70	6,7	23,3	70	0	23,3	76,7	0	30	70

U tabeli 9 data je frekvencija raspodele i procentni odnos odgovora na deveto pitanje (Pitanje 9: „Da li ste realizovali zadatke na PARALELNOM RAZBOJU?“), po razredima.

Tabela 9. Odgovori na pitanje: „Da li ste realizovali zadatke na PARALELNOM RAZBOJU?“

Razred	Prvi do četvrti			Peti			Šesti			Sedmi			Osmi		
	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne
F	0	1	29	3	8	19	3	10	17	5	8	17	5	8	17
%	0	3,3	96,7	10	26,7	63,3	10	33,3	56,7	16,7	26,7	56,6	16,7	26,7	56,6

U tabeli 10 data je frekvencija raspodele i procentni odnos odgovora na deseto pitanje (Pitanje 10: „Da li ste realizovali zadatke na KONJU SA HVATALJKAMA?“), po razredima.

Tabela 10. Odgovori na pitanje: „Da li ste realizovali zadatke na KONJU SA HVATALJKAMA?“

Razred	Prvi do četvrti			Peti			Šesti			Sedmi			Osmi		
	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne
Odgovor															
F	0	0	30	1	2	27	1	2	27	3	2	25	3	2	25
%	0	0	100	3,3	6,7	90	3,3	6,7	90	10	6,7	83,3	10	6,7	83,3

U tabeli 11 data je frekvencija raspodele i procentni odnos odgovora na jedanaesto pitanje (Pitanje 11: „Da li ste realizovali zadatke na KRUGOVIMA?“), po razredima.

Tabela 11. Odgovori na pitanje: „Da li ste realizovali zadatke na KRUGOVIMA?“

Razred	Prvi do četvrti			Peti			Šesti			Sedmi			Osmi		
	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne
Odgovor															
F	0	1	29	4	9	17	4	9	17	6	10	14	6	10	14
%	0	3,3	96,7	13,3	30	56,7	13,3	30	56,7	20	33,3	46,7	20	33,3	46,7

U tabeli 12 data je frekvencija raspodele i procentni odnos odgovora na dvanaesto pitanje (Pitanje 12: „Da li ste realizovali zadatke na DVOVISINSKOM RAZBOJU?“), po razredima.

Tabela 12. Odgovori na pitanje: „Da li ste realizovali zadatke na DVOVISINSKOM RAZBOJU?“

Razred	Prvi do četvrti			Peti			Šesti			Sedmi			Osmi		
	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne
Odgovor															
F	0	0	30	3	4	23	3	4	23	2	7	22	2	7	22
%	0	0	100	10	13,3	76,7	10	13,3	76,7	6,7	23,3	73,3	6,7	23,3	73,3

U tabeli 13 data je frekvencija raspodele i procentni odnos odgovora na trinaesto pitanje (Pitanje 13: „Da li ste realizovali zadatke na GREDI?“), po razredima.

Tabela 13. Odgovori na pitanje: „Da li ste realizovali zadatke na GREDI?“

Razred	Prvi do četvrti			Peti			Šesti			Sedmi			Osmi		
	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne	U potpunosti	Delimično	Ne
F	7	6	17	16	13	1	16	13	1	13	16	1	13	14	3
%	23,3	20	56,7	53,3	43,3	3,3	53,3	43,3	3,3	43,3	53,3	3,3	43,3	46,7	10

U tabeli 14 data je frekvencija raspodele i procentni odnos odgovora na pitanje: „Da li biste iz programa vežbi na spravama i tlu izbacili zadatke koje ste označili kao suviše teške?„

Tabela 14. Odgovori na pitanje „Da li biste iz programa vežbi na spravama i tlu izbacili zadatke koje ste označili kao suviše teške?„

Odgovor	Da	Ne
F	6	24
%	20	80

Na osnovu ove analize može se doneti zaključak da većina nastavnika želi da sprovedi važeći program sportske gimnastike, ali da za to u školama u kojima oni rade, ne postoje uslovi kako bi se on realizovao u predviđenoj meri.

Uzimajući u obzir odgovore na pitanje broj petnaest otvorenog tipa i komentare nastavnika (Pitanje 15: „Da li biste iz programa vežbi na spravama i tlu izbacili određene sprave (navedite koje i zbog čega)?“), mogu se doneti sledeći zaključci:

- 70% nastavnika ne bi izbacilo ni jednu spravu, već smatraju da bi nastavnici fizičkog vaspitanja trebalo da rade i u nižim razredima osnovne škole, ili od prvog ili od trećeg razreda pa na dalje.
- 20% nastavnika bi izbacilo konja sa hvataljkama, jer smatraju da je učenicima u današnje vreme muskulatura ruku i ramenog pojasa veoma slaba za izvođenje predviđenih zadataka na ovoj spravi.
- 4% nastavnika bi izbacilo preskok, jer smatraju da se učenici plaše preskakanja kozlića.
- 3% nastavnika bi izbacilo krugove i vratilo, jer na časovima na kojima bi zadaci na ovim spravama trebalo da se realizuju, učenici ne shvataju kakve posledice mogu imati, ako su neobazrivi na spravi i rade vežbe bez odobrenja i nadzora nastavnika.
- 3% nastavnika se izjasnilo da bi izbacili dvovisinski razboj, jer učenice ne pokazuju dovoljno veliko interesovanje za realizaciju zadataka predviđenih za ovu spravu.
- Ono što 80% nastavnika tvrdi, jeste da su sprave u većini škola dotrajale i rizične za upotrebu. Moguće je da nastavnici u ovim školama ne realizuju predviđeni program upravo zbog rizika od povređivanja. Jedan od odgovora koji govori u prilog tome, je da je u jednoj školi nastavnik fizičkog vaspitanja prilikom provere stanja sprave, krugova, jedan od kaiševa koji drže krugove za konstrukciju pukao.

Diskusija

Ono što se može zaključiti na osnovu analize odgovora na prvo pitanje je to da su škole samo delimično opremljene spravama za sportsku gimnastiku. Sprave koje većina škola poseduje i na kojima nastavnici mogu da realizuju nastavu predviđenu nastavnim planom i programom, jesu strunjače, sprave za preskok (mali i veliki kozlić), niska greda i švedske klupe. Polovina škola ima uslove za realizaciju nastave na paralelnom razboju. Nastavu na dvovisinskom razboju, konju sa hvataljkama i krugovima je gotovo nemoguće realizovati u većini škola, zbog toga što ne postoje uslovi, odnosno sprave. Ovo ukazuje da veoma

malo osnovnih škola u Srbiji poseduje viseće sprave. Iz komentara nastavnika se može zaključiti da većina škola koje ih poseduju, svoje sale nakon radnog vremena izdaju gimnastičkim klubovima.

Nastavnicima fizičkog vaspitanja mora biti omogućeno da pravovremeno postavе sprave i rekvizite kako bi mogli da realizuju program sportske gimnastike koji je predviđen nastavnim planom i programom, kao i njihovo uklanjanje kada se čas (ciklus) završi (tabela 2).

Nastavnici smatraju da učiteljice i učitelji nisu dovoljno stručno osposobljeni za realizaciju nastave sportske gimnastike od prvog do četvrog razreda (tabela 3). To implicira da bi nastavu fizičkog vaspitanja od prvog do četvrtog razreda, trebalo da realizuju nastavnici fizičkog vaspitanja.

Iz odgovora na pitanje četiri sledi da većina nastavnika smatra da je program dobro osmišljen i da zadaci nisu teški za učenike od prvog do osmog razreda.

Analizirajući podatke dobijene iz pitanja broj pet, sledi da nastavnici smatraju da je sadržaj programa sportske gimnastike za osnovnu školu, u svim razredima, učenicima prihvatljiv. Samo se približno 20% nastavnika izjasnilo da je sadržaj programa sportske gimnastike, u svim razredima osnovne škole, učenicima težak. Ovakva tvrdnja potkrepljena je zaključkom izvedenim iz pitanja broj četiri, gde nastavnici smatraju da je program sportske gimnastike dobro osmišljen.

Analizom odgovora na pitanje broj šest, proizilazi zaključak da se od prvog do četvrtog razreda, zadaci na tlu ne realizuju u čak 66,7% škola u Srbiji, delimično u 23,3%, dok se u samo 10% škola zadaci realizuju. Ovo se može pripisati činjenici da u školama od prvog do četvrtog razreda, realizaciju programa sportske gimnastike vrše učiteljice/učitelji. Ako se pogleda analiza pitanja broj tri, može se videti da se 56,7% ispitanika izjasnilo da smatraju da učiteljice/učitelji nisu u mogućnosti da realizuju program od prvog do četvrtog razreda. Daljom analizom pitanja, zaključuje se da postoji potpuna ili delimična realizacija zadataka iz programa sportske gimnastike od petog do osmog razreda.

Analizom odgovora na pitanje broj sedam, može se zaključiti da se zadaci na preskoku od prvog do četvrtog razreda samo u malom broju škola realizuju, dok se u većini škola ne realizuju. Takođe se može zaključiti da se zadaci na preskoku u višim razredima osnove škole delimično do potpuno realizuju.

Na osnovu ukupnih odgovora ispitanika na pitanje broj osam, može se izvesti zaključak da se zadaci na vratilu gotovo ne realizuju u osnovnoj školi. Čak 96,7% nastavnika odnosno učiteljica/učitelja od prvog do četvrtog razreda ne realizuje predviđene zadatke na vratilu. Od petog do osmog razreda se zadaci na vratilu delimično realizuju u 30% škola, dok u se u ostalih 70% škola uopšte ne sprovode.

Osvrtom na frekvenciju raspodele i procentnog odnosa odgovora nastavnika na pitanje broj devet, može se uvideti da realizacije zadataka na paralelnom razboju gotovo da nema od prvog do četvrtog razreda. U petom i šestom razredu realizacija u potpunosti je nešto bolja, 10%. U sedmom i osmom razredu se može primetiti porast stepena potpune realizacije zadataka koja iznosi 16,7%. Međutim, stepen nerealizacije je konstantan od šestog do osmog razreda i iznosi 56,7%. Ovaj blagi trend porasta stepena realizacije, od šestog do osmog razreda, se može pripisati činjenici da su učenici vremenom motorički sposobniji i stoga psihički spremniji za realizaciju zadataka kod kojih se javlja određena doza straha od povrede pri izvođenju.

Upoređivanjem frekvencija raspodele i procentnog odnosa odgovora na pitanje broj deset, uočava se veliki stepen nerealizacije zadataka. Od prvog do četvrtog razreda taj stepen je alarmirajuć, jer se 100% nastavnika izjasnilo da zadaci nisu realizovani u ovom periodu. Kada se pogleda stepen realizacije u višim razredima osnovne škole, može se uočiti samo blagi porast potpune realizacije koji čini 10% i delimične realizacije koji čini 6,7%. Stepem nerealizovanja zadataka je i dalje veliki sa 83,3%. S obzirom na činjenicu da u 30% ispitivanih škola postoji konj sa hvataljkama (tabela 1), može se reći da je izuzetno visok stepen nerealizacije posledica nekih drugih faktora, koji verovatno potiču od strane nastavnika.

Analizom frekvencije raspodele i procentnog odnosa odgovora na pitanje broj jedanaest, može se zaključiti da nastavnici odnosno učiteljice/učitelji, u periodu od prvog do četvrtog razreda nisu realizovali

predviđeni program i zadatke na krugovima. U višim razredima se primećuje porast stepena realizacije, a stepen nerealizacije iznosi 46,7% što govori o boljem sprovođenju zadataka u starijim razredima osnovne škole.

Analizom frekvencije raspodele i procentnog odnosa odgovora na pitanje broj dvanaest, dolazi se do zaključka da u najmlađim razredima osnovne škole, nema realizacije zadataka na dvovisinskom razboju. U starijim razredima stepen realizacije je veći i pokazuje trend rasta ka starijim razredima. Ipak je izuzetno visok procenat nastavnika koji uopšte nisu realizovali zadatke predviđene programom nastave, preko 70% nastavnika. Blagom porastu stepena realizacije može se pripisati činjenica da učenici postaju motorički spremniji i obučeniji za njihovo izvođenje kako prelaze iz razreda u razred. S obzirom da su nastavnici mišljenja da učitelji uopšte nisu sprovodili zadatke na ovoj spravi u mlađim razredima, može se pretpostaviti da se teže savladavaju sadržaji bez prethodno stečenih osnova kretanja, što bi moglo da utiče na samo blagi trend rasta realizacije.

Analizom frekvencije raspodele i procentnog odnosa odgovora na pitanje broj trinaest, dolazi se do zaključka da je stepen realizacije zadataka na gredi u svim razredima osnovne škole veći nego na ostalim spravama. U periodu od prvog do četvrtog razreda stepen realizacije je neznatno veći, dok je u starijim razredima znatno veći. U petom i šestom razredu samo 3.3% nastavnika nije uspešno realizovalo zadatke na gredi. U osmom razredu stepen realizacije malo opada, dok stepen nerealizacije raste i iznosi 10%. Ove tvrdnje se mogu potkrepiti činjenicom da su zadaci na gredi u sedmom i osmom razredu znatno teži, i da učenici poseduju dozu straha i nesigurnosti za njihovo izvođenje.

Zaključak

Cilj ovog istraživanja bio je da se utvrde stepen realizacije i mogući razlozi zbog kojih se postojeći nastavni plan i program sportske gimnastike, ne realizuje u meri u kojoj je predviđen, a prema mišljenju i stavovima nastavnika.

Obuhvaćeni uzorak nastavnika osnovnih škola bio je 30 nastavnika iz različitih gradova Republike Srbije (Beograd, Smederevo, Požarevac Niš i Bor).

Analizom rezultata istraživanja pokazalo se da se veći deo nastavnog plana i programa vežbi na spravama i tlu u osnovnoj školi, u svim razredima, ne realizuje u predviđenoj meri.

Nastavnici su naveli da se veći deo sadržaja uopšte ne realizuje zbog loših uslova i oskudne opremljenosti sala za nastavu fizičkog vaspitanja. Sprave koje se nalaze u školama, uglavnom su u lošem stanju i suviše rizične za realizaciju programa nastave na njima, pa je pretpostavka je da je jedan od relevantnijih uzroka trenutne situacije u nastavi fizičkog vaspitanja nepostojanje adekvatnih materijalno-tehničkih uslova za sprovođenje programa nastave.

Prema mišljenju nastavnika, nastavni plan i program vežbi na spravama i tlu od prvog do četvrtog razreda se jednim delom ne realizuje zbog nedovoljne kompetentnosti učiteljica/učitelja da sprovedu obuku zadataka iz programa. Drugim delom, nastavnici smatraju da do realizacije ne dolazi, jer učiteljice/učitelji nemaju dostupnu salu i sprave ili iz razloga što vreme predviđeno za časove fizičkog vaspitanja koriste kao nadoknadu za izgublenu nastavu iz drugih predmeta.

Na osnovu analize odgovora nastavnika može se izvući zaključak da postoji nedovoljna zainteresovanost učenika za realizaciju zadataka iz programa vežbi na spravama i tlu. Njihova iskustva pokazala su da mnogi učenici ne žele da vežbaju, jer se plaše povreda, veliki deo učenika izbegava časove fizičkog vaspitanja kada vidi strunjače ili postavljene sprave. Podatak koji je alarmantan je taj da se veliki broj učenika oslobađa nastave fizičkog vaspitanja, iako nema zdravstvenih razloga za to. Oni koji žele da vežbaju sportsku gimnastiku idu u privatne gimnastičke klubove.

Nedovoljna zainteresovanost učiteljica/učitelja i nastavnika se može izdvojiti kao jedan od mogućih razloga slabijeg stepena sprovođenja programa sportske gimnastike. Nastavnici su mišljenja da ova nezainteresovanost proizilazi delom iz toga što postoji strah da se učenici ne povrede prilikom izvođenja nekih od zadataka. Ipak, većina nastavnika obuhvaćena upitnikom (preko 80%), pokazuje želju i zainteresovanost za realizaciju nastave iz programa vežbi na spravama i tlu, ali navodi da za to ne postoje uslovi u školama u kojima oni rade (veliki broj đaka, nedostatak opreme, kratko efektivno vreme rada i dr.).

Kao glavni relevantni uzroci trenutne situacije u nastavnoj praksi na časovima fizičkog vaspitanja, prema mišljenju nastavnika, izdvojili su se: loši materijalno-tehnički uslovi u salama, nedovoljna kompetentnost učitelja za realizaciju zadataka u mlađim razredima, nedovoljna zainteresovanost učenika, učitelja i delom nastavnika. Izvučene zaključke o uzrocima slabijeg stepena realizacije zadataka iz sportske gimnastike trebalo bi uslovno prihvatiti i eksperimentalno proveriti u budućnosti nekom od adekvatnih statističkih procedura. U budućim istraživanjima trebalo bi uključiti u uzorak i veći broj ispitanika, nastavnika fizičkog vaspitanja, a posebno učitelja, sa ciljem dobijanja validnijih i pouzdanijih podataka.

Jedan od ključnih zadataka nastavnika i samog fizičkog vaspitanja je da kod dece dovedu do „usvajanja znanja radi razumevanja značaja i suštine fizičkog vaspitanja definisanog ciljem ovog vaspitno – obrazovnog područja“ (Radisavljević, 2008). S obzirom na cilj fizičkog vaspitanja, potrebno je edukovati kako učenike tako i njihove roditelje o značaju raznovrsnih fizičkih aktivnosti za pravilan razvoj i zdravlje. Posebno je važno istaći, od kakvog je značaja vežbanje na spravama i tlu i koliko ono može podstaći pravilan rast i razvoj organizma učenika.

Zaključak koji može biti izveden na osnovu sprovedenog upitnika, napomena i komentara nastavnika je taj, da bi problem nedovoljne realizacije programa sportske gimnastike, odnosno vežbi na spravama i tlu, mogao biti ublažen, pre svega, uključivanjem nastavnika fizičkog vaspitanja u rad sa učenicima u mlađim razredima osnovne škole (od prvog do četvrtog razreda), kao i uvođenjem priručnika sa ilustracijama ključnih vežbi iz programa i uputstvom za čuvanje i pomaganje, radi olakšavanja procesa obuke.

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RACE WALKING AS A MOVING ACTIVITY IN FITNESS

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Introduction

Doing some sports, whether professionally or recreationally, is important for all people because exercising and any sporting activity is a predictor of a healthy and long life (Torbarina, 2011), and as physical activity activates a complete locomotor system critical to transforming energy that is necessary for an activity of all cells in a body, the sport and physical activity can be treated as a determinant for a harmonious development of anthropological characteristics (Krzelj, 2009). Physical activity affects the quality of life (Pucci, Rech, Fermino, & Reis, 2012), and participation in sports recreational activities increases a level of motor and functional abilities, which is a direct contribution to the quality of life (Jurakic & Andrijasevic, 2012). It was found that aerobic programs have a transformational effect on a morphological and motoric status, and programs of running and walking on changes in functional abilities (Sekulic, Rausavljevic, & Zenic, 2003). The term fitness is used in the process of development, raising or maintenance at an optimal level of general psychophysical abilities and characteristics of an organism, and it implies thorough preparation of the organism for efforts and goals of persons who are engaged in physical activities for recreational reasons (Omrčen, Andrijasevic and Stefic, 2007). Walking as the basic form of movement maintains a system of initiation of movement, maintains its function, and at the same time makes the most effective exercise in the fight against stress (Zokovic, 2005). Being kinesiological activities, walking, hiking and running have proven multiple beneficial effects on the human organism, but sports fast walking also equally contributes to that (Kosinac, 2011). Sports walking has the advantage that knee injuries are not as common as during jogging and is therefore often an alternative to jogging (Rost, 1994). During 10km of intensive walking, 1 kg of body weight can be lost [7]. Liptak [8] characterized sports walking as a cyclic endurance competition recommended for every person, because a technical design requires a correct position of a pelvis, good mobility in knees, hips and shoulder joints. During sports walking, athletes achieve an average length of a step of 105-130 cm and a frequency of 180-200 steps per minute [10]. The fact is that a large number of children are involved in organized sports programs, but it is evident that the most of them drop out entering a puberty (Fraser Thomas et al., 2008; Horga, 2009). Adolescence is a formative period for adopting behaviors relevant to attitudes, habits and lifestyles (Lackovic - Grgin, 2006). Since free time is significant for the quality of life, and a way of spending leisure time is in direct relation with indicators of quality of life (Perasovic & Bartoluci, 2008), it is desirable to find new movement structures that have an overall positive effect on the body to ensure movement of the body forward using own strength, increasing motor safety (Herzog, 1981).

Accordingly, the aim of the research was to determine a possibility of having 12 weeks of sports walking to improve mobility, stability and changes in the composition of an adolescent body, for mass application in group fitness programs and sports and recreational activities.

Methods

The sample of respondents consisted of 17 male (9-experimental group, 8-control group) and 21 female (11-experimental, 10-control group) respondents of adolescent population (16 years \pm 6 months) who were not included in any type of sport-recreational activities and were of optimal health without

injuries to the locomotion apparatus. The aim of the research was to determine the effect of the 12-week sports walking program (author Eastler, 2012) on improving mobility, stability and body composition changes to eliminate extremity asymmetry and for mass use in group fitness programs and sport-recreational activities. The program (table 1) was designed for the age of the juniors (taken from <https://racewalk.com/resources/RacewalkingFunFinal.pdf>), five training sessions were conducted during a week (the participants covered from 17.5 to 30 km per week on average), and basic elements of all-round sports walking training were present: technique, mobility and flexibility, speed and special endurance and strength and strength endurance. The load was designed to move the heart rate in the ranges of the first three load zones, depending on the movement activity and the intensity. The overall program, structure and composition of each training course must be carefully planned to properly reflect overall development and include all of these elements [15].

The effectiveness of the program was verified by establishing functional abilities indicators - the fitness index FI (2km UKK test), basal metabolism (BMR), while the effect of the program activity was determined by changing the body composition variables (data obtained by Body composition analyser TANITA BC-418), - total fat percentage (FAT), percentage of fatty tissue segmented (percentage of fatty tissue of left leg (FATll), right leg (FATrl), left arm (FATla), right arm (FATra) and body (FATbo) impedance, muscular mass - MM (determined by the formula Martin, Spent, Drinkwater, & Clarys (1990) for men and Doupe, Martin, Searle, Kriellaars, Giesbrecht, (1997) for women (based on TV variables - body height (cm), CTG - corrected circumference of the upper leg (cm) [volume (cm) -3.14 * (DKN upper leg (mm)/10), FG - maximum circumference of forearm, CCG - corrected circumference of lower leg [volume (cm) -3.14 * (DKN of lower leg (mm)/10), TM body mass (kg), and assessment of mobility and stability level based on application of Functional Movement Screening (FMS) methods (seven tests) before and after the implementation of the program.

In order to obtain valid results, the statistical program SPSS 16,0 and the following statistical methods were applied: basic descriptive statistics, KS test-analysis of normality of results, independent t-test-analysis of differences between groups and dependent t-test-analysis of differences within the group.

Results with discussion

Table 1. Descriptive statistics of all variables in experimental and control groups in both groups of respondents

Men						women						
Mean		Std. Dev		ks		Mean		Std. Dev		ks		
e	k	e	k	e	k	e	k	e	k	e	k	
12.77	10.91	2.3863	2.23	0.62	0.56	Fms	10.7	9.91	2.31	2.21	0.62	0.56
28.64	29.68	7.71	7.54	0.80	0.87	fet	26.6	28.6	7.78	7.55	0.80	0.87
1426.8	1336.1	226.27	105.45	0.90	0.86	bmr	1326.8	1326.1	226.41	105.49	0.90	0.86
98.45	97.35	18.21	19.46	0.72	0.78	Ukk	92.45	91.35	18.54	19.42	0.72	0.78
33.28	32.48	4.18	4.25	0.90	0.56	Upper arm circumference	31.28	30.48	4.21	4.28	0.90	0.56
27.14	26.17	6.25	6.84	0.45	0.87	Forearm circumference	28.14	27.17	4.18	4.25	0.90	0.56
86.52	88.42	15.21	15.46	0.75	0.86	Stomach circumference	91.52	90.42	15.45	15.47	0.75	0.86
48.20	46.28	8.41	8.57	0.82	0.78	Upper leg circumference	48.20	47.28	8.78	8.41	0.82	0.78
32.30	31.38	7.54	7.21	0.93	0.91	Lower leg circumference	31.30	30.38	7.24	7.31	0.93	0.91
175.52	174.42	41.25	44.28	0.52	0.57	Tv	169.5	164.4	41.89	44.85	0.52	0.57
45.21	44.87	4.18	4.25	0.90	0.56	Muscle mass estimate	39.2	38.5	4.18	4.25	0.90	0.56
35.21	33.47	6.38	5.69	0.59	0.29	Fat left arm	33.2	32.4	6.54	5.69	0.59	0.29
33.25	33.19	6.72	5.17	0.45	0.13	Fat right arm	31.2	30.1	6.91	5.27	0.45	0.13
32.39	29.57	7.55	6.17	0.95	0.43	Fat left leg	30.3	29.8	7.77	6.45	0.95	0.43
33.22	29.80	7.83	6.67	0.87	0.19	Fat right leg	32.2	30.8	7.64	6.97	0.87	0.19
30.62	26.90	9.28	9.63	0.64	0.42	Fat trunk	35.6	36.9	9.99	9.93	0.64	0.42

Table 2. Descriptive statistics of all variables in experimental and control groups in both groups of respondents

Men						women						
Mean		Std. Dev		ks			Mean		Std. Dev		ks	
e	k	e	k	e	k		e	k	e	k	e	k
14.888	10.250	2.7131	1.1649	0.74	0.23	Fms	10.8	9.98	2.30	2.20	0.60	0.50
27.277	30.525	6.9306	7.4302	0.90	0.91	fet	26.7	28.8	7.70	7.50	0.80	0.80
1507.8	1320.8	223.92	92.550	0.51	0.83	bmr	1326.9	1326.1	226.0	105.40	0.90	0.80
102.45	97.38	18.25	19.66	0.81	0.78	Ukk	92.55	91.34	18.50	19.40	0.70	0.70
33.38	32.58	4.25	4.95	0.92	0.34	Upper arm circumference	31.38	30.49	4.20	4.20	0.90	0.50
28.14	26.26	6.32	6.72	0.74	0.81	Forearm circumference	28.24	27.21	6.80	6.20	0.40	0.80
85.52	87.92	15.28	15.54	0.90	0.73	Stomach circumference	91.88	90.52	15.40	15.40	0.70	0.80
49.20	46.38	8.52	8.72	0.51	0.71	Upper leg circumference	48.98	47.35	8.70	8.40	0.80	0.70
32.30	31.52	7.81	7.85	0.74	0.90	Lower leg circumference	31.24	30.74	7.20	7.3	0.90	0.90
175.53	174.43	41.87	44.31	0.52	0.52	Tv	169.5	164.5	41.80	44.80	0.50	0.50
47.21	45.87	4.19	4.26	0.97	0.58	Muscle mass estimate	39.2	38.7	4.19	4.26	0.91	0.58
34.21	33.49	6.21	5.91	0.74	0.71	Fat left arm	33.1	32.2	6.50	5.60	0.50	0.20
31.25	32.99	6.82	5.21	0.90	0.18	Fat right arm	31.5	30.9	6.90	5.20	0.40	0.10
30.39	29.51	7.74	6.85	0.51	0.24	Fat left leg	30.4	29.6	7.70	6.40	0.90	0.40
32.22	29.95	7.92	6.43	0.54	0.25	Fat right leg	32.5	30.9	7.60	6.90	0.80	0.10
28.62	29.90	9.45	9.91	0.69	0.78	Fat trunk	35.7	36.2	9.90	9.90	0.60	0.420

Tables 1. and 2. show values of descriptive statistics of the results of all variables of both groups of respondents at initial and final measurement. From the values shown in the tables it can be seen that there was a change in average values for both groups of respondents. In the experimental group there was a decrease in the value of the FET results, while the value of FMS and BMR results was increased. In the control group there was a decrease in the value of FMS and BMR results, while the FET results were increased.

Table 3. Results of an independent T-Test, difference between experimental and control groups at final measurement of men

	t	df.	sig.
Fms in - fms final	-4.359	16	0.002
fet in - fet final	1.323	16	0.301
bmr inc - bmr fin	-2.438	16	0.041
Ukk in-ukkk final	4.750	16	0.001
Upper arm circumference in - Upper arm circumference final	0.421	16	0.548
Forearm circumference in - Forearm circumference final	9.540	16	0.000
Stomach circumference in- Stomach circumference final	8.580	16	0.000
Upper leg circumference in- Upper leg circumference final	12.284	16	0.000
Lower leg circumference in- Lower leg circumference final	0.394	16	0.621
Tvin-tvfinal	0.194	16	0.861
Muscle mass estimate in- Muscle mass estimate final	9.410	16	0.000
Fat left arm n- Fat left arm final	4.940	16	0.001
Fat right arm in- Fat right arm final	4.220	16	0.003
Fat left leg in- Fat left leg final	4.269	16	0.003
Fat right leg in- Fat right leg final	3.098	16	0.015
Fat trunk in-fat trunk final	8.125	16	0.000

Table 4. Results of an independent T-Test, difference between experimental and control groups at final measurement of women

	t	df.	sig.
Fms in - fms final	-5.229	20	0.000
fet in - fet final	7.232	20	0.000
bmr inc - bmr fin	-2.438	20	0.041
Ukk in-ukk final	7.850	20	0.000
Upper arm circumference in - Upper arm circumference final	0.421	20	0.548
Forearm circumference in - Forearm circumference final	9.540	20	0.000
Stomach circumference in- Stomach circumference final	6.780	20	0.000
Upper leg circumference in- Upper leg circumference final	11.884	20	0.000
Lower leg circumference in- Lower leg circumference final	0.394	20	0.621
Tvin-tvfinal	0.194	20	0.861
Muscle mass estimate in- Muscle mass estimate final	9.750	20	0.000
Fat left arm n- Fat left arm final	6.940	20	0.000
Fat right arm in- Fat right arm final	5.320	20	0.001
Fat left leg in- Fat left leg final	5.125	20	0.003
Fat right leg in- Fat right leg final	4.099	20	0.015
Fat trunk in-fat trunk final	6.521	20	0.000

After the 12-week sports walking program, the use of t-tests for independent samples in the experimental group of male patients was found to have improved the results: fitness index ($t=4.750$ $p=0.001$), basal metabolism ($t=-2.438$ $p=0.041$), FMS ($t=-4.359$ $p=0.002$), upper extremities fat (left $t=4.940$ $p=0.001$; right $t=4.220$ $p=0.003$), forearm circumference ($t=9.540$ $p=0.000$), stomach circumference ($t=8.580$ $p=0.000$), upper leg circumference ($t=12.284$ $p=0.000$) and muscle mass ($t=9.410$ $p=0.000$) in relation to the control group.

After the experimental program of sports walking, the experimental group of female respondents improved results: fitness index ($t=7.580$ $p=0.000$), FMS ($t=-5.229$ $p=0.000$), fat lower extremities (left $t=5.125$ $p=0.003$; right $t=4.099$ $p=0.015$), fat trunk ($t=6.521$ $p=0.000$), fat total ($t=7.232$ $p=0.000$), stomach circumference ($t=6.780$ $p=0.000$), upper leg circumference ($t=11.884$ $p=0.000$) and muscle mass ($t=9.750$ $p=0.000$) in relation to the control group.

Improvement of the results of both experimental groups in the 2km UKK test after the implementation of a sports walking training program (the statistical significance of the change in fitness index of male subjects was $t = 4.750$ $p = 0.001$ and in female subjects $t = 7.580$ $p = 0.000$) indicates the efficiency of the implemented walk program. Since the program had positive effects on the respondents, it can be stated that it can be used in adolescent age as a program of movement activity of sport-recreational nature, performed with light and moderate load to improve development at that age. The development of the body will only be stimulated by the activation of the motion system, which includes all adaptation mechanisms, locomotor system, cardio-vascular and respiratory system, thermoregulation and hormone release system, and cellular nutrition and elimination of metabolites systems (Bujas, 1968).

The physical system cannot be treated as a physical ability but can be altered under the influence of exercise directed towards the development of the aforementioned physical abilities (strength development is usually followed by increased muscle mass and increased aerobic endurance is often followed by reduction of subcutaneous fat tissue) so it can be an indirect indicator of fitness level, while on the other hand, the physical composition affects physical fitness expression and health (McArdle, Katch, Katch, Lippincott Williams & Wilkins, 2006). By analyzing the physical appearance (somatotype) of sportsmen who are engaged in sports walking, it can be concluded that world competitors belong to the mesomorphic type of medium slimness with well-developed muscles of legs (13). Male and female sports walking specialists at a junior age have a lower percentage of fat compared to the normal amount for teenage age, higher lung

capacity and well-developed leg musculature (13.14), and the influence of sports walking on body composition has also been shown in this study in both sexes as the effect of the program was increased muscle mass and a reduction in the percentage of fat tissue.

The programmed systemic exercise affects the transformation of the female body composition (Fogelholm, Kukkonen-Harjula, & Oja, 1999), and in particular the reduction of the percentage of body fat in the body (Siric, Prelecec, Brcic, 2005) which was also shown in this research, since in the case of the experimental group female respondents, under the influence of the program, the percentage of fatty tissue decreased in total and segments, and this was also the case with male respondents.

By analyzing a group fitness program, one can notice that the program was designed for beginners, and that the trainings consisted of several components that affect morphological and functional characteristics. Reduction of fatty tissue of the lower extremities and the body can be attributed to the choice of motion activities and sports walking techniques because they required active work of the muscles of the arms, the body and the lower extremities. Since it was determined that the selected movement activities had a positive effect on muscle activation and reduction of fatty tissue of the trunk and lower extremities, it was expected that the mobility would be improved and that a significant difference would be observed among the female respondents of the experimental group compared to the control group female respondents at mobility and stability tests in which lower extremities and abdominal muscles are more active.

Djug and Mikic (2007), by applying step aerobic fitness program and in the anthropometric and motor characteristics of female students achieved significant partial changes, and Pavic & Zuvella (2004) found that aerobic exercises led to reduced subcutaneous fat tissue, confirming that the activity selection which is in line with the aim, age and sex of respondents results in positive effects.

Childhood and youth are the most important formative periods, and some development segments, such as specific motor skills, can only be developed by means used in sports (Doupona & Petrovic, 1997), so it is important that the sporting activity that is selected is not a burden, that it fulfills them with pleasure and joy (Martincevic, 2010), which will at the same time relieve stress and, above all, create a habit of sporting activities at early age which will continue during growth and become part of everyday life (Krzelj, 2009).

Conclusion

It should be borne in mind that, although it is a youth age, one should not rush with selecting and directing into certain sports and recreational activities, because the level of ability is directly linked to accumulated exercise (Ericsson and Charness, 1994, Ericsson & Lehmann, 1996).

The selection of a group of fitness program designed by the experts aimed at the beginners and focused on the comprehensive work of moderate intensity resulted in positive changes in the body composition in subjects of both sexes at an adolescent age. According to the results, the use of sports walking as a movement activity in the group fitness program program had positive effects on functional abilities, body composition and mobility and stamina in both male and female adolescent populations, that is, proved to be a good sport-recreational activity in this age because it can motivate them to further engage in some group or individual fitness programs and a possibility of its wider application may be considered. All this points to the need to conduct research of a similar character to allow adolescents of both sexes to engage in sport-recreational activities that do not require too much effort and have a positive effect on their health status.

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SPORTSKO HODANJE KAO KRETNA AKTIVNOST U FITNESS-U

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Uvod

Bavljenje nekim sportom, bilo profesionalno ili rekreativno, važno je za sve ljude jer je vježbanje i svaka sportska aktivnost prediktor za zdrav i dug život (Torbarina, 2011), a kako tjelesna aktivnost aktivira kompletni lokomotorni sistem presudan za transformaciju energije koja je preko potrebna za aktivnost svih ćelija u organizmu, to se sport i tjelesna aktivnost mogu tretirati kao odrednica za skladan razvoj antropoloških osobina (Krželj, 2009). Tjelesna aktivnost utiče na kvalitetu života (Pucci, Rech, Fermino, & Reis, 2012), a učestvovanjem u sportskoj rekreaciji povećava se nivo motoričkih i funkcionalnih sposobnosti, što je direktan doprinos kvaliteti života (Jurakić & Andrijašević, 2012). Utvrđeno je da programi aerobika imaju transformacioni učinak na morfološki i motorički status, a programi trčanja i hodanja na promjene funkcionalnih sposobnosti (Sekulić, Rausavljević, & Zenić, 2003). Termin fitnes se koristi u procesu razvoja, podizanja ili održavanja na optimalnoj razini općih psihofizičkih sposobnosti i karakteristika organizma te podrazumijeva temeljitu pripremu organizma za napore i ciljeve osoba koje se tjelesnom aktivnošću bave iz rekreativnih razloga (Omrčen, Andrijašević i Štefić, 2007). Hodanje kao osnovni oblik kretanja održava sistem za pokretanje, održava njegovu funkciju, a istodobno čini najdostupniju tjelovježbu u borbi protiv stresa (Zoković, 2005). Kao kineziološke aktivnosti, hodanje, pješčenje i trčanje imaju dokazan višestruko povoljan utjecaj na ljudski organizam, ali tomu jednako doprinosi i sportsko brzo hodanje (Kosinac, 2011). Sportsko hodanje ima prednost u tome što ozljede koljena nisu tako česte kao tokom džogiranja i stoga je često alternativa džogingu (Rost, 1994). Tokom 10km intenzivnog hodanja, može se izgubiti 1 kg tjelesne mase. Liptak je okarakterisao sportsko hodanje kao ciklično takmičenje izdržljivosti preporučeno za svaku osobu, jer tehnička izvedba zahtijeva pravilnu poziciju karlice, dobru pokretljivost u koljenima, kukovima i ramenskim zglobovima. Tokom sportskog hodanja, sportisti postižu prosječnu dužinu koraka 105-130 cm i učestalost od 180-200 koraka u minuti. Činjenica je da se velik broj djece uključuje u organizirane sportske programe, no ulaskom u pubertet evidentno je da ih većina odustaje (Fraser Thomas & sur., 2008; Horga, 2009). Adolescencija je formativno razdoblje za usvajanje ponašanja relevantnih za stavove, navike i stil života (Lacković – Grgin, 2006). Budući da je slobodno vrijeme značajno za kvalitetu života, a način provođenja slobodnog vremena u izravnoj vezi s pokazateljima kvalitete života (Perasović & Bartoluci, 2008), poželjno je iznalaziti nove kretne strukture koje imaju cjelokupan pozitivan uticaj na organizam kojima se osigurava kretanje tijela naprijed korištenjem vlastite snage, povećavajući motoričku sigurnost (Herzog, 1981).

Shodno tome, cilj istraživanja bio je, utvrditi mogućnost djelovanja 12 sedmica sportskog hodanja na poboljšanje mobilnosti, stabilnosti i na promjene kompozicije tijela adolescenata, radi masovne primjene u grupnim fitnes programima i sportsko-rekreativnim aktivnostima.

Metod

Uzorak ispitanika sastojao se od 17 ispitanika muške (9-eksperimentalna grupa, 8-kontrolna grupa) i 21 ispitanica ženske (11-eksperimentalna, 10-kontrolna grupa) populacije adolescenata (16 godina ± 6 mjeseci), koji nisu bili uključeni u neki vid sportsko-rekreativne aktivnosti i bili su optimalnog zdravlja bez povreda lokomotornog aparata. Istraživanjem se željelo utvrditi efekat 12 sedmica programa sportskog

hodanja (Eastler, 2012) na poboljšanje mobilnosti, stabilnosti i na promjene kompozicije tijela, radi otklanjanja asimetrije ekstremiteta i radi masovne primjene u grupnim fitnes programima i sportsko-rekreativnim aktivnostima. Program (tabela 1.) je dizajniran za uzrast juniora (preuzet sa <https://racewalk.com/resources/RacewalkingFunFinal.pdf>), tokom sedmice je provedeno pet treninga (prosječno su ispitanici prelazili od 17,5 do 30 km sedmično), a zastupljeni su osnovni elementi cjelokupnog treninga sportskog hodanja: tehnika, mobilnost i fleksibilnost, brzina i specijalna izdržljivost i snaga i izdržljivost u snazi. Opterećenje je dizajnirano da se frekvencija srca kretala u rasponima prve tri zone opterećenja, u zavisnosti od kretne aktivnosti i intenziteta.

Efikasnost programa provjerena je utvrđivanjem pokazatelja funkcionalnih sposobnosti – fitness index FI (2km UKK test), bazalni metabolizam (BMR), dok su efekti djelovanja programa utvrđeni na osnovu promjena varijabli tjelesne kompozicije tijela (podaci dobijeni pomoću aparata *Body composition analyser TANITA BC-418*) – ukupnog postotka masnog tkiva (FAT), postotka masnog tkiva segmentarno (postotak masnog tkiva lijeve noge (FATln), desne noge (FATdn), lijeve ruke (FATlr), desne ruke (FATdr) i trupa (FATtr), impedanca, mišićna masa - MM (određena je po formuli Martin, Spent, Drinkwater, & Clarys (1990) za muškarce i Doupe, Martin, Searle, Kriellaars, Giesbrecht, (1997) za žene (na osnovu varijabli TV - tjelesna visina (cm), CTG - korigovan obim natkoljenice (cm) [obim (cm)-3,14*(DKN natkoljenice (mm)/10)], FG - maksimalan obim podlaktice, CCG - korigovan obim potkoljenice [obim (cm)-3,14*(DKN potkoljenice (mm)/10)], TM - tjelesna masa (kg), te procjenom nivoa mobilnosti i stabilnosti – na osnovu primjene *Functional movement screening* (FMS) metode (sedam testova) prije i poslije provođenja programa.

Za dobijanje valjanih rezultata primijenjen je statistički program SPSS 16,0 i sljedeće statističke metode: osnovna deskriptivna statistika, KS test-analiza normalnosti rezultata, nezavisni t-test-analiza razlika između grupa i zavisni t-test-analiza razlika unutar grupe.

Rezultati sa diskusijom

Tabela 1. Deskriptivna statistika svih varijabli kod eksperimentalne i kontrolne grupe kod obe grupe ispitanika

muškarci						žene						
Mean		Std. Dev		ks		Mean		Std. Dev		ks		
e	k	e	k	e	k	e	k	e	k	e	k	
12,77	10,91	2,3863	2,23	0,62	0,56	Fms	10,7	9,91	2,31	2,21	0,62	0,56
28,64	29,68	7,71	7,54	0,80	0,87	fet	26,6	28,6	7,78	7,55	0,80	0,87
1426,8	1336,1	226,27	105,45	0,90	0,86	bmr	1326,8	1326,1	226,41	105,49	0,90	0,86
98,45	97,35	18,21	19,46	0,72	0,78	Ukk	92,45	91,35	18,54	19,42	0,72	0,78
33,28	32,48	4,18	4,25	0,90	0,56	Obim nadlaktice	31,28	30,48	4,21	4,28	0,90	0,56
27,14	26,17	6,25	6,84	0,45	0,87	Obim podlaktice	28,14	27,17	4,18	4,25	0,90	0,56
86,52	88,42	15,21	15,46	0,75	0,86	Obim trbuha	91,52	90,42	15,45	15,47	0,75	0,86
48,20	46,28	8,41	8,57	0,82	0,78	Obim natkoljenice	48,20	47,28	8,78	8,41	0,82	0,78
32,30	31,38	7,54	7,21	0,93	0,91	Obim potkoljenice	31,30	30,38	7,24	7,31	0,93	0,91
175,52	174,42	41,25	44,28	0,52	0,57	Tv	169,5	164,4	41,89	44,85	0,52	0,57
45,21	44,87	4,18	4,25	0,90	0,56	Procjena mišićne mase	39,2	38,5	4,18	4,25	0,90	0,56
35,21	33,47	6,38	5,69	0,59	0,29	Fet lijeva ruka	33,2	32,4	6,54	5,69	0,59	0,29
33,25	33,19	6,72	5,17	0,45	0,13	Fet desna ruka	31,2	30,1	6,91	5,27	0,45	0,13
32,39	29,57	7,55	6,17	0,95	0,43	Fet lijeva noga	30,3	29,8	7,77	6,45	0,95	0,43
33,22	29,80	7,83	6,67	0,87	0,19	Fet desna noga	32,2	30,8	7,64	6,97	0,87	0,19
30,62	26,90	9,28	9,63	0,64	0,42	Fet trup	35,6	36,9	9,99	9,93	0,64	0,42

Tabela 2. Deskriptivna statistika svih varijabli kod eksperimentalne i kontrolne grupe kod obe grupe ispitanika

muškarci						žene						
Mean		Std. Dev		ks		Mean		Std. Dev		ks		
e	k	e	k	e	k	e	k	e	k	e	k	
14,888	10,250	2,7131	1,1649	0,74	0,23	Fms	10,8	9,98	2,30	2,20	0,60	0,50
27,277	30,525	6,9306	7,4302	0,90	0,91	fet	26,7	28,8	7,70	7,50	0,80	0,80
1507,8	1320,8	223,92	92,550	0,51	0,83	bmr	1326,9	1326,1	226,0	105,40	0,90	0,80
102,45	97,38	18,25	19,66	0,81	0,78	Ukk	92,55	91,34	18,50	19,40	0,70	0,70
33,38	32,58	4,25	4,95	0,92	0,34	Obimna dlaktice	31,38	30,49	4,20	4,20	0,90	0,50
28,14	26,26	6,32	6,72	0,74	0,81	Obim podlaktice	28,24	27,21	6,80	6,20	0,40	0,80
85,52	87,92	15,28	15,54	0,90	0,73	Obim trbuha	91,88	90,52	15,40	15,40	0,70	0,80
49,20	46,38	8,52	8,72	0,51	0,71	Obim natkoljenice	48,98	47,35	8,70	8,40	0,80	0,70
32,30	31,52	7,81	7,85	0,74	0,90	Obim potkoljenice	31,24	30,74	7,20	7,3	0,90	0,90
175,53	174,43	41,87	44,31	0,52	0,52	Tv	169,5	164,5	41,80	44,80	0,50	0,50
47,21	45,87	4,19	4,26	0,97	0,58	Procjena mišićne mase	39,2	38,7	4,19	4,26	0,91	0,58
34,21	33,49	6,21	5,91	0,74	0,71	Fet lijeva ruka	33,1	32,2	6,50	5,60	0,50	0,20
31,25	32,99	6,82	5,21	0,90	0,18	Fet desna ruka	31,5	30,9	6,90	5,20	0,40	0,10
30,39	29,51	7,74	6,85	0,51	0,24	Fet lijeva noga	30,4	29,6	7,70	6,40	0,90	0,40
32,22	29,95	7,92	6,43	0,54	0,25	Fet desna noga	32,5	30,9	7,60	6,90	0,80	0,10
28,62	29,90	9,45	9,91	0,69	0,78	Fet trup	35,7	36,2	9,90	9,90	0,60	0,42

U tabelama 1 i 2 su prikazane vrijednosti deskriptivne statistike rezultata svih varijabli obe grupe ispitanika na inicijalnom i finalnom mjerenju. Iz vrijednosti prikazanih u tabelama može se vidjeti da je došlo do promjena prosječnih vrijednosti kod obe grupe ispitanika. Kod eksperimentalne grupe je došlo do smanjenja vrijednosti rezultata FET, a do povećanja vrijednosti rezultata FMS i BMR. Kod kontrolne grupe je došlo do smanjenja vrijednosti rezultata FMS i BMR, a do povećanja vrijednosti rezultata FET.

Tabela 3. Rezultati nezavisnog T-testa, razlika između eksperimentalne i kontrolne grupe na finalnom mjerenju muškarci

	t	df.	sig.
Fms in - fms final	-4,359	16	0,002
fet in - fet final	1,323	16	0,301
bmr in - bmr final	-2,438	16	0,041
Ukk in - ukk final	4,750	16	0,001
Obim nadlaktice in - obim nadlaktice final	0,421	16	0,548
Obim podlaktice in - obim podlaktice final	9,540	16	0,000
Obim trbuha in - obim trbuha final	8,580	16	0,000
Obim natkoljenice in - obim natkoljenice final	12,284	16	0,000
Obim potkoljenice in - obim potkoljenice final	0,394	16	0,621
Tv in - tv final	0,194	16	0,861
Procjena mišićne mase in - procjena mišićne mase final	9,410	16	0,000
Fet lijevaruka in - Fet lijeva ruka in final	4,940	16	0,001
Fet desnaruka in - Fet desna ruka final	4,220	16	0,003
Fet lijevanoga in - Fet lijeva noga final	4,269	16	0,003
Fet desnanoga in - Fet desna noga final	3,098	16	0,015
Fet trup in - fet trup final	8,125	16	0,000

Tabela 4. Rezultati nezavisnog T-testa, razlika između eksperimentalne i kontrolne grupe na finalnom mjerenju žene

	t	df.	sig.
Fms in - fms final	-5,229	20	0,000
fet in - fet final	7,232	20	0,000
bmr in - bmr final	-2,438	20	0,041
Ukk in - ukk final	7,850	20	0,000
Obim nadlaktice in - obim nadlaktice final	0,421	20	0,548
Obim podlaktice in - obim podlaktice final	9,540	20	0,000
Obim trbuha in - obim trbuha final	6,780	20	0,000
Obim natkoljenice in - obim natkoljenice final	11,884	20	0,000
Obim potkoljenice in - obim potkoljenice final	0,394	20	0,621
Tv in - tv final	0,194	20	0,861
Procjena mišićne mase in - procjena mišićne mase final	9,750	20	0,000
Fet lijeva ruka in - Fet lijeva ruka final	6,940	20	0,000
Fet desna ruka in - Fet desna ruka final	5,320	20	0,001
Fet lijeva noga in - Fet lijeva noga final	5,125	20	0,003
Fet desna noga in - Fet desna noga final	4,099	20	0,015
Fet trup in - fet trup final	6,521	20	0,000

Nakon provedenih 12 sedmica programa sportskog hodanja, primjenom T-testa za nezavisne uzorke kod ispitanika eksperimentalne grupe muškog pola utvrdilo se da je došlo je do poboljšanja rezultata: fitness indexa ($t=4,750$ $p=0,001$), bazalni metabolizam ($t=-2,438$ $p=0,041$), FMS ($t=-4,359$ $p=0,002$), fat gornjih ekstremiteta (lijevi $t=4,940$ $p=0,001$; desni $t=4,220$ $p=0,003$), obim podlaktice ($t=9,540$ $p=0,000$), obim trbuha ($t=8,580$ $p=0,000$), obim natkoljenice ($t=12,284$ $p=0,000$) i mišićna masa ($t=9,410$ $p=0,000$) u odnosu na kontrolnu grupu.

Nakon provedenog eksperimentalnog programa sportskog hodanja, kod ispitanica eksperimentalne grupe ženskog pola došlo je do poboljšanja rezultata: fitness indexa ($t=7,580$ $p=0,000$), FMS ($t=-5,229$ $p=0,000$), fat donji ekstremiteta (lijevi $t=5,125$ $p=0,003$; desni $t=4,099$ $p=0,015$), fat trup ($t=6,521$ $p=0,000$), fat ukupno ($t=7,232$ $p=0,000$), obim trbuha ($t=6,780$ $p=0,000$), obim natkoljenice ($t=11,884$ $p=0,000$) i mišićna masa ($t=9,750$ $p=0,000$) u odnosu na kontrolnu grupu.

Poboljšanje rezultata, koje su ispitanici oba pola eksperimentalne grupe postigli u 2km UKK test-u poslije provođenja programa treninga sportskog hodanja (statistička značajnost promjene fitness index-a muških ispitanika iznosila je $t=4,750$ $p=0,001$ a kod ženskih ispitanika $T=7,580$ $p=0,000$) ukazuje na efikasnost provedenog programa hodanja. Budući da je program imao pozitivne efekte na ispitanike, može se konstatovati da se može primjenjivati u adolescentskom uzrastu kao program kretne aktivnosti sportsko-rekreativnog karaktera koja se izvodi laganim i umjerenim opterećenjem sa ciljem poboljšanja razvoja u tom uzrastu. Razvoj organizma potaknut će se jedino aktivacijom sustava za kretanje koji uključuje sve mehanizme adaptacije, lokomotorni sistem, kardio-vaskularni i respiratorni sistem, sistem termoregulacije i lučenja hormona, te sisteme za prehranu ćelija i eliminaciju metabolita (Bujas, 1968).

Tjelesni sistem se ne može tretirati kao fizička sposobnost, ali se može mijenjati pod uticajem vježbanja usmjerenog na razvoj gore navedenih fizičkih sposobnosti (razvoj snage po pravilu je praćen povećanjem mišićne mase, a povećanje aerobne izdržljivosti često je praćeno smanjenjem potkožnog masnog tkiva) pa tako može da bude posredni pokazatelj nivoa fitnessa, dok sa druge strane, tjelesni sastav utiče na ispoljavanje fizičkih sposobnosti i na zdravlje (McArdle, Katch, Lippincott Williams & Wilkins, 2006). Analizirajući tjelesni izgled (somatotip) sportista koji se bave sportskim hodanjem, može se zaključiti da svjetski takmičari pripadaju mezomorfnom tipu srednje vitkosti sa dobro razvijenim mišićima nogu (13). Momci i djevojke, koji specijalizuju sportsko hodanje u juniorskom uzrastu, imaju manju količinu postotka masnog tkiva u odnosu na normalnu količinu za tinejdžerski uzrast, viši kapacitet pluća i dobro razvijenu

muskulaturu nogu (13,14), a uticaj sportskog hodanja na tjelesnu kompoziciju pokazao se i u ovom istraživanju i to kod oba pola jer je pod uticajem programa došlo do povećanja mišićne mase i smanjenja postotka masnog tkiva.

Programirano sistemsko vježbanje utiče na transformaciju tjelesnog sastava žena (Fogelholm, Kukkonen-Harjula, & Oja, 1999), a posebice na smanjenje postotka tjelesne masti u organizmu (Širić, Prelčec, Brčić, 2005), što se pokazalo i u ovom istraživanju, jer je kod ispitanica eksperimentalne grupe, pod uticajem programa došlo do smanjenja postotka masnog tkiva ukupno i segmentarno, a to je bio slučaj i sa ispitanicima muškog pola.

Analizirajući program grupnog fitnesa može se uočiti da je program dizajniran za početnike, te da su se treninzi sastojali od više komponenti koje utiču na morfološke i funkcionalne karakteristike. Smanjenje masnog tkiva donjih ekstremiteta i trupa može se pripisati odabiru kretnih aktivnosti i tehnici sportskog hodanja jer su zahtijevale aktivan rad mišića ruku, trupa i donjih ekstremiteta. Budući da se utvrdilo da su odabrane kretne aktivnosti djelovale pozitivno na aktivaciju mišića i smanjenje masnog tkiva trupa i donjih ekstremiteta bilo je za očekivati da će se poboljšati i pokretljivost i da će se pokazati značajna razlika kod ispitanica eksperimentalne grupe u odnosu na ispitanice kontrolne grupe u testovima mobilnosti i stabilnosti u kojima su aktivniji mišići donjih ekstremiteta i mišići trbuha.

Đug & Mikić (2007) su primjenom fitnes programa step aerobika i kod antropometrijskih i motoričkih karakteristika studentica postigli značajne parcijalne promjene, a Pavić & Žuvela (2004) su utvrdili da je aerobik vježbanjem došlo do smanjenja potkožnog masnog tkiva, što potvrđuje da odabir aktivnosti usklađen sa ciljem i uzrastom i polom sa kojim se radi rezultira pozitivnim efektima.

Djetinjstvo i mladost su najvažnija formativna razdoblja, a neki se segmenti razvoja, npr. specifična motorička znanja mogu razviti samo sredstvima koja se koriste u sportu (Doupona & Petrović, 1997), tako da je važno da sportska aktivnost koja se odabere bude neopterećujuća, koja će ih ispunjavati zadovoljstvom i radošću (Martinčević, 2010), a koja će ih istodobno osloboditi stresa i prije svega stvoriti od malena naviku bavljenja sportom koja će se nastaviti tijekom odrastanja i prerasti u dio svakodnevnog života (Krželj, 2009).

Zaključak

Treba imati na umu da, iako se radi o omladinskom uzrastu, ne treba da se žuri sa odabirom i usmjeravanjem u određene sportsko-rekreativne aktivnosti, jer je nivo sposobnosti direktno povezan sa akumuliranom vježbom (Ericsson i Charness, 1994, Ericsson & Lehmann, 1996). Odabir grupnog fitnes programa, koji je dizajniran od strane stručnjaka, namijenjen početnicima i usmjeren na sveobuhvatan rad umjerenog intenziteta rezultirao je pozitivnim promjenama tjelesne kompozicije kod ispitanika oba pola adolescentskog uzrasta. Prema rezultatima, primjena sportskog hodanja kao kretne aktivnosti u programu grupnih fitness programa imao je pozitivne efekte na funkcionalne sposobnosti, kompoziciju tijela i na mobilnost i stabilnost i kod muške i kod ženske populacije adolescenata, tj. pokazao se kao dobra sportsko-rekreativna aktivnost u ovom uzrastu jer može motivisati za dalje bavljenje nekim grupnim ili individualnim fitnes programom te se može razmotriti mogućnost njegove šire primjene. Sve to ukazuje na potrebu provođenja istraživanja sličnog karaktera kako bi se omogućilo adolescentima oba pola da se bave sportsko-rekreativnim aktivnostima koje ne zahtijevaju prevelike napore a koji imaju pozitivan učinak na njihov zdravstveni status.

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Bio-medical aspects of physical activity application

Biomedicinski aspekti primene
fizičke aktivnosti

FOOT DEFORMITIES IN BALLET SCHOOL STUDENTS AND PROFESSIONAL BALLET PLAYERS

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Introduction

The ballet is a superb form of artistic dance that involves the rhythmic movement of the body performed to music in a limited space in order to express an idea or emotion and energy release filled with enjoyment in every movement. It is an artistic form of dance that features the perfect balance of dancers, elegance, rhythm and speed of movement. It is not known exactly when the art dance began to be called ballet. In the first ballet school (Paris Academy founded by Louis XIV, 1662), rules were established in order to avoid dance errors, keep its elegance and design the ballet technique according to certain rules. The movements were given names (terms) that are still used today in classical ballet: slipping - glissade, bending - plié, lifting - relevé, jumping - sauté etc. Turns (pirouettes, etc.), elevations, jumps, pas de deux are characteristic especially for the classical ballet. A classic ballet reached its climax in the nineteenth century by introducing the ballet technique known as "dancing on the tiptoes (dance en pointe)" (Jocić, 1999).

In order to perform precise and highly formalized steps and positions within ballet choreography, a long-term, hardworking exercise is required. The greatest possible balance of movement and music within ballet choreography is the ultimate goal for ballet dancers. It demands years of strenuous work, at least eight to ten years on a daily basis and because of that ballet dancers begin their dance education most often when they are 7 to 10 years old. At the age of 12 they become students of the ballet school in order to become professional ballet dancers.

Ballet dancers, either in the primary or secondary ballet school or in the theatre, must practice at least 5-6 hours a day. They perform steps, jumps and ballet figures which often demand remarkably large range of body and joint motion. Workouts performed on scene and on ballet barre in the pointe ballet shoes are necessary for achieving the whole body movement synchronization. The ballet dancers bodies are exposed to the heavy load that is most emphasised in the area of the lower limbs, especially on the feet.

Keeping the feet in the no physiological position for a long period of time often brings injuries and facilitate occurrence of numerous changes in the morphology and function of the joints which can lead to the lower limb deformities development especially whole foot deformities evolving (Butković, 2005) (Figure 1). The earlier the ballet dancer start to dance, the greater is the risk for development of foot deformities since the locomotor apparatus in childhood, puberty and during adolescence period is particularly sensitive to prolonged effect of pressure forces and stretching (Zimmermann and Nikolić, 1970).

The ballet dancers' foot status was rarely the subject of research. Zimmermann and Nikolić (1970) conducted a research in Zagreb on 50 professional ballet dancers of both sexes, which have danced more than ten years at the moment they have been examined, and on that occasion they found the most expressive changes on tarsus bones, especially on the talus. They established that the ballet dancers had more often lower transverse and longitudinal foot arch and foot arthrosis compared to subjects in the control group. During the last few years, authors mostly researched ballet injuries, and when it comes to deformities, they mainly dealt with hallux valgus deformity in ballet dancers (Einarsdóttir, Troell & Wykman, 1995; Kennedy & Collumbier, 2008; Davenport, Simmel & Kadel, 2014; Steinberg, Siev-Ner, Zeev & Dar, 2015). None of these studies confirmed with certainty the connection of the hallux valgus development with dancing alone, but

other risk factors for this deformity evolving were also taken into account: genetic heritage, gender, foot architecture, Achilles tendon status.



Figure 1. Ballet foot

Until the present time there have not been any scientific studies in our country and abroad which would describe the ballet dancer's foot status. Because of it the aim of this research was to determine the foot status and the presence of foot deformities in ballet school students and professional ballet dancers.

Method

In this survey, which was carried out over a period of one month, 31 ballet dancers of both sexes participated: 20 students from the Secondary Ballet School "Lujko Davičo" aged 15 to 18 years and 11 professional ballet dancers from the National Theatre in Belgrade.

The status of the foot of the examinees was established by the plantography method. The presence of foot deformity was determined by the analysis of the obtained plantographies using the Majer method. In Majer method line is drawn along the foot from the middle of the heel to the medial edge of the fourth foot finger - Majer line. If the width of the footprint of the middle narrow part of the foot crosses this line, the subject has a fallen foot arch. Because of its simplicity and the possibility of detecting the presence of deformities in early stage, this method is most often used for the routine determination of the presence of lowered feet arches (Trošt, Ciliga and Petrinović, 2005).

The presence of the foot deformities was diagnosed by the analysis of the obtained plantographies using Majer method, by observation method and on the basis of the data obtained through the questionnaire designed for the purpose of this research.

The questionnaire contained questions related to sexes, age, for how long participants dance and how long do they exercise per one week. In addition, the respondents answered to the questions related to the previous injuries connected to dance, they also described the way how the injury happen and how long they were missing does from the scene or from the ballet school because of it.

Results and Discussion

The results obtained during this study are presented in the table 1 below.

Table 1 show the data obtained in the survey via questionnaire.

Table 1. The data obtained through the survey

	Secondary Ballet School	National Theater
Total number of participants	20	11
Women	19	6
Men	1	5
Median age of participants	18	24
Average duration of exercise per week	20 - 25	20 - 25
Injuries	right ankle injuries 2x	- right ankle injury 1x - first metatarsal bone injury, left foot 1x - second metatarsal bone injury, left foot 1x - surgical treatment of the first and second metatarsal bone injury, left foot 1x

The research involved 20 ballerinas and 11 male ballet dancers (students and professional ballet dancers) aged 16 to 41 years. The average duration of exercise per week for both groups of subjects was almost the same, 20-25 hours per week. Two students stated they had a right hinge injury. Professional ballet dancers were more injured: one ballerina had a right ankle injury; one of male ballet dancers had a first metatarsal bone injury on a left foot, one female ballet dancer had the injury of the second metatarsal bone on left foot as well. One male ballet dancer reported that he had a surgical treatment of the first and second metatarsal bone injury on the left foot.

Foot status examination results which included plantography of all study participants analysed using the Meyer method and data gotten using observation (inspection) method are presented in Table 2.

Table 2. Foot status examination results

	Normal foot	High arched feet (pes cavus)	Bunion (hallux valgus)	Flat feet (pes planus) first grade	Foot sole facing outwards (pes varus)
Total number of participants (n=31)	17	8	3	2	1
Total number percentage (%)	54.83	25.80	9.67	6.45	3.22

The results of foot status examination (plantographies analysis and data gotten using observation method) showed the presence and frequency of foot deformity in almost half of all subjects. In comparison to the whole sample of 31 subjects, 17 examinees (54.83%) has a healthy, normal foot, 8 study participants (25.80%) has high arched feet (pes cavus), 3 participants (9.67%) has bunions (hallux valgus), 2 of them (6.45%) has flat feet (pes planus), 1st grade - one ballet dancer has 12.5% and other has 16% of medial longitudinal arch lowering. One ballet dancer (3.22%) has foot sole facing outwards (pes varus). The results of the plantography of Secondary Ballet School students are shown in Table 3.

Table 3. Plantography results of the Secondary Ballet School students

	Normal foot	High arched feet (pes cavus)	Bunion (hallux valgus)	Flat feet (pes planus) first grade	Foot sole facing outwards (pes varus)
Total number of participants (n=20)	14	3	1	1	1
Total number percentage (%)	70	15	5	5	5

Obtained plantographies showed that 14 students (70%) have a normal, healthy foot, and only 6 students (30%) have some foot deformities. Three examinees have high arched feet (pes cavus), one female

student has bunion (hallux valgus), one male ballet dancer has flat feet, and one female student has a foot sole facing outwards. These results can be explained by the fact that their feet due to the short ballet career has not yet started to develop deformities (pointed ballet shoe “form”).

Table 4. Plantography results of professional ballet dancers

	Normal foot	High arched feet (pes cavus)	Bunion (hallux valgus)	Flat feet (pes planus) first grade	Foot sole facing outwards (pes varus)
Total number of participants (n=11)	3	5	2	1	-
Total number percentage (%)	27.27	45.45	18.18	9.09	-

Results of the professional ballet dancers plantography analysis are presented in Table 4. Data were significantly different comparing to those obtained from Secondary Ballet School students. Only 3 professional ballet dancers (2 women, 1 male (27.27%)) has a normal, healthy foot, 5 participants (4 women, 1 male) has high arched feet (45,45%), two of them has bunions (2 men (18,18%)) and 1male ballet dancer has flat foot (9.09%).

Plantographies of professional ballet players are presented in Figure 2. The obtained findings are most likely a consequence of everyday long-term hardworking exercise over the years. It brings heavy load on the lower extremities, especially the feet, but the influence of sex and hereditary factors should be also taken into account.



Figure 2. Plantographies of professional ballet dancers

Conclusion

In this study we obtained and analyzed foot status, presence and frequency of foot deformities in students of the Secondary Ballet School "Lujo Davičo" (20 participants) and in professional ballet players (11 participants) using the various methods – plantography method, questionnaire surveys and foot observation (inspection) method.

Examined ballet dancers were of both sexes and 16 to 41 years old. Results of this study showed that more than half of the examined ballet dancers (54.83%) had a normal, healthy foot. The most common

foot deformity was high arched feet (pes cavus) (25,80%). Small number of subjects had a flat feet (pes planus) (6,45%), bunion (hallux valgus) (9,67%) and foot sole facing outwards (pes varus) (3.22%).

Students group who participated in this research was remarkably bigger than one with professional ballet dancers. Our data showed that the presence of foot deformities is significantly lower in students (30% of the participants have some foot deformity) compared to professional ballet dancers (72,72% of professional ballet dancers have some foot deformity). Since students have shorter ballet career compared to professional ballet dancers, it can be concluded that long-term practice is one of the possible factors which facilitate development of foot deformities.

In this research interesting data were obtained - all respondents who stated in the survey that they had foot and ankle injuries had a normal, healthy feet, without the presence of deformities.

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PRISUSTVO DEFORMITETA STOPALA KOD UČENIKA SREDNJE BALETSKE ŠKOLE I PROFESIONALNIH BALETSKIH IGRAČA

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Uvod

Balet predstavlja vrhunski oblik umetničkog plesa koji uključuje ritmičko pokretanje tela u skladu sa muzikom i u ograničenom prostoru, sa ciljem da se izrazi ideja ili emocija, oslobodi energija, ili jednostavno uživa u svakom pokretu. To je muzičko – scenski oblik igre koji karakteriše besprekorna ravnoteža plesača, elegancija, ritam i brzina pokreta. Ne zna se tačno kada se umetnički ples počeo nazivati baletom. U prvoj baletskoj školi (Akademiji u Parizu koju je osnovao Luj XIV, 1662.) utvrđena su pravila da bi se ples sačuvao od grešaka i da bi se usavršila tehnika u određenom pravcu i po određenim pravilima. Pokreti su dobili nazive (termine) kojima se i danas služi klasičan balet: isklizavanje - glissade, savijanje – plié, dizanje – relevé, skakanje – sauté itd. Posebno se u klasičnom baletu vežbaju okreti, skokovi, određene podrške u plesanju parova. Klasičan balet dostiže svoj vrhunac u XIX veku uvođenjem tehnike plesanja na „vrhovima nožnih prstiju“ (Jocić,1999).

Da bi se izveli stilizovani pokreti i stavovi i postigao najveći mogući sklad pokreta i muzike u okviru baletskih koreografija neophodno je višegodišnje višečasovno vežbanje. Baletski igrači počinju da igraju najčešće u uzrastu od 7 do 10 godina, a sa 12 godina postaju učenici baletske škole za profesionalne baletske igrače. Kako bi jedan igrač mogao da usavrši svoju igru on mora svakodnevno da vežba barem 8 do 10 godina.

Baletski igrači, bilo u nižoj ili srednjoj baletskoj školi, bilo u pozorištu, moraju da vežbaju minimum 5-6 sati dnevno. Za vreme vežbi dominiraju pokreti tela i zglobova izvanredno velikog raspona, zatim skokovi i baletske figure. Vežbe u parteru, na štapu, u špic patikama, pomažu u postizanju sinhronizacije pokreta celog tela. Telo baletskog igrača je tom prilikom izloženo velikom opterećenju koje se najviše ispoljava u predelu donjih ekstremiteta, naročito stopala.

Dugotrajno zadržavanje stopala u ne fiziološkom položaju često dovodi do nastanka povreda, brojnih promena u morfologiji i funkciji nožnih zglobova i razvoja deformiteta stopala u celini (Butković, 2005) (Slika 1). Što je igrač ranije počeo da igra, veći je i rizik da te promene u području stopala budu izraženije i veće, jer je lokomotorni aparat u periodu detinjstva, puberteta i adolescentnog perioda posebno osetljiv na produženo dejstvo sila pritiska i istezanja (Zimmermann i Nikolić, 1970).

Status stopala baletskih igrača je retko bio predmet istraživanja. Zimmermann i Nikolić (1970) su sproveli jedno istraživanje u Zagrebu na 50 baletskih igrača oba pola, sa baletskim stažom dužim od deset godina, i tom prilikom su utvrdili da su najizraženije promene bile na kostima nožja, naročito talusu i da su baletski igrači češće imali spušten poprečni i uzdužni svod stopala i artroze u odnosu na ispitanike u kontrolnoj grupi. Poslednjih godina autori se uglavnom bave povredama, a kada su u pitanju deformiteti, uglavnom se bave deformitetom prstiju, naročito halluxvalgus-om kod baletskih igrača (Einarsdóttir, Troell&Wykman, 1995; Kennedy&Collumbier, 2008; Davenport, Simmel&Kadel, 2014; Steinberg, Siev-Ner, Zeev& Dar, 2015). Nijedno od tih istraživanja nije sa sigurnošću potvrdilo povezanost nastanka halluxvalgus-a isključivo sa plesom već su u obzir uzeti i drugi faktori rizika za nastanak ovog deformiteta: genetsko nasleđe, pol, arhitektura stopala, status Ahilove tetive.



Slika 1. Baletsko stopalo

S obzirom da do sada u našoj zemlji nije bilo naučnih istraživanja koja bi pokazala status stopala baletskih igrača, sprovedeno je istraživanje koje je imalo za cilj utvrđivanje statusa stopala i prisustva deformiteta stopala kod učenika srednje baletske škole i profesionalnih baletskih igrača.

Metode

U ovom istraživanju koje je obavljeno u periodu od mesec dana, učestvovao je 31 ispitanik oba pola: 20 ispitanika iz srednje baletske škole „Lujo Davičo“ uzrasta od 15 do 18 godina i 11 ispitanika iz Narodnog pozorišta u Beogradu.

Status stopala ispitanika je ustanovljen metodom plantograma. Prisustvo deformiteta stopala je utvrđeno analizom dobijenih plantograma Majerovom metodom. Majerova metoda podrazumeva da se duž stopala povuče crta – Majerova linija (od sredine otiska pete prema medijalnoj ivici četvrtog prsta). Ako širina otiska srednjeg uskog dela stopala prelazi medijalno ovu liniju, ispitanik ima spušten svod stopala. Zbog njene jednostavnosti i mogućnosti otkrivanja prisustva deformiteta već u ranoj fazi, ova metoda se najviše koristi za rutinsko utvrđivanje prisustva spuštenih svodova stopala (Trošt, Ciliga i Petrinović, 2005).

Prisustvo deformiteta stopala je utvrđeno i korišćenjem metode posmatranja (inspekcije) stopala kao i na osnovu upitnika osmišljenog za potrebe ovog istraživanja. Upitnik je sadržao pitanja koja se odnose na pol ispitanika, godine starosti, dužinu baletskog staža i na dužinu vežbanja tokom jedne nedelje. Osim toga, ispitanici su u upitnik unosili podatke o prethodnim povredama, opisivali način njihovog nastanka i navodili koliko dugo su zbog toga odsustvovali sa scene ili iz baletske škole.

Rezultati i diskusija

Rezultati dobijeni tokom ovog istraživanja su prikazani putem tabela. U Tabeli 1 su prikazani podaci dobijeni putem ankete.

Tabela 1. Prikaz podataka dobijenih putem ankete

	Srednja baletska škola	Narodno pozorište
Ukupan broj	20	11
Žene	19	6
Muškarci	1	5
Prosečna starost	18	24
Okvirna satnica vežbanja	20 - 25	20 - 25
Povrede	desni skočni zglob 2x	-desni skočni zglob 1x -prva metatarzalna kost, levo stopalo 1x -druga metatarzalna kost, levo stopalo 1x -operacija I i II metatarzalne kosti levog stopala

U istraživanju je učestvovalo 20 balerina i 11 baletana (učenici i profesionalni igrači), starosti od 16 do 41 godine. Okvirna satnica vežbanja obe grupe ispitanika je bila gotovo ista, 20-25 sati vežbanja nedeljno. Dve učenice srednje baletske škole su navele da su imale povrede desnog skočnog zgloba. Povrede kod profesionalnih baletskih igrača u pozorištu su bile brojnije: jedna balerina je navela povredu desnog skočnog zgloba; povredu prve metatarzalne kosti levog stopala je naveo jedan baletski igrač, a povredu druge metatarzalne kosti isto levog stopala jedna balerina; jedan baletski igrač je naveo povredu I i II metatarzalne kosti levog stopala koja je sanirana operativnim putem.

Nakon uzimanja otiska stopala od svih ispitanika i njihovom analizom pomoću Majerove metode i metode posmatranja (inspekcije) stopala dobijeni su rezultati koji su prikazani u Tabeli 2.

Tabela 2. Prikaz rezultata analize plantograma svih ispitanika

	Normalno stopalo	Izdubljeno stopalo (pesexcavatus ; pescavus)	Čukalj (halluxvalgus)	Ravno stopalo (pes plana) I stepen	Taban stopala okrenut spolja (varus)
Broj ispitanika (n=31)	17	8	3	2	1
% ukupnog broja	54,83	25,80	9,67	6,45	3,22

Rezultati ispitivanja statusa stopala u Tabeli 2 prikazuju prisustvo i učestalost pojave deformiteta stopala kod svih ispitanika. U odnosu na ceo uzorak od 31 ispitanika, 17 ispitanika (54,83%) ima zdravo, normalno stopalo, 8 ispitanika (25,80%) ima izdubljeno stopalo (pesexcavatus; pescavus), 3 ispitanika (9,67%) ima čukalj (halluxvalgus), 2 ispitanika (6,45%) imaju ravno stopalo (pes plana) - jedan ispitanik ima 16% spuštenosti i spada u I stepen spuštenosti stopala, dok drugi ispitanik ima 12,5% i spada takođe u I stepen spuštenosti stopala. Jednom ispitaniku (3,22%) je taban stopala okrenut prema spolja (varus). Rezultati plantograma učenika srednje baletske škole su prikazani u Tabeli 3.

Tabela 3. Rezultati plantograma učenika Srednje baletske škole

	Normalno stopalo	Izdubljeno stopalo (pesexcavatus ; pescavus)	Čukalj (halluxvalgus)	Ravno stopalo (pes plana) I stepen	Taban stopala okrenut spolja (varus)
Broj ispitanika (n=20)	14	3	1	1	1
% ukupnog broja	70	15	5	5	5

Na osnovu dobijenih plantograma utvrđeno je da 14 učenika (70%) ima normalno, zdravo stopalo, a samo 6 učenika (30%) ima neki deformitet stopala. Izdubljeno stopalo imaju 3 ispitanice, jedna ispitanica ima čukalj, jedan ispitanik (baletski igrač) ravno stopalo, a jedna ispitanica ima taban stopala okrenut prema spolja. Dobijeni rezultati se mogu objasniti time da, njihovo stopalo zbog kratkog baletskog staža još uvek nije počelo da se „formira“ prema baletskoj patici.

Tabela 4. Rezultati plantograma kod profesionalnih baletskih igrača

	Normalno stopalo	Izdubljeno stopalo (pesexcavatus ; pescavus)	Čukalj (halluxvalgus)	Ravno stopalo (pes plana) I stepen	Taban stopala okrenut spolja (varus)
Broj ispitanika (n=11)	3	5	2	1	-
% ukupnog broja	27,27	45,45	18,18	9,09	-

U Tabeli 4 su prikazani rezultati analize plantograma profesionalnih baletskih igrača i oni su bili znatno drugačiji u odnosu na one dobijene kod učenika srednje baletske škole: samo 3 ispitanika (2 žene, 1

muškarac (27,27%)) ima normalno, zdravo stopalo, 5 ispitanika (4 žene, 1 muškarac) ima izdubljeno stopalo (45,45%), 2 ispitanika čukalj (dva muškarca (18,18%)), a jedan ispitanik ravno stopalo (muškarac (9.09%)).

Na Slici 2 su prikazani neki od plantograma profesionalnih baletskih igrača. Dobijeni nalaz je najverovatnije posledica svakodnevnog, višesatnog, dugogodišnjeg vežbanja i opterećenja donjih ekstremiteta, naročito stopala, ali ne treba isključiti ni uticaj pola i naslednih faktora.



Slika 2. Plantogrami profesionalnih baletskih igrača

Zaključak

U ovom radu predstavljeno je istraživanje u kojem je korišćenjem različitih metoda - plantograma, ankete i metode posmatranja (inspekcije) stopala razmatran status i deformiteti stopala kod učenika srednje baletske škole "Lujó Davičo" (20 ispitanika) i profesionalnih baletskih igrača (11 ispitanika).

Kod obe grupe ispitanika su bila zastupljena oba pola, starosti od 16 do 41 godine, a rezultati su pokazali da više od polovine ispitanika (54,83%) ima normalno, zdravo stopalo. Najzastupljeniji deformitet je bio izdubljeno stopalo (pesexcavatus; pescavus) (25,80%), dok je mali broj ispitanika imao ravno stopalo (pes plana) (6,45%), čukalj palca (halluxvalgus) (9,67%) i iskrivljenje stopala upolje - lateralno (pesvarus)(3,22%).

Uzorak ispitanika učenika je bio znatno veći u odnosu na uzorak profesionalnih baletskih igrača, ali i pored toga može se zaključiti da je zastupljenost deformiteta značajno manja kod učenika (kod 30% ispitanika je uočen neki od deformiteta) u odnosu na profesionalne baletske igrače (72,72% ispitanika ima neki od deformiteta stopala). S obzirom da učenici imaju kraći igrački staž u odnosu na profesionalne igrače, može se zaključiti da je dugogodišnje vežbanje jedan od mogućih faktora koji utiču na nastanak deformiteta.

Tokom ovog istraživanja je dobijen zanimljiv podatak - kod svih ispitanika koji su u anketi naveli da su imali neku od povreda skočnih zglobova i stopala analizom plantograma je utvrđeno da imaju normalno, zdravo stopalo, bez prisustva deformiteta.

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THE POSTURAL STATUS OF FEMALE FOOTBALL PLAYERS IN RELATION TO LEVELS OF COMPETITION

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Introduction

Poor posture does not include only a single disorder, a specific deformity, instead it subsumes numerous disorders whose shared feature is that they disappear through active tightening of the musculature. Poor posture is characterized by the weakness of the entire body, especially the joint-muscle apparatus. In these conditions, the most prevalent is the functional weakness of the spinal column, which is conditioned by a weakness in the other parts of the locomotor apparatus (Živković, 2000, 2009). The most frequent deviations from proper posture can be noted on the spinal column and feet, and somewhat less frequently in the region of the rib cage or the lower extremities (Milenković, 2007).

Football belongs to a group of poly-structural, cyclical and acyclical types of movement, and gross motor skills, with a high level of maximal O₂ uptake (Leger & Lambert, 1982; Castagna et al., 2006). Football practice has a significant impact on the development and improvement of motor skills such as increased strength of the leg muscles, increased speed, mobility, coordination, as well as general and specific endurance. Running, kicking a ball, jumping and other technical elements involve the muscles of the entire body, and affect posture (Bogdanović, Ilić & Vidaković, 2015). The influence of football training on posture and the feet has been analyzed in several studies (Asadi, Nourasteh & Daneshmandi, 2014; Grabara, 2012; Jorgić, Živković, Milenković & Živković, 2017; Marenčakova et al., 2018; Negrini et al., 2009; Wodecki et al., 2002). Negrini et al. (2009) determined a statistically significant greater prevalence of postural kyphosis among football players aged 11 to 16, compared to their non-athlete peers. Unlike the previous study, Grabara (2012) on a study carried out on football players and non-athletes aged 11 to 14 did not determine any differences in the index of body symmetry, that is, determined no differences in terms of postural disorders. Asadi, Nourasteh & Daneshmandi (2014) determined, among former football players with a minimum of 15 years of football training, a greater prevalence of deformities such as lordosis and forward head posture. Jorgić, Živković, Milenković & Živković (2017) determined a statistically significant lesser prevalence of flat feet among football players aged 10 to 12, compared to non-athletes of the same age. The duration of the active sports training of football players, the rank of competition, the frequency and intensity of the training, all represent factors which can have a positive or negative impact on the overall body of the football players, and thus body posture and postural disorders. In accordance with the aforementioned, the aim of this paper was to determine whether the level of competition and duration of active sports training affect the differences in the prevalence of postural disorders among female soccer players.

Method

Sample of participants

This paper presents the results of a transversal study, in which the sample of participants was divided by a method of targeted random sampling into two groups. The first group consisted of 16 female football players, members of the "Mašinac" women's football club, competing in the Serbian SuperLiga. The second group consisted of 17 female soccer players playing for the Serbian First League, members of the "Radnički 2012" women's football club. The average duration of the active football training of the members of the first

group was 10.38±2.85 years. The youngest female football players in this group was 15, and the oldest 26. The frequency of their training sessions was 6 times a week. For the second group of football players, the duration of their average active football training was 4,59±2,35 years. The youngest football player in this group was 14, the oldest 25. The frequency of their training sessions was 3 times a week.

The sample of measuring instruments

The variables used to evaluate the postural disorders in the sagittal plane included:

- no postural disorders (BPP);
- postural kyphosis (KIFO);
- lordosis (LORD);
- kypho-lordosis (KILO).

The “SpinalMouse” model IDIAG M360pro, whose metric characteristics have been validated (Mannion, Knecht, Balaban, Dvorak, & Grob, 2004; Post & Leferink, 2004) was used to measure the postural disorders of the spinal column. This device has already been used in studies which included younger categories of football players, as well as professional athletes (Muyor, López-Miñarro & Alacid, 2011; Hussein & El-Agamy, 2016; Jorgić et al., 2017).

The variables used to evaluate of the status of the feet included:

1. normal foot (NS)
2. flat foot, first degree (I)
3. flat foot, second degree (II)
4. flat foot, third degree (III).

To determine the possible presence of flat feet, the plantography method was used, and the results were obtained from the plantogram method of Russian authors (Živković, 2009).

The research was carried out in the diagnostics center of the Faculty of Sport and Physical Education in Niš.

Data processing

The results of the measurements will be represented as numerical values and as percentage frequency. To determine the statistically significant differences in the prevalence of postural disorders between the two groups of participants, we used the Chi-square test of independence. To determine the differences in the prevalence of postural disorders within each individual group of participants the Chi-square goodness of fit test was used, at the sig. ≤ 0,05 level of significance. The data were processed in the statistical program of the IBM Corp. Released 2010. IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp.

Results

Table 1. The prevalence of postural disorders of the spinal column among lower ranked female football players

Variables	No. of participants	%
KIFO	2	11.76
LORD	3	17.65
KILO	1	5.88
BPP	11	64.71
Total	17	100

Legend: BPP-no postural disorder; KIFO-postural kyphosis; LORD-lordosis; KILO-kypho-lordosis.

Table 2. The results of the Chi-square test for the prevalence of postural disorders of the spinal column among lower ranked female football players

	Observed N	Expected N	Residual		
With a deformity	6	8.5	-2.5	Chi-Square	1.471
Without a deformity	11	8.5	2.5	df	1
Total	17			Asymp. Sig.	0.225

The results shown in table 2 indicate that there is no statistically significant difference in the frequency of lower ranked female football players with and without postural disorders. The level of statistical significance was set at 0.05 (Asymp. Sig.=0.225).

Table 3. The prevalence of postural disorders of the spinal column among higher ranked female football players

Variables	No. of participants	%
KIFO	7	43.75
LORD	1	6.25
KILO	4	2.,00
BPP	4	23.53
Total	16	100

Legend: BPP-no postural disorder; KIFO-postural kyphosis; LORD-lordosis; KILO-kypho-lordosis.

The results shown in table 3 indicate that most of the higher ranked female football players have postural disorders of the spinal column, where the most prevalent postural disorder is kyphosis with 43.75%.

Table 4. The results of the Chi-square test of the prevalence of postural disorders of the spinal column among higher ranked female football players

	Observed N	Expected N	Residual	Chi-Square	
With a deformity	12	8.0	4.0		4.000
Without a deformity	4	8.0	-4.0	df	1
Total	16			Asymp. Sig.	0.046

The results shown in table 4 indicate that there is a statistically significant greater frequency of higher ranked female football players with postural disorders of the spinal column (Asymp. Sig.= 0.046).

Table 5. The results of the Chi-square test of independence for the prevalence of postural disorders of the spinal column

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.241	1	0.022

The results of the Chi-square test of independence shown in table 5 indicate that the proportion of the higher ranked female football players with postural disorders of the spinal column is significantly greater than that of the lower ranked female football players.

Table 6. The prevalence of flat feet among lower ranked female football players

Variables	No. of participants	%
NS	6	35.29
I	6	35.9
II	3	17.65
III	2	11.76
Total	17	100

Legend: NS-normal foot; I-flat foot, first degree; II-flat foot, second degree; III-flat foot, third degree

The results in table 6 indicate that many of the lower ranked female football players have fallen arches, 35.29% of whom are classified as having flat foot, first degree, 17.65% as flat foot, second degree, and 11.76% as flat foot, third degree.

Table 7. The results of the Chi-square test for the prevalence of flat feet among lower ranked female football players

	Observed N	Expected N	Residual	Chi-Square	1.471
Without a deformity	6	8.5	-2.5	df	1
With a deformity	11	8.5	2.5	Asymp. Sig.	0.225
Total	17				

The results shown in table 7 indicate that among the lower ranked female football players there is an equal prevalence of flat feet and feet with normal arches, that is, there is no statistically significant difference in frequency.

Table 8. The prevalence of flat feet among higher ranked female football players

Variables	No. of participants	%
NS	12	75.00
I	2	12.50
II	2	12.50
III	0	0.00
Total	16	100

Legend: NS-normal foot; I-flat foot, first degree; II-flat foot, second degree; III-flat foot, third degree

The results shown in table 8 indicate that of the higher ranked female football players 75% had normal arches. Flat foot, first and second degree, was found in 12.5% of the population each, while none of the female football players showed signs of flat foot, third degree.

Table 9. The results of the Chi-square test for the prevalence of flat feet among higher ranked female football players

	Observed N	Expected N	Residual	Chi-Square	4.000
Without a deformity	12	8.0	4.0	df	1
With a deformity	4	8.0	-4.0	Asymp. Sig.	0.046
Total	16				

The results shown in table 9 indicate that among higher ranked female football players there is a statistically significant higher number of players without flat feet (Asymp. Sig.= 0.046).

Table 10. The results of the Chi-square tests of independence for the prevalence of flat feet

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.241	1	0.022

The results of the Chi-square test of independence shown in table 10 indicate that the proportions of the lower ranked female football players with flat feet is statistically significantly greater compared to that of the higher ranked female football players.

Discussion

Based on the obtained results which indicate the postural status and varying degrees of collapse of arches, it was determined that physical deformities can be found both among higher ranked and lower ranked female football players. In the case of the postural disorder of flat feet, the results indicate that as many as 64.71% of the female football players competing in lower ranked competitions shows signs of at least some degree of flat foot, while among the female football players competing in higher ranked

competitions, this percentage is 25%. This difference obtained in the prevalence of flat feet between the higher and lower ranked female football players was statistically significant. In addition, it is important to point out that among the higher ranked female football players who compete in higher ranks of competition, only flat foot, first and second degree, occurs, while in the case of female football players competing in lower ranks of competition, flat foot, third degree, was also recorded. The lower prevalence of fallen arches among female football players competing in higher ranks of competition can be explained by the longer period of time during which they intensely practice football, greater frequency of weekly training sessions, and a greater overall training volume which is a characteristic of higher ranks of competition, as opposed to lower ones. This further indicates that constant changes in the type of surface for training, the performance of various kicks, jumps, low and high skips, as well as the movement itself which involves sudden changes in direction, lead to the development of the muscles of the lower extremities, that is, the gluteal muscles, the lower leg extensors, the flexors and extensors of the foot, all of which has a positive effect on the prevention and correction of flat feet. This indicates that the exercises which are being used during football practice as part various forms of movement with and without a ball can also be used as exercises for correcting flat feet. What supports these results are the results of other studies (Grković, 2016; Jorgić et al., 2017) which have indicated that the degree of prevalence of flat feet is much higher among boys who do not take part in football.

In the case of postural disorders of the spinal column, greater prevalence can be found among female football players who compete in higher ranks of competition. Among them, the prevalence of the disorders is 76.47%, among which the most frequent one is postural kyphosis with 43.75%. Among the lower ranked female football players, lordosis was the most prevalent with 17.65%, and postural kyphosis with 11.76%. These data indicate that longer period of football training and more intense training sessions contribute to the onset of kyphosis, which is in agreement with the results of other studies (Negrini et al., 2009) where based on the current postural status of adolescents who practice football 2 to 3 times a week, a tendency for postural kyphosis was determined. This occurrence can be explained by the position of the player's head for extended periods of time during a football match. The head is lowered toward the ground to follow the movement of the ball, which in turn extends the neck and creates curvatures at the level of the vertebrae of the thoracic spine. A greater prevalence of spinal column deformities among female football players competing in higher ranked competitions was also determined in the results of other studies (Asadi et al., 2014) where a greater prevalence of the deformity described as forward head posture was noted for a group of football players when compared to non-athletes. Possible preventive measures could involve the inclusion of corrective exercises and exercises meant to strengthen the back muscles at the end of each training session, as well as the appropriate muscle stretches.

The data obtained in this study can lead us to conclude that the duration of active training in football and the rank of competition do influence the prevalence of postural disorders of the spinal column and flat feet only on the level of the studied sample. One of the reasons for this could be the lack of any other similar studies carried out with the same goal, which would enable data comparison. The second reason is the difference in frequency, volume and intensity of training among higher and lower ranked women's football clubs, which is characteristic of our country and need not be the same in other countries where women's football is more developed.

Conclusion

The research results have indicated that a significantly greater number of lower ranked female football players show signs of flat feet, while higher ranked female football players indicated a prevalence of postural kyphosis and lordosis. It could be said that long-term football training, greater frequency and

volume of training have positive effects in the sense of correcting flat feet among female football players. In the case of postural disorders of the spinal column, regular football practice could be additionally enhanced by the inclusion of exercises for the correction of postural disorders, that is, exercises that would strengthen the back muscles, as well as exercises that would increase flexibility.

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POSTURALNI STATUS FUDBALERKI U ODNOSU NA TAKMIČARSKI NIVO

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Uvod

Pod lošim držanjem tela se ne podrazumeva samo jedan poremećaj, jedna konkretna deformacija, već više poremećaja čija je zajednička osobina da aktivnim zatezanjem muskulature iščezavaju. Loše držanje se karakteriše slabošću celog organizma, naročito zglobno-mišićnog aparata. Kod ovakvih stanja najizraženija je funkcionalna slabost kičmenog stuba, što je uslovljeno slabošću i ostalih delova lokomotornog aparata (Živković, 2000; Živković, 2009). Najčešće odstupanje od pravilnog držanja tela može se registrovati na kičmenom stubu i stopalima, a nešto ređi slučaj je sa regijom grudnog koša ili donjim ekstremitetima (Milenković, 2007).

Fudbal se ubraja u polistrukturalna, ciklična i aciklična kretanja, gde su motoričke sposobnosti zastupljene kompleksno sa visokim nivoom maksimalne potrošnje O_2 (Castagna et al., 2006; Leger i Lambert, 1982;). Bavljenje fudbalom značajno utiče na razvoj i usavršavanje motoričkih sposobnosti, kao što je povećanje snage mišića nogu, povećanje brzine, pokretljivosti, koordinacije, kao i opšte i lokalne izdržljivosti. Trčanje, šutiranje lopte, skokovi i drugi tehnički elementi u fudbalu angažuju mišiće celog tela što ima uticaj na držanje tela i posturalni status (Bogdanović, Ilić i Vidaković, 2015). Uticaj bavljenja fudbalom na posturalni status kičmenog stuba i stopala istraživano je u nekoliko radova (Asadi, Nourasteh i Daneshmandi, 2014; Grabara, 2012; Jorgić, Živković, Milenković i Živković, 2017; Marencakova et al., 2018; Negrini et al., 2009; Wodecki et al., 2002). Negrini et al. (2009) su kod fudbalera starosti od 11 do 16 godina utvrdili statistički značajno veću prisutnost kifotičkog lošeg držanja tela u odnosu na njihove vršnjake nesportiste. Za razliku od prethodnog istraživanja, Grabara (2012) u istraživanju sprovedenom na fudbalerima i nesportistima starosti od 11 do 14 godina nije utvrdio razlike u indeksu posturalne simetrije, odnosno nije utvrdio razlike u posturalnim poremećajima. Asadi, Nourasteh i Daneshmandi (2014) su kod bivših fudbalera koji su imali minimum 15 godina fudbalskog staža, utvrdili veću zastupljenost deformiteta lordoze i glave povijene prema napred. Jorgić, Živković, Milenković i Živković (2017) su utvrdili statistički značajno manju zastupljenost ravnih stopala kod fudbalera starosti od 10 do 12 godina u odnosu na nesportiste istog uzrasta. Sportski staž fudbalera, rang takmičenja, učestalost i intenzitet treninga, predstavljaju faktore koji mogu imati pozitivan ili negativan uticaj na celokupni organizam fudbalera, pa samim tim i na držanje tela i na posturalne poremećaje. U skladu sa navedenim, **cilj** rada je utvrditi da li rang takmičenja i sportski staž utiču na razlike u zastupljenosti posturalnih poremećaja kod fudbalerki.

Metode

Uzorak ispitanika

U radu je primenjeno transversalno istraživanje, u kojem je uzorak ispitanika bio podeljen metodom ciljanog uzorka u dve grupe. Prvu grupu činilo je 16 fudbalerki ženskog fudbalskog kluba „Mašinac“, koje igraju Super ligu Srbije. Drugu grupu činilo je 17 fudbalerki ženskog fudbalskog kluba „Radnički 2012“ koje igraju Prvu ligu Srbije. Prosečan sportski staž fudbalerki prve grupe iznosio je $10,38 \pm 2,85$ godina. Najmlađa fudbalerka u ovoj grupi imala je 15, a najstarija 26 godina. Učestalost njihovih treninga je 6 puta nedeljno. Kod druge grupe fudbalerki prosečan sportski staž iznosio je $4,59 \pm 2,35$ godina. Najmlađa fudbalerka u ovoj grupi imala je 14, a najstarija 25 godina. Nedeljna učestalost treninga ove grupe iznosila je 3 puta nedeljno.

Uzorak varijabli

Varijable za procenu posturalnih poremećaja kičmenog stuba u sagitalnoj ravni su:

- bez posturalnog poremećaja (BPP);
- kifotičko loše držanje (KIFO);
- lordotičko loše držanje (LORD);
- kifolordoza (KILO).

Posturalni poremećaji kičmenog stuba mereni su uređajem „Spinal Mouse“, model IDIAG M360pro, koji ima potvrđene metrijske karakteristike (Mannion, Knecht, Balaban, Dvorak, & Grob, 2004; Post & Leferink, 2004). Ovaj uređaj je već korišćen u istraživanju kod fudbalera mlađih kategorija, kao i kod profesionalnih sportista (Muyor, López-Miñarro & Alacid, 2011; Hussein & El-Agamy, 2016; Jorgić et al., 2017).

Varijable za procenu statusa stopala su:

- normalno stopalo (NS)
- prvi stepen spuštenosti (I)
- drugi stepen spuštenosti (II)
- treći stepen spuštenosti (III)

Utvrđivanje stepena spuštenosti svoda stopala vršeno je metodom plantografije, a za čitanje dobijenih rezultata na plantogramu korišćena je metoda ruskih autora (Živković, 2009).

Istraživanje je sprovedeno u dijagnostičkom centru Fakulteta sporta i fizičkog vaspitanja u Nišu.

Statistička obrada podataka

Rezultati merenja predstavljeni su kao numeričke vrednosti i procentualno kao frekvencije rezultata. Za utvrđivanje statistički značajne razlike u zastupljenosti posturalnih poremećaja između dve grupe ispitanika koristio se Hi kvadrat test nezavisnosti, dok je razlika u zastupljenosti posturalnih poremećaja unutar svake pojedinačne grupe ispitanika utvrđivana korišćenjem Hi kvadrat testa kvaliteta podudaranja, na nivou značajnosti sig. $\leq 0,05$. Podaci su obrađeni u statističkom programu IBM Corp. Released 2010. IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp.

Rezultati

Rezultati u tabeli 1. ukazuju da najveći broj fudbalerki nižeg ranga takmičenja nema posturalne poremećaje na kičmenom stubu (64,71%). Pri čemu je od posturalnih poremećaja najzastupljenija lordoza sa 17,65%.

Tabela 1. Zastupljenost posturalnih poremećaja na kičmenom stubu kod fudbalerki nižeg ranga

Varijable	Broj ispitanika	%
KIFO	2	11,76
LORD	3	17,65
KILO	1	5,88
BPP	11	64,71
Ukupno	17	100

Legenda: BPP-bez posturalnog poremećaja; KIFO-kifotičko loše držanje; LORD-lordotičko loše držanje; KILO-kifolordoza.

Tabela 2. Rezultati Hi kvadrat testa zastupljenosti posturalnih poremećaja na kičmenom stubu kod fudbalerki nižeg ranga

	Observed N	Expected N	Residual		
Sa deformitetom	6	8,5	-2,5	Chi-Square	1,471
Bez deformiteta	11	8,5	2,5	df	1
Total	17			Asymp. Sig.	0,225

Rezultati u tabeli 2. ukazuju da ne postoji statistički značajna razlika u frekvenciji fudbalerki nižeg ranga sa i bez posturalnih poremećaja. Vrednost nivoa statističke značajnosti je preko 0,05 (Asymp. Sig.=0,225).

Tabela 3. Zastupljenost posturalnih poremećaja na kičmenom stubu kod fudbalerki višeg ranga

Varijable	Broj ispitanika	%
KIFO	7	43,75
LORD	1	6,25
KILO	4	2
BPP	4	23,53
Ukupno	16	100

Legenda: BPP-bez posturalnog poremećaja ; KIFO-kifotičko loše držanje; LORD-lordotičko loše držanje; KILO-kifolordoza.

Rezultati u tabeli 3. ukazuju da veliki broj fudbalerki višeg ranga takmičenja ima posturalne poremećaje na kičmenom stubu, pri čemu je od posturalnih poremećaja najzastupljenija kifoza sa 43,75%.

Tabela 4. Rezultati Hi kvadrat testa zastupljenosti posturalnih poremećaja na kičmenom stubu kod fudbalerki višeg ranga

	Observed N	Expected N	Residual		
Sa deformitetom	12	8,0	4,0	Chi-Square	4,000
Bez deformiteta	4	8,0	-4,0	df	1
Total	16			Asymp. Sig.	0,046

Rezultati u tabeli 4. ukazuju da postoji statistički značajno veća frekvencija fudbalerki višeg ranga koje imaju posturalne poremećaje na kičmenom stubu (Asymp. Sig.= 0,046).

Tabela 5. Rezultati Hi kvadrat testa nezavisnosti za zastupljenost posturalnih poremećaja na kičmenom stubu

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5,241	1	0,022

Rezultati Hi kvadrat testa nezavisnosti prikazanih u tabeli 5. ukazuju da je proporcija fudbalerki višeg ranga koje imaju posturalne poremećaje na kičmenom stubu statistički značajno veća u odnosu na fudbalerke nižeg ranga.

Tabela 6. Zastupljenost ravnih stopala kod fudbalerki nižeg ranga

Varijable	broj ispitanika	%
NS	6	35,29
I	6	35,9
II	3	17,65
III	2	11,76
Ukupno	17	100

Legenda: NS-normalno stopalo; I-prvi stepen spuštenosti; II-drugi stepe spuštenosti; III-treći stepen spuštenosti

Rezultati u tabeli 6. ukazuju da veliki broj fudbalerki nižeg ranga takmičenja imaju spuštene svod stopala, od toga 35,29% ima prvi stepen spuštenosti, drugi 17,65% a treći 11,76%.

Tabela 7. Rezultati Hi kvadrat testa zastupljenosti ravnih stopala kod fudbalerki nižeg ranga

	Observed N	Expected N	Residual		
Bez deformiteta	6	8,5	-2,5	Chi-Square	1,471
Sa deformitetom	11	8,5	2,5	df	1
Total	17			Asymp. Sig.	0,225

Rezultati u tabeli 7. ukazuju da kod fudbalerki nižeg ranga imamo podjednaku zastupljenost ravnih stopala i normalnih stopala, odnosno da ne postoji statistički značajna razlika u frekvenciji.

Tabela 8. Zastupljenost ravnih stopala kod fudbalerki višeg ranga

Varijable	broj ispitanika	%
NS	12	75
I	2	12,5
II	2	12,5
III	0	0,00
Ukupno	16	100

Legenda: NS-normalno stopalo; I-prvi stepen spuštenosti; II-drugi stepen spuštenosti; III-treći stepen spuštenosti

Rezultati u tabeli 8. ukazuju da kod fudbalerki višeg ranga takmičenja 75% njih ima normalni svod stopala. Prvi i drugi stepen spuštenosti svoda stopala je zastupljen sa po 12,5%, dok nijedna fudbalerka nema treći stepen spuštenosti.

Tabela 9. Rezultati Hi kvadrat testa zastupljenosti ravnih stopala kod fudbalerki višeg ranga

	Observed N	Expected N	Residual		
Bez deformiteta	12	8,0	4,0	Chi-Square	4,000
Sa deformitetom	4	8,0	-4,0	df	1
Total	16			Asymp. Sig.	0,046

Rezultati u tabeli 9. ukazuju da kod fudbalerki višeg ranga postoji statistički značajno veći broj fudbalerki bez ravnog stopala (Asymp. Sig.= 0,046).

Tabela 10. Rezultati Hi kvadrat testa nezavisnosti za zastupljenost ravnih stopala

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5,241	1	0,022

Rezultati Hi kvadrat testa nezavisnosti prikazanih u tabeli 10. ukazuju da je proporcija fudbalerki nižeg ranga takmičenja koje imaju ravna stopala statistički značajno veća u odnosu na fudbalerke višeg ranga.

Diskusija

Na osnovu dobijenih rezultata koji ukazuju na stanje posturalnih poremećaja na kičmenom stubu i stepena spuštenosti svoda stopala, utvrđeno je da su telesni deformiteti prisutni i kod fudbalerki višeg i kod fudbalerki nižeg ranga. Kada je u pitanju posturalni poremećaj ravnih stopala, rezultati ukazuju na to da čak 64,71% fudbalerki koje nastupaju u nižem rangu imaju neki stepen spuštenosti svoda stopala, dok je kod fudbalerki koje nastupaju u višem rangu ta zastupljenost 25%. Ovako dobijena razlika u zastupljenosti ravnih stopala između fudbalerki nižeg i višeg ranga bila je i statistički značajna. Takođe, potrebno je napomenuti da se kod fudbalerki koje igraju viši rang javljaju samo prvi i drugi stepen spuštenosti svoda stopala, dok se kod

fudbalerki koje igraju niži rang javlja i treći stepen spuštenosti svoda stopala. Manja zastupljenost spuštenog svoda stopala kod fudbalerki višeg ranga može se objasniti dužim sportskim stažom, to znači da su duže izložene trenažnom procesu, kao i većoj nedeljnoj učestalosti treninga pa samim tim i većem ukupnom trenažnom obimu u višem rangu takmičenja u odnosu na niži. To dalje ukazuje da stalne promene podloge, izvođenje različitih vrsta udaraca po lopti stopalom, skokovi, nizak i visok skip, kao i sama kretnja sa naglom promenom pravca dovode do razvoja mišića donjih ekstremiteta, odnosno glutealne muskulature, ekstenzora potkolenica, fleksora i ekstenzora stopala, čime se pozitivno utiče na prevenciju i korekciju spuštenosti svoda stopala. S tim u vezi može se reći da se vežbe koje se koriste na fudbalskim treninzima kroz različite oblike kretanja sa i bez lopte mogu koristiti i kao vežbe za korekciju spuštenih svodova stopala.

U prilog ovome su rezultati istraživanja (Grković, 2016; Jorgić et al., 2017) koja su pokazala da je stepen zastupljenosti spuštenog svoda stopala mnogo veći kod dečaka koji se ne bave fudbalom. Kada su u pitanju poremećaji posturalnog statusa kičmenog stuba statistički značajno veća zastupljenost se javlja kod fudbalerki koje nastupaju u višem rangu takmičenja. Kod njih stepen zastupljenosti nekog od poremećaja iznosi 76,47%, pri čemu je pojedinačno najzastupljenije kifotično loše držanje tela sa 43,75%. Kod fudbalerki nižeg ranga najzastupljenije je lordotično lože držanje tela sa 17,65%, dok je kifotično loše držanje tela zastupljeno sa 11,76%. Ovako dobijeni podaci ukazuju da duže bavljenje fudbalom, kao i veća učestalost i intenzivniji treninzi koji su karakteristični za viši rang takmičenja, doprinose pojavi kifoze, što se podudara sa istraživanjem (Negrini et al., 2009) gde je na osnovu trenutnog posturalnog statusa adolescenata koji se bave fudbalom 2 do 3 puta nedeljno ustanovljena tendencija ka nastajanju kifoze. Ova pojava može se objasniti položajem u kojem se glava nalazi veći deo vremena prilikom igranja fudbala. Glava je spuštena ka zemlji kako bi se pratila lopta što dovodi do izvijanja vrata i stvaranja krivine kod pršljenova u visini grudnog koša. U prilog ovome idu i rezultati istraživanja (Asadi et al., 2014) u kome je utvrđeno veća zastupljenost deformiteta koji se opisuje kao povijenost glave prema napred kod grupe fudbalera u odnosu na nesportiste. Prevencija ovako nečemu mogu biti korektivne vežbe i vežbe za jačanje mišića leđa na kraju svakog treninga kao i adekvatno istezanje mišića.

Dobijeni podaci u sprovedenom istraživanju omogućavaju zaključivanje o uticaju sportskog staža u fudbalu i ranga takmičenja na zastupljenost posturalnih poremećaja na kičmenom stubu i ravnim stopalima samo na nivou ispitivanog uzorka. Jedan od razloga tome je ne postojanje drugih sličnih istraživanja sa istim ciljem kako bi dobijeni podaci mogli da se međusobno uporede. Drugi razlog je razlika u učestalosti, obimu i intenzitetu treninga između klubova višeg i nižeg ranga u ženskom fudbalu koji je karakterističan za našu državu a ne mora biti isti i u drugim zemljama gde je ženski fudbal razvijeniji.

Zaključak

Rezultati istraživanja su pokazali da značajno veći broj fudbalerki nižeg ranga takmičenja i kraćeg sportskog staža ima zastupljen deformitet ravna stopala, dok fudbalerke višeg ranga imaju zastupljenije kifoze i lordoze. Može se reći da duže vremensko bavljenje fudbalom, veća učestalost i obim treninga imaju pozitivne efekte u smislu korekcije ravnih stopala kod fudbalerki. Kada su u pitanju posturalni poremećaji na kičmenom stubu, potrebno je uz redovan fudbalski trening koristiti dodatno i vežbe za korekciju posturalnih poremećaja, odnosno vežbe za jačanje leđne muskulature, kao i vežbe za povećanje fleksibilnosti.

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A COMPARISON OF BIOELECTRICAL IMPEDANCE AND SKINFOLD MEASUREMENTS IN THE ASSESSMENT OF BODY COMPOSITION IN UNIVERSITY STUDENTS

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Introduction

Body composition is one of the five health-related fitness components, and can be defined as the ratio of lean body mass and fat body mass. As obesity represents one of the most serious global health problems, topics as excess body weight, body type, optimal body fat percentage, fat reduction technology have always been interesting to students. Using bodyweight as the sole measure of body composition can be misleading; an ordinary body weight scale does not distinguish between fat mass and lean mass. Body mass index (BMI) can give a similarly inaccurate impression of body composition status (Nieman, 2007). Today there are a variety of accepted laboratory and field methods for estimating percent body fat (%BF), including hydrostatic weighing, skinfolds calipers, DEXA dual-energy x-ray absorptiometry, scans and air displacement plethysmography, infrared spectroscopy, ultrasonography, neutron activation analysis, computed tomography, magnetic resonance spectroscopy, etc. The aforementioned methods of estimating %BF are generally costly and/or require professional expertise for effective and safe use, placing them beyond the reach of the general public. Skinfold calipers are relatively inexpensive, but still require a trained technician to produce accurate estimates of %BF. However, a variety of consumer-grade devices targeted at the public purportedly estimate %BF, usually through bioelectrical impedance (BIA). Such products come in many forms, including attachable electrodes, handheld devices, scales, and products that are a combination of these. The Omron HBF-511 is an inexpensive body composition monitor that incorporates both hand-to-hand and foot-to-foot electrical impedance technology. Current studies of the HBF-511 have only examined a very limited segment of the population and produced varied reports on the device's accuracy, the accuracy of this instrument needs further examination (Barnes et al.,2008).The purpose of this study was to compare two different methods for assessment of body composition, bioelectrical impedance (Omron type BF511, Japan) and skinfold measurement (Harpenden caliper) as a criterion. Skinfold measurement was chosen as a criterion due to accessibility and its established accuracy Harpenden skinfold caliper are widely accepted as the "Gold Standard" instrument for skinfold measurement (Whitehead, 1990, p.10-14).

Method

Participants

A total of 132 female and 56 male students of the first year of study (age=18.74 ± 0.75 yrs) from the field of natural sciences at J.J. Strossmayer university of Osijek participated in study. Participant characteristics can be seen in Table 1.

Table 1. Means and standard deviations of participant characteristics

	Total (N= 188)	Male (n= 56)	Female (n= 132)
Age	18.73±0.75	18.98± 1.10	18.62±0.51
Height (cm)	170.96±8.74	180.27±6.80	167.00 ±6.08
Weight (kg)	68.21±15.1	75.70±13.30	65.03±14.72
BMI (kg/m ²)	22.43±3.40	23.16±3.41	22.13±3.36

Data Collection - Procedures

On the day of assessment, participants were asked to refrain from exercise and to have not eaten a heavy meal (a meal that would typically constitute breakfast, lunch or dinner) 3 hours prior to measurement. Participants were first asked to relieve themselves and to change into skintight clothing such as sport or cycling shorts. All other clothing and items, such as shoes, jewelry, and glasses were also removed. Participants then had their height measured using a Seca 214 portable height rod (Hamburg, Germany). Participants were then assessed on the Omron HBF-511 scale, which involved entry of the participant's age, height, and gender. Still wearing the skintight clothing, participants stood on the scale barefoot and grasped the handle electrodes for approximately 10 seconds until the process was complete. Assessment using the Harpenden SF caliper immediately followed. The body composition of each student was assessed using a Harpenden SF caliper at each site by the same kinesiologist. The SF of male students was measured at 3 sites (chest, abdominal and thigh) and the SF of female students was measured at other 3 sites (triceps, suprailiac, and thigh) in accordance with the protocol of Harpenden used to establish the Jackson et al equation (Jackson et al., 1980, p.175-181). Body density was calculated and converted to percentage of body fat using the Brozek et al equation (Brozek et al., 1963, p.113-140).

Statistical Analysis

Statistical analyses were performed with Statistica 10. A Student's t-test for dependent samples was used to determine differences mean in %BF estimated from Harpenden SF and the Omron HBF-511 body composition analyzer (Table 2). A Pearson's Product Moment correlation was used to examine the relationship between the %BF estimates from the two instruments. Since a high correlation does not necessarily imply agreement, Bland-Altman plots of SF and HBF-511 registered by the instruments were used to provide an indication of over/under representation of %BF and agreement between the measures (Bland and Altman, 1986, p.301-310). Scores above zero indicate an overestimation by the HBF-511 and scores below zero indicate an underestimation by the HBF-511. A Intra-class correlation (ICC) and coefficient of variation (CV) was used to assess the reliability of the %BF estimates from the two instruments.

Table 2. Differences between methods tested by the t-test for dependent samples

	AS	SD	N	Diff	t	df	p
HBF 511	27.03	8.64					
Harpenden SF	23.69	9.05	188	3.39	13.44	187	0.00

Results

A total of 188 university students from J.J. Strossmayer University of Osijek participate in this study. The t-test for dependent samples was demonstrated significant difference in obtained mean values of body fat percentage between the methods (SF 23,7±9,1; BIA 27,1±8,6; $P < 0,05$). The Pearson Product moment correlation (Figure 1) between the two measures was very strong $r = .92$, $p = .001$. This indicated that participants with a high %BF measured on SF were also measured with a high %BF on the HBF-511. The coefficient of variation is 9.64 (95% CV = 8.89-10.54), while the intra-class correlation coefficient is 0.92 (95% ICC = 0.90-0.94).

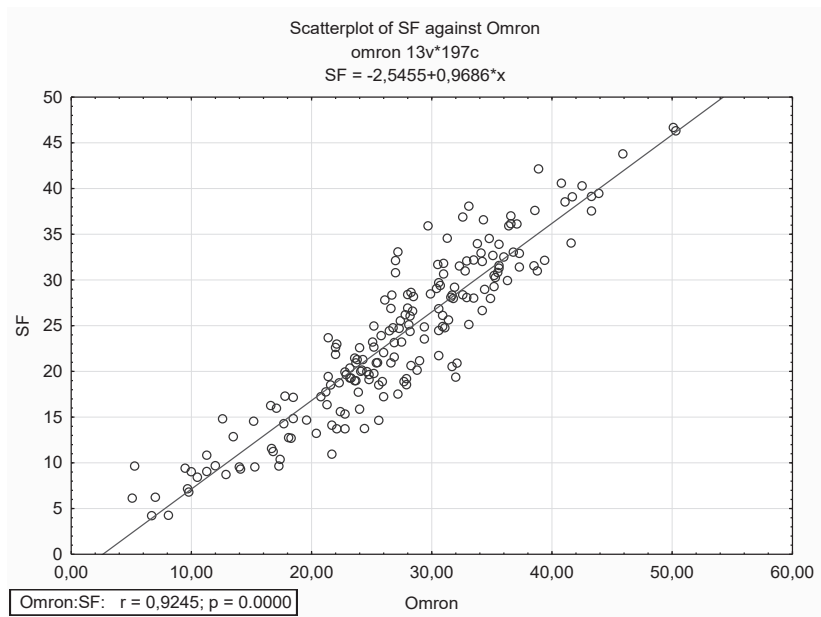


Figure 1. Correlation between body fat measured by the SF and Omron

Bland and Altman (1986) stated that if the true value is not known, then the appropriate way to plot the data is to compare the difference between methods against the mean of the 2 methods. Solid line on the graph is the mean difference in the for SF and the chosen BIA equations, and the dashed lines indicate the limits of agreement (± 2 SDs). Perfect agreement would have been a difference of ± 0.0 SD (Figure 2). Mean difference between the instruments was 3,4 %BF. Note that only 6 scores fell outside the upper dashed line, and 7 scores fell outside lower dashed line, so the 93% of differences lie between limits of agreement.

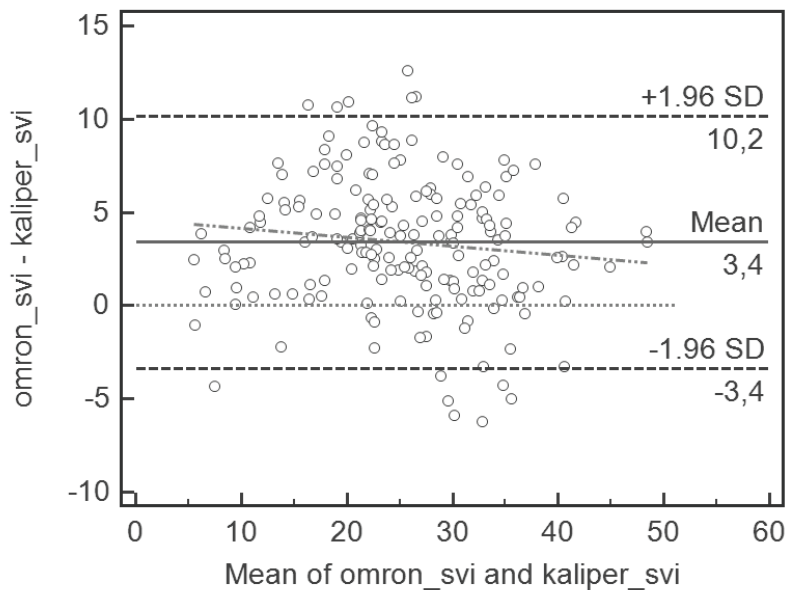


Figure 2. Bland-Altman plot for SF and the Omron HBF-511

Discussion

This study examined the accuracy of the Omron HBF-511 as an instrument for estimating %BF. It appears the HBF-511 significantly overestimates %BF, mean difference between %BF estimates was 3,4%. In some studies BIA also overestimated BF by more than 3% and 4% in men and women when BF was higher than 15% and 25% respectively (Sun et al., 2005,p.74-78). The correlation coefficients in this study is higher comparing to some other studies (McRae, 2010,p.158-161) whereas the female subjects had a correlation coefficient of 0.84, the men had a coefficient of 0.70. The SF was chosen as a criterion measure due to its established accuracy, and availability to the researchers. A standard criterion for estimating %BF does not presently exist, and it could be argued that using the SF in this role is not ideal. Our major finding was that if we have choice to choose is better to use a skinfold measurements to determine body fat in order to give feedback information to students, because BIA analysis give statistically different results.

Conclusion

In accordance with the results of this study, both methods of assessing body composition are acceptable to gain a general idea of body composition status, but in cases where an accurate estimate of %BF is crucial, using a more established method than the Omron is recommended.

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EFFECTS OF FASTING AND VERY LOW CALORY DIET ON BODY COMPOSITION: A SYSTEMATIC REVIEW

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Introduction

Fasting (FS) and very low calorie diet (VLCD) are commonly used in subjects with high obesity level (BMI>30kg/m²). A VLCD is the type of diet that focuses on continuous caloric restriction, determinate on the daily level of around of 800– 1200 kcal/day (Aragon et al., 2017). It is important to outline that low calorie diet have also been given a more liberal definition of providing 800–1800 kcal (Tsai et al., 2006). This diminished calorie input can have possible negative outcomes and will result in lowering basal metabolic rate (Master et al. 1935), nonmalignant like loss in strength, slight fall in body temperature, reduction in hearth size and appearance of edema (Keys et all., 1945). On the other hand fasting (FS) (are the kind of diets that emphasis intermittent caloric restriction. There is a few types of intermittent fasting (IF) diets: Alternate-day fasting (ADF): alternate 24-h fast, 24-h fed, whole-day fasting (WDF) 1-2 days per week of complete fasting and time-restricted feeding (TRF) 16-20 hours of fast and 4-8 hours of daily feed. Unlike VLCD, here we have notable physiological changes, especially in bioenergetics with an intensification of a process called beta oxidation (Porcari et al., 2015), which will lead to a state called ketosis (James et al., 2004).

The primary aim of this paper was to evaluate the benefits and disadvantages of fasting and traditional caloric restriction diets with/without exercise on morphological status. Additionally, focus was on changes in body composition, specifically changes in weight, fat and fat free mass in diets based on fasting and very low calorie diets and to what extent human bodies can change after one week adherence to one of these diets. Besides that, endeavor was made to find other physiological contributors for both FS and VLCD that may be crucial when someone starting a new diet, as well as possible explanation behind both results and physiological contributors. In the end, effort was made to found out how much implementation of exercises can affect these regimes.

Method

The following databases were searched: Index Medicus through MEDLINE, EBSCO, DOAJ, OVID and PUBMED using key words: fasting, diet, fat, lean mass, ghrelin, ketosis, weight loss, fat loss.

Results with discussion

The presented results are obtained after finding all available data with earlier described method and data will be represented on a weekly basis if not noted otherwise. Several studies showed diverse results, and when it emphasize on FS based diets eighteen studies showed that they are an effective method for weight loss. Minimal weight loss after a week is approximately -0.7 kg (-1%) (Heilbronn et al., 2005) while maximum was -2.4 kg (-1.1%) (Stewart et al., 1973). Considering that main goal of diets is primarily fat loss, sixteen studies showed positive effects on this aspect of body composition with a minimal fat loss of -0.15 kg (-0.17%) (Varady et al., 2015) while maximum was -1.2 kg (-1.2%) on weekly level (Belza et al., 2009). One of the essentials components of body composition is also a fat-free mas (FFM), that should in a good diets remain the same because loss in fat-free mass is indirectly correlated with loss of skeletal muscle

(Gosker et al., 2002), which is in most cases undesirable effect. Eight studies show changes in fat-free mass (FFM), and while most of them showed no changes or negative changes one study showed rise in FFM of +0.12 kg (+0.11%) (Klempel et al., 2013) contrary to previous study maximum occurred fat-free mass loss was -0.5 kg (-0.4%) (Belza et al., 2009). After searching databases we found fourteen studies that present VLCD as effective method for weight loss, with minimal weight loss after a week is approximately -0.27 kg (0.25%) (Wing et al., 1994) while maximum weight reduction was -2.0 kg (1.8%) (Saris, 2001). In the studies with VLCD based diets fat mass diminution was found in seven studies and it was from minimal -0.2 kg (-0.3%) (Keys et al., 1945) to maximal -1.95 kg (-2.6%) (Öckerman 1992). FFM decrease was obtained in six studies with VLCD based diets and it goes from minimal FFM loss of -0.099 kg (-0.08%) (Lantz, et al., 2003) to maximal -0.4 kg (-0.5%) during one diet week (Eston et al., 1992). In the study of Klempel and coauthors (2015) combined VLCD with IF on 54 obese women were randomized to either the intermittent fasting caloric restriction-liquid (IFCR-L) or intermittent fasting caloric restriction -food based (IFCR-F) diet that resulted in decrease of body weight more in the IFCR-L group (3.9 ± 1.4 kg) versus the IFCR-F group (2.5 ± 0.6 kg). Fat mass decreased similarly in the IFCR-L and IFCR-F groups (2.8 ± 1.2 kg and 1.9 ± 0.7 kg, respectively). Most important result was an increase of +1.2 kg in FFM in FS based diet that was 10 weeks long. This can be explained by another study (Espelund, et al., 2005) in which they performed measurements of ghrelin (as well as insulin, growth hormone (GH), and cortisol) every 3 hours during 84 hours of fasting in 33 healthy subjects that showed GH levels increased during fasting but only in lean subjects (34 ± 5 vs. 71 ± 11 vs. 51 ± 6 g/liter·h, d 1 vs. d 2 vs. d 3; $P < 0.01$). GH is well known anabolic, and even when the gene for human growth hormone was introduced into the genome of the mouse expression of the gene resulted in the unusually large size of this mouse (Nelson et al., 2008). It is important to note that all data are presented as average, and not all diets programs had the same length. They varies from 4-8 weeks in one study to 57 weeks in another, and one study showed (Eston et al., 1992) that the most rapid reduction in body mass occurred during first two weeks. It means that the longer studies, and results obtain out of them, have quite greater value.

In the conditions where these diets were implemented with exercises it showed positive outcomes when it comes to improving body composition. First of there is a comparative study (Bhutani et al., 2013) with 64 obese (BMI between 30 and 39.9 kg/m²) subjects, separated in four groups and comparison was made between 4 groups: 1) combination (alternate day fasting (ADF) + endurance exercises), 2) ADF, 3) exercises, 4) control group, that show greater weight loss in group performing alternate day fasting with exercises (6 ± 4 kg) while groups who just fasted lose (3 ± 1 kg), and exercise group lose (1 ± 0 kg) after the period of 12 week. Same implementations were done with VLCD. In one study (Eston et al., 1992) ten moderately obese women (aged 23-57 years) received VLCD (1695 kJ/day) for 6 weeks, and the average reduction was 11.5 kg in body mass from which was approximately loss of 63% fat and 37% FFM. From both studies we see that combination of exercises and diets lead to higher weight loss, and possible explanation for lower changes in first study may be because the ADF day was not a complete fasting yet participants consumed 25% of their baseline energy needs on the fast day (24h) and consumed food ad libitum on each feed day (24h) which may be very profusely.

In the novel study of Tinsley et al. (2017), where participated generally healthy, recreationally active men who had not followed a consistent resistance training (RT) program over the previous three months divided in 2 groups, both performing RT, while control group was on normal diet (ND) while other is on time restricted feeding (TRF) with 20 hours restriction, and four hours period for consuming calories. Muscular performances were compared between them, on four components: bench-press 1RM, bench press endurance, hip sled 1RM, hip sled endurance. After a period of 8 weeks, RT-TRF have showed (Bench-press 1RM ND +7 kg/TRF +10 kg, Bench-press endurance ND -1 rep/TRF +1 rep, hip sled 1RM ND + 74 kg/TRF

+119 kg, hip sled endurance ND +6 rep/TRF +5 rep) better performance than ND in three out of four components. In the same study weight changes in ND was +3 kg, and TRF -1 kg, lean soft tissue raised in ND for + 2.3 kg, and in TRF there is a loss of just -0.2 kg, fat mass raised in ND +0.8 kg and in TRF group there is a loss of -0.6 kg, there is also a change in body fat percentage and it raises in ND +0.4 % and drops in TRF for - 0.6 %. Similar study (Moro et al., 2017) with combination of TRF and RT showed different results. In this study 31 resistance-trained males were randomly assigned to time-restricted feeding (TRF) or normal diet group (ND). TRF subjects consumed 100 % of their energy needs in an 8-h period of time each day, with their caloric intake divided into three meals consumed at 1 p.m., 4 p.m., and 8 p.m. The remaining 16 h per 24-h period made up the fasting period. Results showed that after 8 weeks, a significant decrease in fat mass was observed in the TRF group (-16.4 vs -2.8 % in ND group), while fat-free mass was maintained in both groups (+0.86 vs +0.64 %), and leg press maximal strength increased significantly, but no difference was present between treatments. It was assumed that the results will be greater if diet is combined with already proven and effective way for successful changes in body composition (Ilić et al., 2012).

When it comes to dieting hormones and hormonal changes plays an important role. And one of vital hormone when it comes to dieting and weight loss is ghrelin, also known as hunger hormone. Besides regulating appetite, ghrelin also plays a significant role in regulating the distribution and rate of use of energy (Burger et al., 2014). In 24 hours fasting state Natalucci and coauthors (2005) were taken blood samples from six healthy volunteers. Results showed an increase and spontaneous decrease in ghrelin was seen at the time points of customary meals. Ghrelin was secreted in a pulsatile manner with approximately 8 peaks/24h. An overall decrease in ghrelin levels was observed during the study period which leads us to conclusion that the longer we stay without food the lesser are our needs for food. Another study mentioned earlier because growth hormone (GH) (Espelund, et al., 2005) also have performed a measurements of ghrelin, insulin, and cortisol, and correlation between them. In this study participants fasted over a period of 84 hours, and yet ghrelin still decreased gradually during the study. The authors have found very strong inverse correlation between the circulating levels of ghrelin and cortisol and the same applies for GH and cortisol, which may be explanation for earlier mention rise in BMR as well as increase in FFM. Earlier we mention lowering of basal metabolism in VLCD, and here where we talk about hormones it is important to mention that one study (Espelund, et al., 2005) showed that there is a rises in resting energy expenditure (REE, BMR) during FS. In this study participated eleven healthy, lean volunteers where basal metabolic rate, was measured by indirect calorimetry, and hormone and substrate concentrations were measured on days 1, 2, 3, and 4 of an 84-h starvation period and resulted in an significantly increase of BMR from 3.97 ± 0.9 kJ/min on day 1 to 4.53 ± 0.9 kJ/min on day 3. This can be correlated to both cortisol and GH.

Experimental studies about effects of different types of diets were performed on animals. One such a study was done on mices (Chaix et al., 2014). In this study they endangered 392 12-week-old male wild-type C57BL/6J mice to different feeding regimens. They exposed mice to ad libitum feeding (ALF) or TRF of a high-fat-plus-high-sucrose diet (FS diet; 25% energy from sucrose, 32% from fat). Mice fed an FS diet ad libitum (FSA) consumed the same amount of calories as mice fed within a 9 hour window of the dark phase (FST), yet the FST mice gained less body weight over a 12-week period (21% compared to 42% for FSA mice). To test whether TRF has a lasting effect that can counter man occasional interruptions or consistent ALF (legacy effect), mice were alternated between TRF and ALF in three crossover experiments. First, mice were alternated between 5 days of TRF (weekdays) and 2 days of ALF (weekends) for 12 weeks (5T2A - alternating between 5 days of TRF and 2 days of ALF). The legacy effect of TRF over this time scale was remarkable, with only 29% body weight gain for 5T2A mice compared to 61% weight gain for FA mice (food consumption was isocaloric compared to all other feeding groups). Next they tested the legacy effect of TRF over an extended period of time. Mice were maintained on TRF for 13 weeks and then switched to ALF for 12

weeks (13:12 FTA mice, which they called the short-term study). The 13:12 FTA mice gained weight rapidly after the transfer to ALF and at the end of the study weighed as much as mice maintained on high-fat diet (HFD) ad libitum (FAA) for the entire 25 weeks (112% and 111% body weight gain, respectively). In contrast, the control group, which was maintained on TRF throughout the 25 weeks (FTT mice), exhibited a 51% body weight increase. In another study, mice were exposed to 26 weeks of TRF and were then transferred to ALF for 12 weeks (26:12 FTA mice, which they call the long-term study). Similar to the short-term study, the 26:12 ad libitum (FTA) mice quickly increased body weight after the switch to ALF. However, weights of these mice stabilized at approximately 48.5 g or a 106% body weight increase, which was significantly less than seen with the 26:12 FAA mice (157% increase in weight). In the end to investigate the therapeutic potential of TRF, we tested whether TRF could reverse or arrest body weight gain in preexisting diet-induced obesity (DIO), as observed in FA mice. In both short-term (13:12) and long-term (26:12) studies, a subset of FA mice was switched to the TRF paradigm (FAT). Within a few days the mice were habituated to the new feeding paradigm and continued to consume equivalent calories. The 13:12 FAT mice showed a modest drop in body weight (40 g to 38 g) and maintained this new body weight until the end of the study, at which point their weight was not statistically different from FTT mice. Similarly, the 26:12 FAT mice exhibited some body weight loss (12%; 53.7 g to 47.5 g) and maintained the new baseline weight until the end of the study. Transferring the mice from ALF to TRF resulted in a 5% body weight loss from the time of crossover (FAT), compared to a 24.8% weight gain for mice maintained in ad libitum conditions (FAA) during the entire 13:12 crossover study. In the 26:12 crossover study, FAT mice lost 12% of their body weight after crossover, which was significantly different than the 10.6% body weight gain for FAA mice. Study of Roberts et al. (2016) on rats examined whether acute and/or chronic skeletal muscle anabolism is impaired with a low-carbohydrate diet formulated to elicit ketosis (LCKD) vs. mixed macronutrient. And they come with a conclusion that LCKDs promote decreases in whole-body adiposity, although there are equivocal reports as to whether or not a LCKD can maintain muscle mass with or without exercise training. The rat models employed herein suggest that, compared with a mixed macronutrient western-diet (WD), the tested LCKD does not affect basal skeletal muscle anabolic signaling markers and/or impair the acute or chronic anabolic skeletal muscle responses to resistance exercise. In study (Vallyathan et al., 1970) with pigeons they tried to break down generally accepted fact that in prolonged muscular activity, fat is actually chief fuel. And from the biochemical data obtained in the present investigation, on the TFA levels in the pigeon pectoralis during fasting and exercise, it is clearly seen that there is considerable increase in total-fatty acids (TFA) during a 72-h period of fasting and also during exercise of the bird for different periods of time. The TFA level in the muscle increased by 42%, 83%, and 168% respectively over the normal value in the 0.5-h, 2-h and 5-h stimulated pigeons. In the fasted and stimulated pigeons, the increase was of the order of 255% over the normal.

Conclusion

Although fasting and very low calorie diet produce quite similar effects on body composition observed through decrease of body weight ad fat mass, the effects on fat free mass can differentiate. Also FS produce better physiological benefits and have much stronger hormonal support in comparison to VLCD. Also all studies done on animals that have genetic, biological and behavioral characteristics that closely resemble those of humans are very supportive when it comes to fasting and some forms of it. We could also conclude that both FS and VLCD have greater effects on subjects with higher BMI (over 30kg/m²). Both diets can be easily implemented in sport and exercises and will provide great result when it comes to positive changes in body composition, but with higher changes in strength with FS. Some further studies need to

compare how activities of different type (endurance, strength, speed, flexibility ect.) function with bout VLCD & FS and how diets reflects on each activity.

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FREQUENCY OF INJURIES OF ATHLETES IN KICKBOXING

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Introduction

Every sporting activity, whether recreational or competitive, carries with it the risk of injuries due to the same. Often, martial arts are considered dangerous, unethical, violent and cruel, which is linked to the view that the main goal of the athlete is to hurt an opponent. This attitude, we can freely say that it is unfounded for the simple reason that sporting fighting in contact martial arts rests on the principles of fair play and the official rules defining it. Injuries are an integral part of the sport and they occur more or less. Certainly, the reduction in the incidence of injuries is also affected by one of the requirements of the International Olympic Committee, which refers to increasing the protection of an athlete from injuries. This requirement relates primarily to the improvement of protective equipment used in the athletic activity of athletes, in order to make sport safer, all with the aim of achieving a sporting result with as little as possible injuries to athletes. Kick boxing belongs to a group of martial arts-based on punching and kicking in which the fight is conducted in order to place as many kicks as possible with hands and legs in the short time interval, and to defeat the opponent and beat the match with the strength and precision of the same (Šćepanović, 2004). Also, according to Salhanović (Salhanović, 1994) kick boxing represents a sports branch characterized by the complex manifestation of motor and psychological characteristics in order to win the opponent in the fight. Activities in kick boxing take place under conditions of increased fatigue, which creates the conditions and the possibility of injuries. "Due to fatigue, there is an uneconomical work and essential change in the structure and parameters of the movement (Koprivica, 2013). In addition to fatigue, factors such as the quality of protective equipment, training conditions and competitions, the skills of the trainer, the social and material conditions of athletes are also not so negligible when the injuries are in question. All of these factors can create conditions and affect the occurrence of injuries both in training and in the kick boxing competition. (Ćirković et al., 2010). The aim of this study was to determine the incidence rate of injury to athletes while doing kickboxing as recreation, as well as during competitive activities.

Method

In this study 198 subjects were divided into 2 groups: competitors (N = 125) and recreational players (N = 73). For the purposes of this study it was used a specially designed questionnaire. The questionnaire included the following variables: duration of training, injury situation, injuries in relation to the anatomical region and time absence after injury. The study uses descriptive method.

Results with discussion

Table 1 shows the numerical and percentage indicators for the variable length of the sports experience of the subjects from which it can be seen that the highest number of subjects are trained over a year, 143 of them (70%), followed by a group of beginners (28) trained from 3-6 months (16%), in the transition group who are trained from 6 to 9 months, there are at least 11 of them (6%), followed by a group of subjects who are trained from 9 to 12 months and have 16 of them (8%).

Table 1. Numerical and percentage indicators for the variable length of the sports experience of the subjects

Sports experience	N	%
3-6 months	28	16%
6-9 months	11	6%
9-12 months	16	8%
Over a year	143	70%

Table 2 shows the percentage indicators related to the time away from the training of the injured subjects. Part of the questionnaire related to the absence from training due to injuries was formed on the scale of the Vahmut and Volk scale, where there are 4 levels in which the injuries are defined as (Vahmut and Volk, according to Ugarkovic, 2001):

- Slight injuries
- Minor injuries
- Median serious injuries
- Serious injuries

Data processing revealed that 48% of subjects did not have absence due to injuries, 20% of subjects were absent for less than one week, 21% from 1-4 weeks, while only 11% of subjects were absent for more than 4 weeks due to injuries. What constitutes curiosity is that the results of the study showed that there were no reported cases with recreational players in terms of the presence of serious injuries with a absence of longer than 4 weeks, i.e. 0%. This information tells us that injuries to recreational characters are transient.

Table 2. Percentage indicators for variable time absence from the training of injured subjects

The situations in which the injuries occurred	%
No absence	48%
Absence of less than 1 week	20%
The absence of 1-4 weeks	21%
Absence of more than 4 weeks	11%

Table 3 shows the percentage indicators for the variable referring to the situations in which the injuries occurred. When it comes to situations related to situations where the injuries occurred, 34% of subjects said that there were not been injuries in the examined conditions, or working on equipment, working with a contestant, during sparring and at the match. Only 20% of competitors injured during the matches, which we can attribute to competitive activity in the maximum conditions of the competition, 19% were injured during conditional sparring and 14% during the agreed sparring, which may be in favor of the fact of inadequate training of athletes and inconsiderate behavior, and 2% using the equipment both for the recreational player and the competitors. This phenomenon can be explained by moderate intensity of work, absence of stress and competitive atmosphere, and one general pleasant method of work that is "favored" at all levels of athletes.

Table 3. Percentage indicators for the situation variable in which the injuries occurred

The situations in which the injuries occurred	%
Without injures	34%
Workout in equipment	2%
Workout with contestant (agreed sparing)	9%
Free sparring	35%
Match	20%

Table 4 shows the percentage indicators for the variable that relates to the distribution of injuries to the anatomical region. The highest percentage (20%) of injuries in the affected anatomical region is foot and lower leg. Such a phenomenon can be interpreted by frequent use of a "low-kick". Thigh (18%) and fingers (18%) are also a sensitive region where injuries occur. Thighs (lateral and medial side of the toe) are regions in which a low low kick is placed, which explains this percentage of injuries. Fingers of the hands as a separate region appear as an injury localized on the dominant side of the body. This injury is due to an improper technique of impact of a crochet or a half-crochet knock known under the term "overhand". The problem of "boxing fists", is the breakthrough of metacarpal bones, appears to be slowly disappearing due to the increasing technological development of protective equipment and materials used to make gloves, bangs and the like. Face (10%) and head (12%) are indispensable parts that are injured and will be injured in kick boxing. As a legitimate area for achieving points, this region, in spite of all protective equipment advancing in the technological sense, will not be left out of blows. However, the information that is looking forward is the fact that the region of the face and head is far behind the regions of the feet and toes by the degree of injuries.

Table 4. Percentage figures for variable injury to the anatomical region

Injuries to the anatomical region	%
Shoulders	4%
Thigh	18%
Fingers of the hands	18%
Lower leg	20%
Knee	8%
Foot	20%
Face	10%
Head	12%

Conclusion

Injuries are an integral part of the sport and are due to a set of factors that influence the occurrence thereof. In comparison to other sports (football and cross-fit) the results of this research have shown a lower incidence of injury (Mehrhab et al., 2017; Grimm, NL et al., 2018). Therefore, kickboxing, although a contact sport, based on the data obtained in this study can be recommended both for recreation and for a competitive this sport.

Reference

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UČESTALOST POVREĐIVANJA SPORTISTA U KIK BOKSU

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Uvod

Svaka sportska aktivnost bilo da je rekreativnog ili takmičarskog karaktera nosi sa sobom i odedeni rizik od nastanka povreda usled bavljenjem istom. Neretko, borilački sportovi se smatraju opasnim, neetičkim, nasilnim i surovim za koje se vezuje stav da je glavni cilj sportiste da povredi protivnika. Ovakav stav, možemo slobodno reći da je neosnovan iz prostog razloga što sportska borba u kontaktnim borilačkim sportovima počiva na načelima fer-pleja i zvaničnim pravilima koja ga definišu. Povrede predstavljaju sastavni deo sporta i javljaju se u većoj ili manjoj meri. Svakako, na smanjenje nastanka povreda utiču i jedan od zahteva Međunarodnog olimpijskog komiteta koji se odnosi na povećanje zaštite sportiste od povređivanja. Ovaj zahtev se pre svega odnosi na unapređivanju zaštitne opreme koja se koristi u okviru takmičarske aktivnosti sportista, kako bi na taj način sport učinili bezbednijim, a sve u cilju ostvarenja sportskog rezultata uz što manji stepen povređivanja sportista. Kik boks spada u grupu borilačkih sportova na bazi udaraca u okviru kojeg se borba vodi sa ciljem da se protivniku u kratkom vremenskom interval plasira što više udaraca rukama i nogama, te da se snagom i preciznošću istih onesposobi protivnik i pobedi na meču (Šćepanović, 2004). Takođe, prema Salhanoviću (Salhanović, 1994) kik boks predstavlja sportsku granu koju karakteriše kompleksno ispoljavanje motoričkih i psihičkih osobina u cilju pobede protivnika u borbi. Aktivnosti u kik boks u odvijaju se u uslovima povećanog zamora, što stvara uslove i mogućnost da dođe do povrede. „Usled zamora javlja se neekonomičnost u radu i suštinske promene u strukturi i parametrima kretanja (Koprivica, 2013). Pored zamora, faktori poput kvaliteta zaštitne opreme, uslovi treniranja i takmičenja, stručnosti trenerskog kadra, socijalnih i materijalnih uslovi sportiste su takođe ne tako zanemarljivi kada je nastanak povrede u pitanju. Svi navedeni faktori mogu stvoriti uslove i utiču na pojavu povreda kako u treningu tako i na takmičenju u kik boks. (Ćirković i sar., 2010). Cilj ovog rada je da se utvrdi stepen učestalosti povređivanja sportista tokom bavljenja kik boksom kako rekreativno, tako i u toku takmičarske aktivnosti.

Metod

Testirano je 198 ispitanika raspoređenih u 2 grupe: takmičari (N=125) i rekreativci (N=73). Za potrebe ovog rada korišćen je upitnik posebno napravljen za ovo istraživanje. Upitnik je obuhvatio sledeće varijable: dužina trenažnog staža, situacija u kojoj je došlo do povrede, zastupljenost povreda u odnosu na anatomsku regiju i vremensko odsustvo nakon povrede. U radu je korišćen deskriptivni metod.

Rezultati sa diskusijom

U Tabeli 1. su prikazani numerički i procentualni pokazatelji za varijablu dužina sportskog staža ispitanika iz koje se može videti da najviše ispitanika ima koji treniraju preko godinu dana, njih 143 (70%), zatim grupa početnika koji treniraju od 3-6 meseci njih 28 (16%), u prelaznoj grupi koji treniraju od 6 do 9 meseci ima najmanje svega njih 11 (6%), a zatim sledi grupa ispitanika koja trenira od 9 do 12 meseci kojih ima 16 (8%).

Tabela 1. Numerički i procentualni pokazatelji za varijablu dužina sportskog staža ispitanika

Sportski staž	N	%
3-6 meseci	28	16%
6-9 meseci	11	6%
9-12 meseci	16	8%
Preko godinu dana	143	70%

U Tabeli 2. su prikazani procentualni pokazatelji koji se odnose na vremensko odsustvo sa treninga povređenih ispitanika. Deo upitnika koji se odnosio na odsustvo sa treninga usled povrede formiran je po uzoru na skalu Vahmut i Volk, gde postoje 4 nivoa u kojima su povrede definisane kao (Vahmut i Volk, prema Ugarković, 2001):

- Neznatne povrede
- Lake povrede
- Srednje teške povrede
- Teške povrede

Obradom podataka dobijeno je da 48% ispitanika nije imalo odsustvo usled povrede, 20% ispitanika je odsustvovalo kraće od jedne nedelje, 21% od 1-4 nedelje, dok je svega 11% ispitanika odsustvovalo duže od 4 nedelje usled povređivanja. Ono što predstavlja kuriozitet jeste da su rezultati istraživanja pokazali da nije bilo prijavljenih slučajeva kod rekreativaca kada je u pitanju zastupljenost teških povreda sa odsustvom dužim od 4 nedelje, tj. 0%. Ovaj podatak nam govori da su povrede kod rekreativaca prolaznog karaktera.

Tabela 2. Procentualni pokazatelji za varijablu vremensko odsustvo sa treninga povređenih ispitanika

Situacije u kojima su se povrede dogodile	%
Bez odsustva	48%
Odsustvo kraće od 1 nedelje	20%
Odsustvo od 1-4 nedelje	21%
Odsustvo duže od 4 nedelje	11%

U Tabeli 3. su prikazani procentualni pokazatelji za varijablu koja se odnosi na situacije u kojima su se povrede dogodile. Kada su u pitanju situacije koje se odnose na situacije u kojima su se povrede desile 34% ispitanika se izjasnilo da nije došlo do povrede u ispitivanim uslovima, odnosno u radu na spravama, u radu sa partnerom, tokom sparinga i na meču. Svega 20% takmičara se povredilo tokom mečeva što možemo pripisati takmičarskoj aktivnosti u maksimalnim uslovima nadmetanja, njih 19% se povredilo tokom uslovnog sparinga i 14% tokom dogovorenog sparinga što može ići u prilog činjenici nedovoljnoj obučenosti sportista i nesmotrenosti, a 2% u radu na spravama kako kod rekreativca tako i kod takmičara. Ovu pojavu možemo objasniti umerenim intenzitetom rada, odsustvom stresa i takmičarske atmosfere i jednim opštim prijatnim metodom rada koji je „omiljen“ kod svih nivoa sportista.

Tabela 3: Procentualni pokazatelji za varijablu situacije u kojima su se povrede dogodile

Situacije u kojima su se povrede dogodile	%
Bez povrede	34%
Rad na spravama	2%
Rad sa partnerom (uslovni sparing)	9%
Sparing (slobodni)	35%
Borba (meč)	20%

U Tabeli 4. su prikazani procentualni pokazatelji za varijablu koja se odnosi raspodelu povreda prema anatomskoj regiji. Najveći procenat (20%) povreda kada je u pitanju povređena anatomska regija jeste stopalo i potkolenica. Ovakava pojava se može tumačiti čestom upotrebom niskog nožnog udarca, „low-kick“. Butina (18%) i prsti ruke (18%) su takođe osetljiva regija u kojoj dolazi do povređivanja. Butina (lateralna i medijalna strana natkolenice) su regije u koje se plasira niski nožni udarac „low-kick“ što objašnjava ovoliki procenat povređivanja. Prsti ruke kao zasebna regija javljaju se kao povreda lokalizovana na dominantnoj strani tela. Do ove povrede dolazi usled nepravilno izvedene tehnike udarca kroše ili udarca polu-kroše poznat pod terminom „overhand“. Problematika „bokserske šake“ tj. preloma metakarpalnih kostiju čini se da polako iščezava usled sve većeg tehnološkog razvoja zaštitne opreme i materijala koji se koristi za izradu rukavica, vreća za udaranje i slično. Lice (10%) i glava (12%) su neizostavni delovi koji se povređuju i koji će se povređivati u kik boks. Kao legitimna površina za ostvarivanje poena, ova regija, i pored sve zaštitne opreme koja napreduje u tehnološkom smislu, neće biti izostavljena od udaraca. Međutim, podatak koji raduje je činjenica da je regija lica i glave daleko iza regija stopala i natkolenice po stepenu povređivanja.

Tabela 4: Procentualni pokazatelji za varijablu povrede prema anatomskoj regiji

Povrede prema anatomskoj regiji	%
Ramena	4%
Butina	18%
Prsti ruke	18%
Potkolenica	20%
Koleno	8%
Stopalo	20%
Lice	10%
Glava	12%

Zaključak

Povrede su sastavni deo bavljenja sportom i nastaju usled skupa faktora koji utiču na pojavu istih. U poređenju sa drugim sportovima (kros fit i fudbal) rezultati ovog istraživanja su pokazali manju učestalost povređivanja (Mehrab i sar., 2017; Grimm, N.L. i sar., 2018). Te stoga, kik boks iako kontaktni sport, a na osnovu podataka dobijenih u ovom istraživanju, može se preporučiti kako za rekreativno tako i za takmičarsko bavljenje ovim sportom.

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CORRELATION BETWEEN POWER POTENTIAL, ANTHROPOMETRY AND THE SPEED OF THE BALL OF IN-STEP KICK IN FOOTBALL

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Introduction

The analysis of the literature on the problem about approaches for increasing the ball speed of the in-step kick shows that there are a lot of research papers with different themes. Widely explored is the problem about changes in muscle size because of training process and the ability to generate greater speed of the kicking leg (Jelusic, 1992, 231-238; Masuda, 2003, 851-858; Manolopoulos, 2004, 701-710; Apriantono, 2006, 951-960; Young, 2011, 561-566; Bacvarevic, 2012, 1945-1952; Пеев, 2015, 71, L. Rodríguez-Lorenzo, 2018, 80-82).

Also there are many researches about the technical ability of the football players related with the control of the performance, anatomic and biomechanical parameters of the in-step kick (Gadev, 2001, 9-15; H. Dörge, 2002, 293-299; Young, 2004, 23-31; Markovic, 2006, 215-220; L. Rodríguez-Lorenzo, 2015, 80-82; Bekris, 71-87 2015; García-Pinillos, 2015, 1293-1297; Peev, 2015, 1008; Takahashi, 2016, 371-374).

In the same time, we found out some differences in the opinions about the influence of the anthropometric variables, strength and power indicators of the ball speed. On the other hand, their effect and their importance across different level of football players aren't fully explored (Cerrah, 2011, 181-190; Noguchi, 2012, 97; Brahim, 2013, 129). All of this defined the purpose of our research. The purpose is to optimize the training process through identification of the influence of the anthropometric and power indicators of the in-step kick in football.

In order to achieve our goal, we set the following tasks:

- Research of the variability of the ball speed of in-step kick, anthropometric indicators and indicators that characterizes explosive power of the lower limbs across different level of football players;
- Research of the correlation between these variables.

Methods

We solved the tasks of the research by the help of the following methods: anthropometric measurement (anthropometry), tensometry (jumping performance measurement), kicking performance measurement (speedometry) and statistical procedures (descriptive statistics and correlation analysis). We describe the tests and their indicators in Table 1.

Table 1. Name of the test, the indicators that they measure, measuring units and their precision.

Test №	Name of the test and indicators	Precision
1.	Height [m]	0.01
2.	Weight [kg]	0.01
3.	Weight-Height index (W/H_{index}) [kg/m]	0.001
4.	Ball speed ($V_{max\ ball}$) [km/h]	1
5.	Average height of the 5 consequent tuck jumps ($h_{average}$) [m]	0.01
6.	Average contact time of the 5 consequent tuck jumps ($t_{contact}$) [s]	0.001
7.	Coefficient of explosiveness of the 5 consequent tuck jumps ($C_{expl.}$) [m/s]	0.001

Anthropometric measurements (Test № 1, 2 and 3) were made from specialist with the following equipment: anthropometer (Seca-213, SECA, Leicester, UK) and electronic weight scale (DB II, Cas Co., USA). We used the formula $W/H_{(index)} = Weight_{(kg)} / Height_{(m)}$ for calculating the weight and height index of the Test 3.

Test 4 is ball speed measurement which were conducted with radar gun “Speedchek” (SCX-01, Tribar Industries Inc., Canada) with detection radius of 10 m. We put the device 11 meters away from the ball to avoid registration of the swinging motion of the leg. The shot was made in front of a net without goalkeeper with the main purpose of maximal effort in the kicking. Every player made 3 attempts as we registered the best of them.

The jumping performance test was conducted on a force plate (ЦОМ-2 (DJC-2)), Sofia, Bulgaria). The tests had the purpose to register parameter that characterizes the explosive power of the lower limbs. They are shown in the Table 1 under number 5, 6 and 7. The force plate was connected to a PC and was placed on a proper location. The device can register until 50 jumps with height of 125 centimeters. The players were instructed to maximize their efforts. All of the tuck jumps were conducted from a standing position with minimal contact time. The legs were bend of the knee in the flight time and direct to the chests. All participants made 5 consequent jumps and the device registered the three parameters of explosive power: average height of the jumps ($h_{average}$), contact time ($t_{support}$) and coefficient of explosiveness (C_{expl}).

In this study we used group of 82 football players: 44 low-skilled players (12-14 years old) and 38 highly qualified players (18-19 years old). The tests were conducted in the two consequent days for every group. First we did the anthropometric measurement and the force plate measurement of coefficient of explosiveness and the average height of five consequent jumps. The kicking performance measurement was conducted on the next day with radar speed gun. The third day, the second group of highly qualified football players, starts with the testing procedures. They made the test in two consequent days as the first group in the same order.

The statistical procedures were made with SPSS Statistics 19 (IBM, Chicago, Illinois, USA). We used descriptive statistics and correlation analysis. The main indicators that we used were average, standard deviation, coefficient of correlation of Pearson (r), asymmetry (As), kurtosis (Ex) and coefficient of variation (CV).

Results

Variability of the indicators of the anthropometric parameters and ball speed of the two groups were summarized in the Table 2 and Table 3. It is obvious from the table that the two groups are homogeneous. The critical values of the asymmetry and kurtosis are accordingly 0.748 and 1.465. The empiric values are smaller than the critical ones which means that the data is normally distributed for the two groups. Together these facts allow us to make a correlation of the researched indicators.

Table 2. Variability of the result of tests №1, №2, №3, №4 of low-skilled players

№ of tests	Descriptive statistics								
	x	m _x	S	Ex	As	R	x _{min}	x _{max}	V%
1	1.64	3.90	11.70	-1.40	-0.40	31	1.45	1.76	7.15
2	48.11	2.33	6.99	-0.26	-0.90	20	36	56	14.53
3	0.293	0.009	0.027	-0.42	-0.93	0.074	0.248	0.322	9.10
4	73.78	3.07	9.20	-0.82	-0.42	28	58	86	12.47

Table 3. Variability of the result of tests №1, №2, №3, №4 of highly qualified players

№ of tests	Descriptive statistics								
	x	m _x	S	Ex	As	R	x _{min}	x _{max}	V%
1	1.76	1.72	4.55	-0.09	1.07	12	1.72	1.84	2.58
2	70.42	2.92	7.42	-1.03	0.09	22	60	82	10.96
3	0.399	0.013	0.035	-1.42	-0.27	0.097	0.348	0.445	8.77
4	104.28	1.99	5.62	-0.14	1.19	15	99	114	5.40

The result shows slightly higher homogeneity of test № 2 and № 4 highly skilled football players. It is noticeable that the values of the *W/H* index increases with the age of the players. These changes are normal and they are connected with development of human body of the youngsters.

In order to understand the influence of these changes in human body we correlate anthropometric indicators with the ball speed of in-step kick. The data and the changes of the coefficient of correlations of the two groups are summarized in Figure 1 and Figure 2.

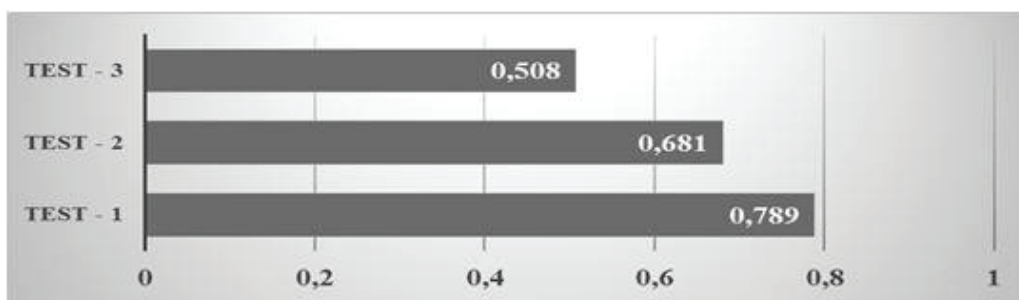


Figure 1. Correlation between anthropometric indicators and ball speed of low-skilled football players

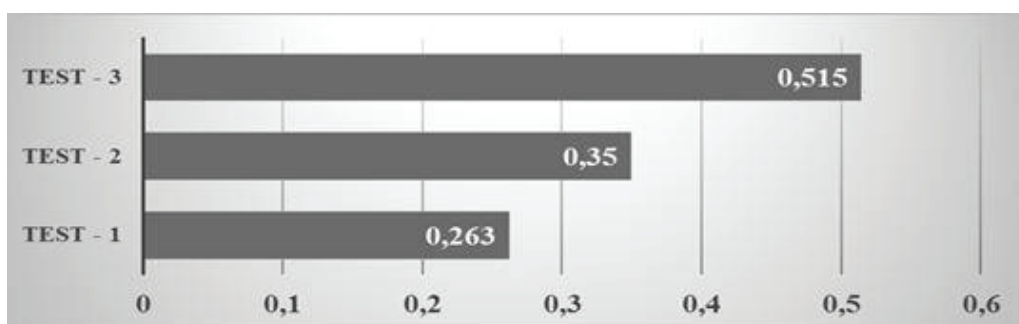


Figure 2. Correlation between anthropometric indicators and ball speed of highly qualified football players

The results show different influence between the studied groups of football players. From one hand we have strong to moderate correlation ($r=0.789$; $r=0.681$; $r=0.508$) about low-skilled player. From the other hand the correlations about the same indicators for highly qualified players are weak to moderate ($r=0.263$; $r=0.350$; $r=0.515$). The significance level was set at $\alpha=0.05$. These results show certain differences when we

speaking about influence of the anthropometric indicators and the ball speed of in-step kick in football which are related with the level of the players.

The other question that we can answer is related to the influence of the explosive power on the ball speed in different groups of football players. In order to solve it we made a descriptive statistical analysis of the indicators № 4 to № 7 from Table 1. The data are summarized in Table 4 and Table 5 for the two groups.

Table 4. Variability of the result of tests №4, №5, №6, №7 of low-skilled players

№ of tests	Descriptive statistics								
	x	m _x	S	Ex	As	R	x _{min}	x _{max}	V%
4	73.78	3.07	9.20	-0.82	-0.42	28	58	86	12.47
5	0.27	1.64	4.93	-0.15	0.46	0.15	0.20	0.35	18.63
6	0.229	0.02	0.06	-0.59	0.82	0.178	0.154	0.332	23.79
7	1.267	0.13	0.39	0.08	1.17	1.106	0.835	1.959	27.05

The results of the descriptive statistics for the low-skilled group show higher coefficient of variation (CV%=12.47-27.05%) but in the range of homogeneity. On the contrary the group of highly qualified players shows greater homogeneity (CV%=5.40-13.04%). The critical values of the asymmetry and kurtosis are the same: 0.748 and 1.465. The empiric values are smaller than the critical ones (As=-0.42-0.67; Ex=0.08 - (-0.82)) which means that the data is with normal distribution for the two groups. Together these facts allow us to make a correlation of the researched indicators.

Table 5. Variability of the result of tests №4, №5, №6, №7 of highly qualified players

№ of tests	Descriptive statistics								
	x	m _x	S	Ex	As	R	x _{min}	x _{max}	V%
4	104.28	1.99	5.62	-0.14	1.19	15	99	114	5.40
5	0.32	1.47	4.17	-1.01	-0.23	0.13	0.25	0.38	13.04
6	0.172	0.003	0.01	0.58	-0.72	0.035	0.151	0.186	6.56
7	1.873	0.06	0.18	-0.14	-0.62	0.534	1.552	2.086	9.79

In order to find the influence of these factors on the ball speed of in-step kick in football we correlate the indicators №4, 5, 6 and 7. The results of this correlation are in Figure 3 and Figure 4. The data about low-skilled players indicate moderate correlation (r=0.326; r=0.342; r=0.466) between the power indicators and ball speed. While the same correlation for highly qualified players is moderate to strong (r=0.758; r=0.571; r=0.672). The significance level was set at α=0.05.

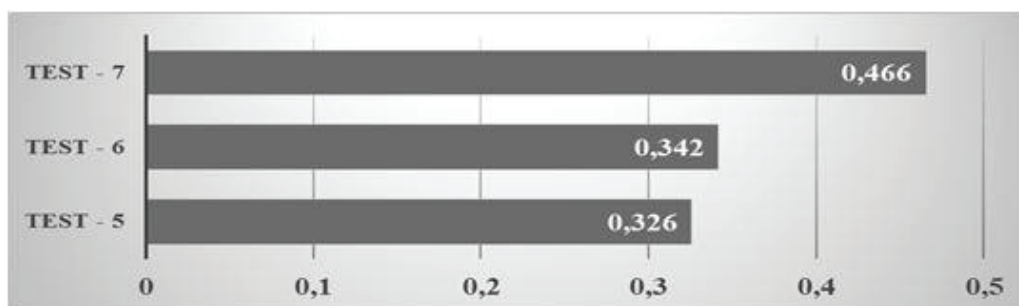


Figure 3. Correlation between explosive power indicators and ball speed of low-skilled football players

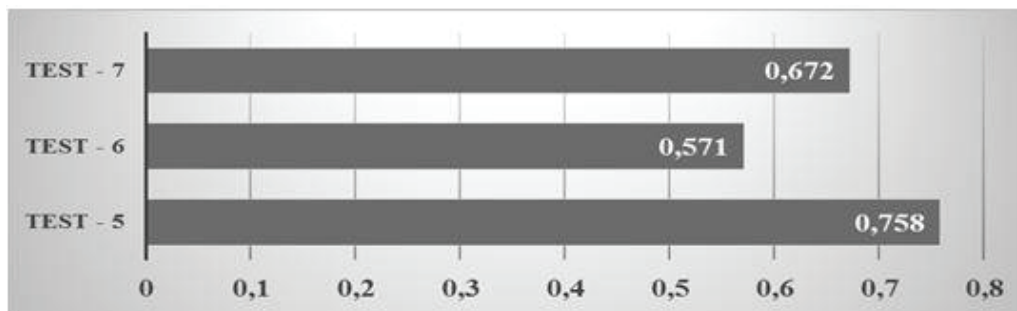


Figure 4. Correlation between explosive power indicators and ball speed of highly qualified football players

The summarized data are predisposition for disclosing the influence of the anthropometric and explosive power indicators on the ball speed of in-step kick in football. In the same time, we consider these results with the player's level of performance.

Discussion

The results of the correlation between the power indicators and the ball speed are in Figure 3 and Figure 4. The data about low-skilled players indicate moderate ($r=0.326$; $r=0.342$; $r=0.466$) correlation between the power indicators and ball speed. While the same correlation for highly qualified players is moderate to strong ($r=0.758$; $r=0.571$; $r=0.672$). We can conclude that the power indicators have greater importance for the highly qualified players than the low-skilled ones.

As we already marked there are differences in the correlation between anthropometric indicators and ball speed of the two researched groups (Fig.1 and Fig 2). First of all, low-skilled players have greatest dependence of the body height ($r=0.789$). On second place they depend on the weight ($r=0.681$) and on the third place – on the W/H_{index} ($r=0.508$). Absolutely opposite of the other group are the highly qualified players. They have weaker dependence of the anthropometric indicators with greatest value in favor of W/H_{index} ($r=0.515$) followed by the weight and the height. Their results are similar with the findings of other scientists that find greater influence of the explosive power (Rodrigo-Lorenzo, 2016; Bekris, 2015; Rodrigo-Lorenzo, 2015; Brahim, 2013). Obviously the anthropometric indicators are more important for the low skilled players than the highly qualified ones. The most substantial fact for this is the level of the technique (Rodríguez-Lorenzo, 2018. Takahashi, 2016; Rodrigo-Lorenzo, 2015; Cerrah, 2011; Young, 2004).

On the other hand, the established correlation of the W/H_{index} of the two groups directs us to the conclusion that the whole body mass and the length of its parts are important for generating greater ball speed. Of course this speed won't be achieved without proper kinematic structure of the movement and technique of execution.

The results of the correlation between the explosive power and the ball speed are different for the low-skilled players. This group has weaker correlation ($r=0.326$; $r=0.342$; $r=0.466$) with all of the indicators. On the other side the highly qualified players have moderate correlation with contact time ($r=0.571$) and coefficient of explosiveness ($r=0.672$) and strong correlation between average height of the jumps ($r=0.758$) and the ball speed. All of this points us to the conclusion that highly qualified players achieved bigger ball speed thanks to a better explosive power level (Rodríguez-Lorenzo, 2018; Rodríguez-Lorenzo, 2016; Takahashi, 2016; Noguchi, 2012; Young, 2011; Masuda, 2003).

Greater average height of the jump and shorter contact time are indicator that supposed better effort distribution for a minimum time that is linked to better movement coordination. The results are basis to

suppose that the lower level of coordination and technical skills are the main reason for weaker correlation of the low-skilled players.

The better results of the ball speed in the highly qualified group and the greater correlation between ball speed and the explosive power indicators points that the explosive power of the lower legs is essential for the in-step kick power. This means that in the training process for young players main part of the training needs to be technical and movement coordination whereas the training for the experienced players must emphasize on power training.

Conclusion

The findings that we made leads us to the statement that we must use different approach for improving the ball speed of in-step kick in soccer in different age groups and levels. In addition to the technical development of the two groups it is recommended that:

- The training process of the low-skilled players must include coordination exercises combined with explosive power;
- The highly qualified players must use power training with plyometric exercises.

In conclusion we think that on the basis of the found out results of the researched indicators we add something to the theory of the sports training. The practical application of this paper gives different directions for developing kicking abilities in different level of football players.

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AEROBIC AND MORPHOLOGICAL CHANGES IN THE ACADEMY OF CRIMINALISTIC AND POLICE STUDIES FEMALE STUDENTS - THREE YEARS FOLLOW-UP STUDIES

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Introduction

Police officers' duties such as giving first aid after a traffic accident or natural disasters, overcoming a suspect or controlling a group of people, require an above-average level of physical fitness while resolving specific incident events (Anderson and Plecas, 2000). It is confirmed that an insufficient level of developed physical abilities represents a limiting factor for officers to conduct professional duties, and can lead to low productivity, injuries or long-term disability. All stated above results in a loss of human resources and economic costs (Lonsway, 2003). In other words, development of physical abilities can affect the professional efficiency and it is related to the officers' health (Copay and Charles, 1998; Strating et al., 2010). Regarding the aforementioned, officers' physical abilities are an integral part of the selection process, education and regular testings during the police career (Bonneau and Brown, 1995).

Specialized physical education (SPE) is a narrow specialized field which is developed as an educational discipline from the scientific field physical culture, and it is dedicated to researching the applicable rules in motor space i.e. compared to moving structures which are necessary in terms of professional needs of the police, as well as educational rules compared to processes of given police education (Blagojević et al., 2006). Year after year ACPS (the Academy of Criminalistic and Police Studies) students i.e. future police officers are obliged to fulfill certain selection criteria which are at the same time indicator of their adaptation level to the applicable training load during their education through the subject SPE (Dopsaj and Vučković, 2006). Due to the possible use of coercive means, primarily it is referred to the smallest means of coercion - physical force, during conducting their tasks and duties, police officers have to be above all educated, healthy, physically fit and adequately trained and in training, from the aspect of general physical abilities but also adequate morphological status (Bonneau and Brown, 1995).

Increased values of basic morphological characteristics – body mass and body mass index (BMI) indicate possible worse health status, lowered level of physical i.e. working skills, especially when it comes to type of general and specific endurance as well as increased cardiovascular disease risk (Sörensen, 2005). The first negative work effects that impact police officers can be determined on the basis of changes in morphological dimensions, but also in motor and functional abilities (Đorđević and Mitrović, 2015). Practice has shown that insufficient level of motor skills is limiting factor for the quality of performing everyday police officers' tasks and duties (Mitrović & Vučković, 2014). Aerobic capacity is one of theirs' most important motor skills in order to be able to respond to all possible types of tasks in terms of quality (Cooper Institute for Aerobics Research, 2002; Roberts et al., 2002). According to published papers and textbooks in the field of sports science, an aerobic capacity is considered the most important component i.e. base of physical fitness (Jozić et al., 2014). In the Ministry of Interior of the Republic of Serbia Cooper 12 minutes running test is used to assess the aerobic capacity of police officers (Janković and Dimitrijević, 2012).

Since the foundation of the ACPS, the SPE plan and program has been reformed twice. At the first-established institution (Police Academy) there were two SPE programs, similar in number of classes and educational content. Lectures were organized during four years of studies and content included: martial arts, conditioning, swimming and skiing. Following the foundation of the ACPS the total number of classes has

been reduced by 80% and those classes are conducted during first three years of studies as the one-semester course.

The purpose of this research is to determine the impact of three years studies, in the new SPE curriculum, on the aerobic endurance and basic morphological characteristics of female students at ACPS.

Method

The research was carried out using the longitudinal research method. The initial measurement had been conducted on the ACPS entrance exam, and the final measurement was conducted three years after the entrance exam. The research involved 34 female students who enrolled at ACPS's basic academic studies in school year 2015/16 and finished the third year of studies on time. The average female examinees' age was 19.1 ± 0.4 year old at the initial testing. Basic morphological characteristics: body height (BH), body mass (BM) and body mass index (BMI) were measured using standardized procedures by experienced and trained experts for working on measuring instruments: Martin Anthropometer for measuring BH; body composition analyzer InBody720 (InBody720, 2005) for measuring BM and BMI. The aerobic capacity was assessed using Cooper 12 minutes running test for measuring the maximum distance which female examinees could master and results were presented in meters with an accuracy of 5 meters (Dopsaj et al., 2007). All results were presented using basic descriptive indicators, while MANOVA was used to determine differences between the initial and final measurements. Statistical significance is defined at the probability level 95% i.e. $p < 0.05$ (Hair et al., 1998), while a statistical package SPSS Statistics for Windows, Version 20.0, was used for statistical data processing.

Results

Table 1 displays basic descriptive indicators of the morphological characteristics and results achieved in Cooper test on entrance exam while Table 2 displays same variables measured after the end of the third year, Table 3 displays MANOVA results in order to determine the existence of a statistically significant difference between initial and final measurement.

Table 1. Basic descriptive data of the initial measurement

Variables	Mean	SD	Min.	Max.	Skew.	Kurt.
TV (cm)	168.5	5.3	160	185	1.092	1.239
TM (kg)	61.3	7.4	48	79	0.502	0.143
BMI (kg/m ²)	21.6	2	18	27	0.581	0.095
KT (m)	2322.5	233.3	1630	2880	-0.712	1.853

Table 2. Basic descriptive data of the final measurement

Variables	Mean	SD	Min.	Max.	Skew.	Kurt.
TV (cm)	168.8	5.0	161	182	0.880	0.207
TM (kg)	61.1	6.5	48	76	0.537	-0.009
BMI (kg/m ²)	21.5	2	19	26.8	1.096	0.769
KT (m)	2195	193.8	1800	2740	0.424	0.975

Reviewing basic descriptive indicators of morphological characteristics, it is assumed that body height was increased by 0.3 cm, and body mass (BM) and body mass index (BMI) were reduced by 0.2 kg and 0.1 kg/m². Meanwhile, a decrease in Cooper test results was found for 127.5 m.

Table 3. Results of MANOVA observed variables

Variables	Mean Square	F	Sig.
TV (cm)	1.139	0.042	0.838
TM (kg)	1.56	0.032	0.859
BMI (kg/m ²)	0.259	0.065	0.799
KT (m)	276356.25	6.005	0.017

Inspecting the MANOVA results, it is concluded that there was a statistically significant reduction of results at the level of 0.05 ($p = 0.017$) only in the Cooper Test (CT) variable from all the observed variables.

Discussion

The study results have shown a statistically significant reduction in the aerobic endurance during the three-year studies among ACPS female students by 5.8% ($F = 6.005$; $p = 0.017$), i.e. the lower results in CT on the final testing than on the initial testing. The statistically significant difference wasn't found (Table 3) in observed morphological characteristics (BH, BM and BMI).

The average values of the observed morphological characteristics during the three years of studies haven't been significantly changed. Tested female students, compared to the model characteristics of the basic anthropometric indicators of healthy and trained young people, are at the level of 45th ‰ for BH, 50th ‰ for BM and BMI (Dopsaj i sar., 2010). Aside from lower BH limit which is 165cm for females, BM is observed within the 3kg range or more i.e. 12kg less than BH lowered by 100cm. These selection criteria provide ACPS female students the lower BM and BMI values at the beginning of their studies (Dimitrijević, 2016).

The methodology of teaching SPE doesn't have continuity, i.e. it is the one-semester course with classes in the first, second and third year of studies (Dimitrijević et al., 2014). Though it has been confirmed that there is no statistically significant change in morphological characteristics during the three years of study, we can assume that the periods when the SPE is conducted have a positive effect on the morphological characteristics of female students. This assumption is based on the research of Mitrović and associates (2016), which had confirmed that during the period starting with passing the entrance exam up to the beginning of SPE course (eight months) there is a statistically significant increase of BMI for 0.8 kg/m², i.e. 3.8%. Morphological characteristics correlate with physical abilities, but with life habits also (Dimitrijević, 2016). Enrollment at the ACPS, life in the student dormitory and changes in the diet, as well as the semester without organized physical activities led to a decrease in physical fitness of female students (Mitrović et al., 2016). Attending the SPE classes and the obligation to fulfill the basic motor skills (BMS) norms, especially CT, indirectly influenced restoring the BMI values to the initial level.

In earlier researches which included the former Police academy students it was confirmed that special program for the development of aerobic capacity has a positive effect on the CT result for 7.9%. These results' improvements are the consequence of the applied training method which has been conducted five times a week for 20 minutes with 60 – 70% of maximum intensity (Milošević et al., 1995). The aerobic capacity development program had a positive effect on female students too. Women had statistically significant improved their running results up to the 3000m during the three years of studies (Lagestad and Van den Tillaar, 2014). However the research results carried out by Blagojević (2003) have shown that SPE (when the specialized program for the development of aerobic capacity isn't conducted) doesn't have a positive effect on CT. Students' aerobic skills have been decreased by 3.2% during the three years of studies. Though CT average values were decreased they were still above the norm.

Average value of the final measurement is 2195 ± 193.8 and it is also above the necessary level to pass BMS (Blagojević et al., 2006). To some extent this fact can explain the lower results compared to the entrance

exam because the stated value allows students to pass a BMS colloquium. Similar results were obtained from the cadets of the Military Academy. It is affirmed that 1600m running test results are increased in the first two years of studies but decreased and getting closer to initial values by the graduation date. However, the implemented program is considered satisfactory as the cadets have met the predicted standards (Marić et al., 2013).

During the ACPS entry exam BMS are estimated through general level of physical fitness (Dopsaj et al., 2007). Each candidate's goal is to achieve as many points as possible and BMS assessment is one of four ways to collect points for enrollment that is represented with 20% of hypothetical maximum. In the previous female researches, a positive trend of changes in the total points achieved at the entrance exam and in the BMS assessment was determined. Also, it was noticed that an increasing number of girls are applying for enrollment at ACPS (Janković and Koropanovski, 2017). This competition increase can positively affect the observed physical abilities of the candidates, which is confirmed with the research that has shown the positive trend of changes in CT results (Koropanovski et al., 2015). Based on the results obtained in this study, we can assume that the reasons for the CT decreased values, during the three-year studies, are on the one hand because of the reduced number of SPE classes and, on the other hand, because of the relatively adequate results that are average above the set norms of aerobic abilities.

Conclusion

The goal of this paper was to determine the impact of the three-year SPE program on the basic morphological characteristics and aerobic endurance of the ACPS female students. The research involved 34 female students who have finished the third year of basic academic studies on time after the enrollment. The initial measurement was carried out at the entrance exam and the final one after the end of third year. The results have shown that during this period there was a statistically significant decrease in female students' aerobic abilities by 5.8% ($F = 6.005$; $p = 0.017$). Possible causes of this decrease are found in a significant reduction of the number of SPE classes compared to the previous study programs and potentially depleted motivation for the final test preparation in comparison with the entrance exam.

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PROMENE AEROBNIH SPOSOBNOSTI I OSNOVNIH MORFOLOŠKIH KARAKTERISTIKA STUDENTKINJA KRIMINALISTIČKO-POLICIJSKE AKADEMIJE U TROGODIŠNJEM PERIODU

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Uvod

Posao policajaca prilikom rešavanja određenih incidentnih situacija, kao što su pomoć nakon udesa ili prirodnih nepogoda, savladavanje osumnjičenog ili kontrola grupe ljudi, zahteva natprosečni nivo fizičke pripremljenosti (Anderson and Plecas, 2000). Utvrđeno je da je nedovoljan nivo razvijenosti fizičkih sposobnosti limitirajući faktor u obavljanju profesionalnih zadataka policajaca, a može da dovede i do slabe produktivnosti, povrede ili dugoročnog invaliditeta. Sve navedeno ima za posledicu gubitak ljudskih resursa i ekonomske troškove (Lonsway, 2003). Drugim rečima, razvijenost fizičkih sposobnosti može da utiče na profesionalnu efikasnost i povezana je sa zdravljem policajaca (Copay and Charles, 1998; Strating et al., 2010) Zbog navedenog fizičke sposobnosti policajaca sastavni su deo selekcionog procesa, edukacije i redovnih provera tokom policijske karijere (Bonneau and Brown, 1995).

Specijalno fizičko obrazovanje (SFO) usko je specijalizovana oblast, koja se kao nastavna disciplina razvila iz naučne oblasti fizička kultura, i bavi se izučavanjem zakonitosti koje vladaju u odnosu na motorički prostor tj. u odnosu na kretne strukture koje su neophodne u smislu profesionalnih potreba policije, kao i zakonitostima edukacije u odnosu na procese datog policijskog obrazovanja (Blagojević et al., 2006). Studenti KPA, tj. budući policijski službenici, dužni su da iz godine u godinu ispunjavaju određene selekzione kriterijume koji istovremeno pokazuju i stepen njihove adaptacije na primenjena trenazna opterećenja tokom nastave na predmetu SFO (Dopsaj and Vučković, 2006). Zbog moguće upotrebe sredstava prinude, gde se pre svega misli na najblaže sredstvo prinude – fizičku snagu, tokom realizacije svojih poslova i zadataka, policijski službenici moraju biti prevashodno edukovani, zdravi, fizički sposobni i adekvatno uvežbani i utrenirani, sa aspekta opštih fizičkih sposobnosti ali i adekvatnog morfološkog statusa (Bonneau and Brown, 1995).

Povećane vrednosti osnovnih morfoloških karakteristika – telesne mase i indeksa mase tela (BMI) ukazuju na potencijalno lošiji zdravstveni status, smanjeni nivo fizičkih odnosno radnih sposobnosti, naročito po tipu opšte i specifične izdržljivosti, kao i na povećanje rizika od kardiovaskularnih oboljenja (Sörensen, 2005). Prvi negativni uticaji posla na policijske službenike mogu da se utvrde na osnovu promena u morfološkim dimenzijama, ali i motoričkim i funkcionalnim sposobnostima (Đorđević and Mitrović, 2015). Praksa je pokazala da nedovoljan nivo motoričkih sposobnosti predstavlja limitirajući faktor za kvalitetno obavljanje svakodnevnih poslova i zadataka policijskih službenika (Mitrović & Vučković, 2014). Aerobna sposobnost predstavlja za njih jednu od najbitnijih motoričkih sposobnosti kako bi mogli što kvalitetnije da odgovore na sve moguće vrste zadataka (Cooper Institute for Aerobics Research, 2002; Roberts et al., 2002). Prema objavljenim radovima i udžbenicima iz oblasti nauke o sportu, aerobna sposobnost smatra se najvažnijom komponentom odnosno bazom fizičke pripremljenosti (Jozić et al., 2014). Za procenu aerobne sposobnosti policijskih službenika MUP Republike Srbije, na proverama fizičkih sposobnosti, koristi se Kuperov test trčanja za 12 minuta (Janković and Dimitrijević, 2012).

Od osnivanja KPA dva puta je reformisan plan i program SFO. Na prvoformiranoj instituciji (Polijskoj akademiji) realizovana su dva programa SFO slična po broju časova i nastavnim sadržajima. Nastava se organizovala tokom sve četiri godine školovanja, a sadržaji su uključivali: borilačke veštine, kondicioniranje plivanje i skijanje. Formiranjem KPA, međutim, ukupan broj časova smanjen je za oko 80% i realizuje se u prve tri godine školovanja kao jednosemestralni predmet (Dimitrijević et al., 2014).

Cilj ovog istraživanja je da utvrdi uticaj trogodišnjeg studiranja po novom nastavnom planu i programu SFO na aerobnu izdržljivost i osnovne morfološke karakteristike studentkinja KPA.

Metode

Istraživanje je realizovano po metodi longitudinalnih istraživanja. Inicijalno merenje izvršeno je na prijemnom ispitu za upis na KPA, dok je finalno merenje urađeno tri godine posle prijemnog. U istraživanju su učestvovala 34 studentkinje koje su školske 2015/16. upisale osnovne akademske studije KPA i u roku završile treću godinu. Na inicijalnom testiranju prosečna starost ispitanica iznosila je 19.1 ± 0.4 godina starosti. Osnovne morfološke karakteristike: telesna visina (TV), telesna masa (TM) i indeks mase tela (BMI) merene su standardizovanim procedurama, i to TV antropometrom po Martinu, a TM i BMI pomoću analizatora telesne strukture InBody720 (InBody720, 2005), od strane iskusnih i obučanih stručnjaka za rad na mernom instrumentu. Aerobni kapacitet procenjivao se Kuperovim testom u trajanju 12 minuta za koje vreme se merila maksimalna distanca koju ispitanice mogu da savladaju i prikazana je u metrima s tačnošću od 5 metara (Dopsaj et al., 2007). Svi rezultati su prikazani korišćenjem osnovnih deskriptivnih pokazatelja, dok je za utvrđivanje razlika između inicijalnog i finalnog merenja korišćena ANOVA. Statistička značajnost definisana je na nivou verovatnoće od 95%, odnosno $p < 0.05$ (Hair et al., 1998), dok je za statističku obradu podataka upotrebljen statistički paket SPSS Statistics for Windows, Version 20.0.

Rezultati

U Tabeli 1 prikazani su osnovni deskriptivni pokazatelji morfoloških karakteristika i rezultata postignutih na Kuperovom testu na prijemnom ispitu dok su u Tabeli 2 prikazane iste varijable izmerene nakon završetka treće godine, a u Tabeli 3 pokazani su rezultati ANOVA kako bi se utvrdilo postojanje statistički značajne razlike između inicijalnog i finalnog merenja.

Tabela 1. Osnovni deskriptivni podaci inicijalnog merenja

Varijable	Mean	SD	Min.	Max.	Skew.	Kurt.
TV (cm)	168,5	5,3	160	185	1,092	1,239
TM (kg)	61,3	7,4	48	79	0,502	0,143
BMI (kg/m ²)	21,6	2	18	27	0,581	0,095
KT (m)	2322,5	233,3	1630	2880	-0,712	1,853

Tabela 2. Osnovni deskriptivni podaci finalnog merenja

Varijable	Mean	SD	Min.	Max.	Skew.	Kurt.
TV (cm)	168,8	5,0	161	182	0,880	0,207
TM (kg)	61,1	6,5	48	76	0,537	-0,009
BMI (kg/m ²)	21,5	2	19	26,8	1,096	0,769
KT (m)	2195	193,8	1800	2740	0,424	0,975

Pregledom osnovnih deskriptivnih pokazatelja morfoloških karakteristika može se konstatovati da je telesna visina povećana za 0.3 cm, a telesna masa (TM) i indeks telesne mase (BMI) smanjeni su za 0.2 kg odnosno 0.1 kg/m². Takođe, utvrđeno je i smanjenje rezultata na Kuperovom testu za 127.5 m.

Tabela 3. Rezultati ANOVA posmatranih varijabli

Varijable	Mean Square	F	Sig.
TV (cm)	1,139	0,042	0,838
TM (kg)	1,56	0,032	0,859
BMI (kg/m ²)	0,259	0,065	0,799
KT (m)	276356,25	6,005	0,017

Inspekcijom rezultata ANOVA može se konstatovati da je od svih posmatranih varijabli jedino kod varijable Kuperov test (KT) došlo do statistički značajnog smanjenja rezultata, na nivou 0.05 ($p = 0.017$).

Diskusija

Rezultati istraživanja pokazali su da je tokom trogodišnjeg studiranja statistički značajno smanjena aerobna izdržljivost studentkinja KPA za 5.8% ($F = 6.005$; $p = 0.017$), odnosno da je rezultat KT na finalnom testiranju bio slabiji za 127.5 m u odnosu na inicijalno. Kod posmatranih morfoloških karakteristika (TV, TM i BMI) nije utvrđena statistički značajna razlika (Tabela 3).

Prosečne vrednosti posmatranih morfoloških karakteristika tokom tri godine studija nisu se značajno promenile. U poređenju s modelnim karakteristikama osnovnih antropometrijskih pokazatelja zdravih i utreniranih mladih osoba testirane studentkinje pripadaju 45-om ‰ za TV, 50-om ‰ za TM i BMI (Dopsaj i sar., 2010). Morfološke karakteristike su jedan od selekcionih kriterijuma za upis na KPA. Osim donje granice TV koja za devojke iznosi 165 cm, posmatra se TM u rasponu od 3 kg više, odnosno 12 kg manje u odnosu na TV umanjenu za 100 cm. Ovakav selekциони kriterijum obezbeđuje niže vrednosti TM i BMI na početku školovanja studentkinja KPA (Dimitrijević, 2016).

Način realizacije nastave SFO nije kontinuiran, odnosno predmet je jednosemestralni i realizuje se u jednom semestru prve, druge i treće godine studija (Dimitrijević et al., 2014). Iako je utvrđeno da ne postoji statistički značajna promena morfoloških karakteristika tokom tri godine studija ipak možemo pretpostaviti da periodi kada se realizuje SFO imaju pozitivan uticaj na morfološke karakteristike studentkinja. Ova pretpostavka zasnovana je na istraživanju Mitrovića i saradnika (2016), kojim se utvrdilo da tokom perioda od prijemnog ispita do početka nastave SFO (osam meseci) dolazi do statistički značajnog povećanja BMI za 0.8 kg/m², odnosno 3.8%. Morfološke karakteristike koreliraju s fizičkim sposobnostima ali i sa životnim navikama (Dimitrijević, 2016). Upis na KPA, život u studentskom domu i promena načina ishrane, kao i semestar u kojem studentkinje nisu imale organizovane fizičke aktivnosti doveo je do smanjenja fizičkih određenih sposobnosti (Mitrović et al., 2016). Početak nastave SFO i obaveza ispunjenja normi bazičnih motoričkih sposobnosti (BMS), posebno KT, posredno su uticali na vraćanje vrednosti BMI inicijalnom nivou.

U ranijim istraživanjima na studentima tadašnje Policijske akademije utvrđeno je da poseban program za razvoj aerobnih sposobnosti pozitivno utiče na rezultat KT za 7.9%. Ova poboljšanja rezultata posledica su primenjenog načina vežbanja, koje se realizovalo pet puta u toku nedelje u trajanju od dvadeset minuta na intenzitetu od 60% do 75% od maksimuma (Milošević et al., 1995). Program razvoja aerobnih sposobnosti imao je pozitivne rezultate i kod studentkinja. Tokom tri godine studija žene su statistički značajno popravile rezultat trčanja na 3000 m (Lagestad and Van den Tillaar, 2014). Međutim, rezultati istraživanja koje je sproveo Blagojević (2003) pokazali su da nastava SFO (kada se ne realizuje poseban program za razvoj aerobnih sposobnosti) nema pozitivan uticaj na KT. Tokom tri godine studija aerobna sposobnost studenata smanjila se za 3.2%. Ipak, bez obzira na smanjenje prosečne vrednosti KT bile su iznad norme.

Prosečna vrednost finalnog merenja iznosi 2195±193.8 i takođe je iznad praga neophodnog za polaganje BMS (Blagojević et al., 2006). Ta činjenica u određenoj meri može da objasni lošije rezultate u odnosu na prijemni ispit jer navedena vrednost omogućava studentkinjama da polože kolokvijum BMS. Slični

rezultati dobijeni su i kod kadeta Vojne akademije. Utvrđeno je da se rezultat trčanja na 1600 m u prve dve godine studija poboljšava ali se do kraja školovanja pogoršava i približava inicijalnim vrednostima. Ipak, realizovan program se smatra zadovoljavajućim jer su kadeti ispunili predviđene standarde (Marić et al., 2013).

Na prijemnom ispitu za upis na KPA vrše se procene BMS koje se posmatraju u vidu generalnog nivoa fizičke pripremljenosti (Dopsaj et al., 2007). Cilj svakog kandidata je da ostvari što veći broj bodova, a procena BMS jedan je od četiri načina prikupljanja bodova za upis i zastupljena je sa 20% u odnosu na hipotetički maksimum. U dosadašnjim istraživanjima kod devojaka je utvrđen pozitivan trend promena ukupno ostvarenih bodova na prijemnom ispitu, pozitivan trend i kod procene BMS. Takođe, uočeno je da se sve veći broj devojaka prijavljuje za upis na KPA (Janković and Koropanovski, 2017). Ovo povećanje konkurencije može pozitivno da utiče na posmatrane fizičke sposobnosti kandidata, što potvrđuje istraživanje koje je pokazalo i pozitivan trend promena rezultata KT (Koropanovski et al., 2015). Na osnovu rezultata dobijenih u ovom istraživanju možemo pretpostaviti da se razlozi smanjenja vrednosti KT tokom trogodišnjeg studija nalaze s jedne strane u smanjenom broju časova SFO i sa druge strane u relativno adekvatnim rezultatima koji su u proseku iznad postavljenih normi aerobnih sposobnosti.

Zaključak

Cilj ovog rada bio je da se utvrdi uticaj trogodišnjeg programa SFO na osnovne morfološke karakteristike i aerobnu izdržljivost studentkinja KPA. U istraživanju su učestvovala 34 studentkinje koje su nakon upisa u roku završile treću godinu osnovnih akademskih studija. Inicijalno merenje realizovano je na prijemnom ispitu, a finalno nakon završetka treće godine. Rezultati su pokazali da je u ovom periodu došlo do statistički značajnog smanjenja aerobnih sposobnosti studentkinja za 5.8% ($F = 6.005$; $p = 0.017$). Mogući razlozi ovog smanjenja nalaze se u znatno smanjenom fondu časova SFO u odnosu na ranije programe, kao i potencijalno slabija motivacija za pripremu finalnog testiranja u odnosu na prijemni ispit.

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**Methodical aspects of the
effects of physical activity
application in young
athletes**

Metodički aspekti primene
fizičke aktivnosti u sportu
mlađeg uzrasta

IMPACT OF FOUR WEEKS PROGRAMMED TREATMENT ON FUNCTIONAL ABILITIES AMONG YOUNG ROWERS

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Introduction

Observing through structural approach, rowing belongs to the group of monostructural cyclic sports, whilst according to the dominant energy demands, belongs to a group of aerobic sports (Martin & Tomescu, 2017). It is also considered as a single and group sport where a rower launches a boat using a paddle. During the rowing process, the characteristic flow of physiology generated by muscular work places different tasks in front of the morphological and energetic capacity of sportsmen with the aim of obtaining optimal results as interaction of the muscular systems involved in the characteristic sequence of the movement (Ingham, Carter, Whyte & Doust, 2008). According to the aforementioned, the fundamental aim of scientific research in rowing is quantification of the degree of effectiveness of chemical energy released from the muscles, and its modalities of transformation due to the purely mechanical effects of rowing (Messias et al. 2015, Bechard et al. 2009). In rowing training, the seven-day micro cycle is an important short-term planning tool that is multi-programmed and applied to determine the quality of annual training programs. Training microcycles can vary by objectives, training methods, and extensibility and load intensity (R'Kiouak et al. 2018, Lindenthaler et al. 2018, Uali et al. 2012). Also, training micro cycles need to change depending on the work capacity, the athlete's recovery and regeneration needs as well as the schedule of competitions. With constant variations in training modalities, human physiology is easier to pass the super compensation phase after training, and athletes will be more easily able to deal with fatigue and avoid overtraining (Legaz-Arrese et al. 2015, Nieman et al. 1999). In accordance with the foregoing, the aim of this paper is to identify the functional status of rowing school attendants and to examine the effect of programmed 4-week training on the functional abilities of young athletes.

Methods

Sample of examinees and variables

The study used a sample of 10 male attendants of rowing school, aged 12.71 ± 1.23 years. All participants attended rowing school for approximately 4 months, 3 to 4 times weekly. Prior to the attendance to rowing school, participants did not have any kind of experience with rowing. After getting acquainted with the research goal, parents of all respondents gave oral consent to the research. During the measurement, the rowing ergometer (Concept2 Model D) and the rowing boats of type skiff (Filippi) and paddles (Macom) were used. All respondents were measured in four time points (pre-test, two transitional points and the final) measured in variables describing functional characteristics using rowing ergometer (Fe) or rowing boat (Fb): the time at 1000m on the rowing ergometer (Fe1000), the time at 1000m in the rowing boat (Fb1000), the time at 4000m on the ergometer (Fe4000), the time at 4000m in the rowing boat (Fb4000).

Experimental Factor

Following are modalities of applied trainings:

A0 - Training and Stabilization Techniques. Basic extensive Endurance (vegetative nervous system, capillarisation)

A1 - Development of Aerobic Endurance. Stabilization and Improvement of Endurance Level. Training of the technique.

A2 - Development of volitional factors. Endurance and strength. Aerobic capacities, intense endurance. Improvement of the oxygen consumption.

An1 – Improvement of specific endurance and tactics. Coordination within the Crew. Developing a Voluntary Factor. Improving oxygen reception.

An2 - Developing feeling for tempo during competition. Development of tactical abilities. Development of speed endurance. Competition.

The structure of training micro cycles is showed in Tables 1, 2, 3 and 4. It must be underlined that all parameters were controlled visually in accordance with comparative tables of pulse, tempo and intensity zone (Ilić, Rajković, 2009; FISA's trainer manual). Also, where used, tempo was defined as strokes per minute, and defined workout time for interval training was for pure training (i.e. 30 min of training is 5×6 minutes of training). Also, during pause, immediately after workout, participants calculated their pulses for 15 second period (i.e. 35 beats per 15 seconds equals 140 beats per minute). When tempo was not specified (i.e. ergometer 30 min), it was clearly stated that trainer's suggestions and feedback have to be applied.

Experimental procedure

During measurement days, participants were asked to have measurements in the morning (08:00-09:00) in the boat (Fb1000, Fb4000) and in the evening (18:00-19:00) using rowing ergometer (Fe1000, Fe4000). After 1000m (Fe or Fb) was done, pause of approximately 30 minutes was applied. Ergometer was manually set to targeted distance (1000 or 4000 meters), and all participants obtained precise instructions on usage.

All results were presented in minutes as decimal numbers (i.e. 04:30 equals 4.50)

Table 1. Structure of first applied micro cycle

Day	Training structure	Intensity
1	Initial testing	
2	Static (5 min) and dynamic warm-up: rope (10 min). Main part of the training: ergometer rowing (3×10 min, pause 3 min, tempo 20-22) Stretching (20 min).	A0
3	Static (5 min) and dynamic warm-up (15min). Running (30 min). Main part of the training: 5 cycles of interval training, pause between cycles 4 min. Stretching (25 min).	An2
4	Static (5 min) and dynamic warm-up running (20 min). Main part of the training: ergometer rowing (30 min). Stretching (20 min).	A1
5	Static (5 min) and dynamic warm-up running. Ergometer (30 min). Main part of the training: 5 cycles of interval training, pause between cycles 4 min. Stretching (25 min).	An2
6	Static (5 min) and dynamic warm-up with rope (10 min). Main part of the training: ergometer rowing (3×15 min, pause 3 min, tempo 20-22) Stretching (20 min).	A0
7	Static (5 min) and dynamic warm-up: rowing in the boat (5 km). Main part of the training: rowing in the boat (2×6000 m, pause 8 min, tempo 26-28). Stretching (20 min).	An1/An2

Table 2. Structure of second applied microcycle

Day	Training structure	Intensity
1	Resting day	
2	Static (5 min) and dynamic warm-up: rowing in the boat (5 km). Main part of the training: rowing in the boat (4×2000 m, pause 4 min, tempo 22-24). Stretching (20 min).	A1
3	Static (5 min) and dynamic warm-up: rowing in the boat (5 km). Main part of the training: rowing in the boat (2×6000 m, pause 8 min, tempo 26-28). Stretching (20 min).	An1/An2
4	Static (5 min) and dynamic warm-up: rowing in the boat (5 km). Main part of the training: rowing in the boat (14000 m, tempo 18-22). Stretching (20 min).	A0
5	Static (5 min) and dynamic warm-up: rowing in the boat (5 km). Main part of the training: rowing in the boat (4×1000 m, pause 6 min, tempo 28-32). Stretching (20 min).	An2
6	Static (5 min) and dynamic warm-up: rowing in the boat (5 km). Main part of the training: rowing in the boat (2×4000 m, pause 4 min, tempo 22-24). Stretching (20 min).	A0
7	First transitive testing	

Table 3. Structure of third applied microcycle

Day	Training structure	Intensity
1	Resting day	
2	Static (5 min) and dynamic warm-up (running, 20 min). Main part of the training: ergometer rowing (40 min, tempo 22-24). Stretching (20 min).	A1
3	Static (5 min) and dynamic warm-up running. Ergometer (30 min). Main part of the training: 5 cycles of interval training, pause between cycles 4 min. Stretching (25 min).	An2
4	Warming up (10 min). Main part of the training: running 60 min. Stretching (20 min).	A0
5	Static (5 min) and dynamic warm-up running (10 min). Main part of the training: ergometer rowing (3×15 min, pause 3 min, tempo 20-24). Stretching (20 min).	A1
6	Static (5 min) and dynamic warm-up running (20 min) + Main part of the training ergometer rowing (30 min, tempo 18-20) + Stretching (20 min)	A0
7	Second transitive testing	

Table 4. Structure of fourth applied microcycle

Day	Training structure	Intensity
1	Resting day	
2	Static (5 min) and dynamic warm-up running (20 min). Main part of the training: ergometer rowing (40 min, tempo 22-24). Stretching (20 min).	A1
3	Static (5 min) and dynamic warm-up: rowing in the boat (5 km). Main part of the training: rowing in the boat (2×6000 m, pause 8 min, tempo 26-28). Stretching (20 min).	An1/An2
4	Static (5 min) and dynamic warm-up with rope (10 min). Main part of the training: ergometer rowing (3×10 min, pause 3 min, tempo 20-22) Stretching (20 min).	A0
5	Static (5 min) and dynamic warm-up running + ergometer (30 min) + Main part of the training: 5 cycles of interval training, pause between cycles 4 min. Stretching (25 min).	An2
6	Static (5 min) and dynamic warm-up: rowing in the boat (5 km). Main part of the training: rowing in the boat (14000 m, tempo 18-22). Stretching (20 min).	A0
7	Final testing	

Data processing methods

Descriptive statistical parameters were calculated: mean and standard deviation. Kolmogorov – Smirnov test was used for normality assessment. Repeated measures ANOVA with Bonferroni correction were used and F value and p level have been calculated. Assumption of sphericity was tested and

Greenhouse-Geiser correction of degrees of freedom was applied. Partial eta squared (η^2) was used as effect size measure. Type one error was set at $\alpha=5\%$.

Results and discussion

Descriptive statistics and repeated measures ANOVA results are presented in Table 5. As stated previously, all results were presented in minutes as decimal numbers.

Table 5 Descriptive statistics and repeated measures ANOVA results.

	I	T1	T2	Final	F	p	η^2	Post-hoc
	M±SD	M±SD	M±SD	M±SD				
Fe1000	4.43±0.58	4.38±0.57	4.34±0.58	4.23±0.53	25.01	<0.01	0.735	I=T1<T2<F
Fb1000	5.45±0.59	5.37±0.48	5.33±0.49	5.20±0.51	10.40	<0.01	0.536	I=T1=T2<F
Fe4000	19.40±2.18	18.89±1.68	18.73±1.63	18.92±2.18	2.00	0.14	0.182	I=T1=T2=F
Fb4000	22.84±2.01	22.63±2.02	22.49±2.01	22.29±2.01	237.42	0.00	0.963	I<T1<T2<F

Legend: mean±standard deviation (M±SD), F value (F), p level (p), partial eta squared (η^2), pairwise comparisons using Bonferroni correction (Post-hoc).

As can be seen from the table 5, results showed significant impact of training programme on the three observed variables. Also, when F value appeared to be significant, Bonferroni corrections consistently revealed significant differences from second transitive and final measurement. Results are consistent with previous research (Lawton, Cronin, and McGuigan 2013, Bazzucchi et al. 2013, Hill 2002). Consequently, it can be stated that applied training programme may provide informations applicable in the rowing practice.

Conclusion

Sport success is no longer achieved by work that is not systematically, consistently evaluated, followed by training diagnosis and subject to changes that the results of such diagnosis require. In short, without diagnostic procedures, training processes are not quantifiable. With organized training programmes and measurements expert trainers can get information about the motor and functional status of rowers, the advantages and disadvantages and the deviations from desired and expected results. Additionally, diagnostics allow complete control of the training performed. Trainers need to have objective indicators that will allow them to evaluate the success of the training and, if necessary, overhaul plan and program over time, and thus make training more effective. Results of the research are implicitly pointing to the fact that rower's condition must be controlled constantly so if unwanted deviations appear, they will be clearly solved. The results of this research can provide important guidelines for the construction and optimization of the training sessions of the young rowers. Further research with larger samples and a control group would provide a larger amount of relevant information for trainers and scientists. Furthermore, it is expected that the data obtained will contribute to the appropriate selection of young rowers.

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Form UN1						
Evaluator:	_____	Date:	_____			
Student:	_____	Year of study:	_____			
School:	_____	Grade:	_____	No. of pupils:	_____	
<i>Parameters for evaluation of the teaching process quality</i>						
Introductory lessonpart	a) Organisation of introductory lesson part	1	2	3	4	5
	b) Content quality of introductory lesson part	1	2	3	4	5
	c) Quality of presentation methodology	1	2	3	4	5
	d) Quality of content realisation	1	2	3	4	5
Preparatory lessonpart	a) Organisation of preparatory lesson part	1	2	3	4	5
	b) Quality of general preparatory exercise series	1	2	3	4	5
	c) Quality of presentation methodology	1	2	3	4	5
	d) Realisation quality of general preparatory exercises	1	2	3	4	5
Main A lesson part	a) Organisation of main A lesson part	1	2	3	4	5
	c) Adequacy of didactical organisational forms of work	1	2	3	4	5
	d) Quality of presentation methodology	1	2	3	4	5
	e) Quality of realisation	1	2	3	4	5
Main B lesson part	a) Organisation of main B lesson part	1	2	3	4	5
	b) Content quality of main B lesson part	1	2	3	4	5
	c) Quality of presentation methodology	1	2	3	4	5
	d) Quality of realisation	1	2	3	4	5
Closing lesson part	a) Organisation of closing lesson part	1	2	3	4	5
	b) Quality of content	1	2	3	4	5
	c) Quality of presentation methodology	1	2	3	4	5
	d) Quality of realisation	1	2	3	4	5
Total mark		1	2	3	4	5

Appendix 1. Teaching process evaluation questionnaire – UN1

EFFECTS OF THE PROGRAMMED TRAINING ON FLEXIBILITY TRANSFORMATION IN 14-YEAR OLD FEMALE VOLLEYBALL PLAYERS

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Introduction

Volleyball is the sports branch featured by diverse and numerous complex, dynamic kinesiological activities (it belongs to the group of *high-intensity intermittent exercises* – HIIE). Therefore, from the analysis of the structure of volleyball game ((Nesic at al., 2011), it can be stated that the realization of actions depends on player's possibility to perform certain movements and motions of different intensity in different directions, using different body parts, which requires optimal development of all motor abilities (Nesic at al., 2013).. Most often, the research of volleyball belongs to the field of speed-strength abilities, while the research of flexibility, though equally important, are less frequent (Stojanovic at al., 2005).

Flexibility is the ability to perform a movement at a maximum amplitude in one or more joints, once or several times (Nešić, 2002; Gardašević at al., 2016). It depends also on some morphological features, type and substance of joints, on elasticity of joint attachments and on ligaments and tendons (Hunter at al., 2002). Namely, it is necessary to underline that too much flexibility can harm a female volleyball player, because in that case it can quite reduce the speed-strength manifestation, which is essential for volleyball game (Nesic, 20015). Only optimal flexibility of female volleyball players can enable usage up to maximal limits, of all potential possibilities in other motor abilities (explosivity, coordination, speed strength, agility ...). However, for a female player's quality manifestation of the volleyball technique she has to have a certain level of flexibility (Lee at al., 1989).

Primarily, the problem orientation of the research regarded establishing the effect of the proposed model of training stimuli within the 6- week preparatory period and their effect on quantitative changes of flexibility of 14-year old female volleyball players. Secondly, the research problem was also the perspective of the level of flexibility of 14-year old female volleyball players before and after the preparatory period.

The subject of this research was flexibility with 14-year old female volleyball players and its variability as a result of the offered training model in the preparatory period.

The basic aim of the research was to establish the level of quantitative changes of flexibility in 14-year old female volleyball players under the influence of the programmed volleyball training that included one 6-week preparatory period.

A hypothesis was made based on the aim of the research:

H₁: It is expected that significant quantitative changes shall occur in flexibility of 14-year old female volleyball players as a result of the programmed volleyball training process.

Research Method

The research method was experimental and as for the time direction it was a longitudinal research, aimed at determining quantitative changes of flexibility in 14-year old female volleyball players at two different points in time under the influence of the programmed training work, which encompassed the preparatory period for the competitive season in pioneer league of Belgrade.

The experimental phase lasted 7 weeks. Both groups had training sessions 5 times a week. Both groups had training sessions together, but the experimental group in the introductory-preparatory phase of the training session besides the athletic part (running) and calisthenics also implemented:

- exercises with pole for shoulder girdle, as well as the
- exercises that implied dynamic stretching of the hamstring, lumbar back and pelvic girdle.

The main and the final part of the training session were done by both groups together, i.e. both groups had the same treatment.

Only the results of those respondents who passed the complete training program were processed.

The sample of the respondents was divided into two sub-samples:

- experimental – 15 female volleyball players and
- control – 10 female volleyball players.

Both groups included the female players of the School of Volleyball DIF from Belgrade, aged 14 years. All respondents had regular medical check ups before the programmed training in order to ensure safe training sessions. Additionally, prior to the conducted experiment, the written consent was obtained from the players' parents or legal representatives.

The sample of variables included the measure of flexibility of the shoulder girdle and flexibility of the hamster, lumbar back and pelvic girdle.

In choosing the measuring instruments (tests) we took care that they met the basic measuring characteristics, that they were adjusted to age and objective substantive and spatial conditions (Milisic, 2003). The tests applied in this research, besides the anthropometric measurements (BH, BM, BMI, RR, MVDJ and MVDO), are the standardized tests for assessment of flexibility:

- *Pole stretch* (ISKRET) and
- *Sit and reach test* (SIR).



Slika 1. Performing a test with a stick (retrieved from Fratrić, http://www.sentazentasport.rs/old/reci_nauke/teorija-sportskog-treninga-fratric/3deo8.pdf)



Slika 2. Performing the test- Sit and Reach (retrieved from Fratrić, http://www.sentasport.rs/old/reci_nauke/teorija-sportskog-treninga-fratric/3deo8.pdf)

Experimental treatment: By using longtime personal experience in work with all age groups of female volleyball players and knowing the methods of work regarding training and improvement of the elements of volleyball game, development of motor abilities, we have decided to include an additional activity for the experimental group in the preparatory phase of the training session (Bompa, 2005), in the form of the pole stretching for shoulder girdle and exercises that implied dynamic stretching of the hamstring, lumbar back and pelvic girdle (performed independently with partner's assistance).

Both groups (experimental and control) conducted the main and the final parts of the training together and with no difference (they all did the same exercises). In the main part of the training, the work was primarily, oriented to elementary volleyball technique but also to some tactic variances necessary to boost efficiency at a competition. Consequently, that work could not affect the measurement results. In the final part of the training the task was to lower the physiological curve to optimal level with usage of the low-intensity content: stretching exercises and relaxation, competitive games of serving-hitting the target with a ball...

Statistical data processing: the data obtained in the research were processed by using descriptive and comparative statistics procedures. The segment of descriptive statistics including Arithmetic mean, minimum (min), maximum (max), standard deviation (SD), skewness and kurtosis was processed for each variable in both initial and final testing

For the segment of comparative statistics for establishment of the differences of the applied variables for flexibility testing at the beginning (initial state) and at the end (final state) of the training program in preparatory period, discriminative parametric procedure of t-test for small dependent samples was used.

Results and discussion

Table 1. Results of descriptive statistic - experimental group – initial measurement for the variables of anthropometric dimensions and flexibility measures

	N	Mean	Min	Max	SD	Skewness	Kurtosis
TV_e_i	15	166.15	158.30	175.50	4.48	0.31	0.05
TM_e_i	15	59.03	45.80	82.20	8.71	1.08	2.84
BMI_e_i	15	21.43	16.97	31.59	3.52	1.71	4.34
RR_e_i	15	166.55	154.50	183.80	7.09	0.77	1.58
MVDJ_e_i	15	215.43	206.00	230.70	6.46	0.63	1.01
MVDO_e_i	15	212.98	202.00	230.00	6.70	0.75	2.27
SiR_e_i	15	21.41	11.00	35.00	7.19	0.40	-0.49
Iskret_e_i	15	69.80	10.00	98.00	5.70	-1.62	4.59

Table 2. Results of descriptive statistic - control group – initial measurement for the variables of anthropometric dimensions and flexibility measures

	N	Mean	Min	Max	SD	Skewness	Kurtosis
TV_k_i	10	160.92	150.70	169.40	6.61	-0.04	-1.12
TM_k_i	10	51.94	41.60	63.30	7.00	-0.09	-0.59
BMI_k_i	10	19.99	17.90	22.35	1.72	0.35	-1.65
RR_k_i	10	159.19	148.00	173.00	7.51	0.53	-0.21
MVDJ_k_i	10	207.87	198.40	222.70	7.74	0.78	-0.10
MVDO_k_i	10	204.67	193.00	219.90	8.14	0.63	-0.10
SiR_k_i	10	19.43	9.70	24.00	4.63	-1.06	0.75
Iskret_k_i	10	72.40	56.00	87.00	9.95	-0.43	-0.46

Table 3. Results of descriptive statistic - experimental group – final measurement for the variables of anthropometric dimensions and flexibility measures

	N	Mean	Min	Max	SD	Skewness	Kurtosis
TV_e_f	15	166.14	158.20	175.40	4.44	.27	.09
TM_e_f	15	59.24	45.80	82.10	8.68	.99	2.68
BMI_e_f	15	21.50	16.97	31.56	3.46	1.74	4.56
RR_e_f	15	166.58	154.50	183.70	7.05	.75	1.57
MVDJ_e_f	15	215.46	206.10	230.50	6.41	.61	.92
MVDO_e_f	15	213.06	203.70	228.10	6.41	.61	.92
SiR_e_f	15	21.82	12.00	35.00	7.10	.43	-.42
Iskret_e_f	15	68.13	10.00	98.00	20.58	-1.46	4.03

Table 4. Results of descriptive statistic - control group – final measurement for the variables of anthropometric dimensions and flexibility measures

	N	Mean	Min	Max	SD	Skewness	Kurtosis
TV_k_f	10	160.95	150.60	169.50	6.69	-0.03	-1.12
TM_k_f	10	51.97	41.60	63.40	7.02	-0.07	-0.60
BMI_k_f	10	17.96	0.20	22.44	6.47	-2.74	8.16
RR_k_f	10	159.16	148.00	173.10	7.49	0.55	-0.11
MVDJ_k_f	10	207.87	198.50	222.80	7.75	0.82	-0.05
MVDO_k_f	10	205.47	196.10	220.40	7.75	0.82	-0.05
SiR_e_f	10	19.51	9.60	24.10	4.68	-1.11	0.87
Iskret_k_f	10	72.40	56.00	87.00	9.75	-0.36	-0.42

Tables 1 and 2 show the basic descriptive statistical parameters of groups of variables for assessment of flexibility and anthropometric features at the initial measurement in both experimental and control group, with calculated values of the following measures of central and dispersion tendency: arithmetic mean (Mean), standard deviation (SD), minimum (Min) and maximum (Max) values, coefficients of symmetry (Skewness) and kurtosis. Additionally, Tables 3. and 4. display the results of descriptive statistics of the final measurement in both control and experimental group for the variables of anthropometric dimensions and flexibility measures.

Table 5. Results of comparative statistics between experimental and control group at the initial measurement

	Paired Differences					t	df	Sig
	Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
SiR_e_i - SiR_k_i	2.810	11.109	3.513	-5.137	10.757	.800	9	.444
ISKRET_e_i - ISKRET_k_i	-3.50	22.461	7.102	-19.567	12.567	-.493	9	.634

By the comparison of the results of flexibility measures between control and experimental group (Table 5), it can be concluded that no statistically significant differences were manifested at the initial measurement, i.e. the sample was homogenous. This implies that each difference observed in the experimental group before and after the preparatory period resulted from the additional training process that focused on flexibility in shoulder girdle and hamster, lumbar back and pelvic girdle.

Table 6. Result of comparative statistics of initial and final measurement of anthropometric dimensions of the entire sample

	Paired Differences					t	df	Sig. 2-tailed
	Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
TV_i - TV_f	-60.952	4.781	.956	-1.759	2.855	-1.000	24	.327
TM_i - TM_f	-.136	.624	.125	-.394	.122	-1.089	24	.287
BMI_i - BMI_f	.767	4.073	.815	-.914	2.448	.942	24	.356
RR_i - RR_f	-.008	.119	.024	-.057	.041	-.337	24	.739
MVDJ_i - MVDJ_f	-.020	.132	.026	-.075	.035	-.756	24	.457
MVDO_i - MVDO_f	-.368	1.699	.340	-1.069	.333	-1.083	24	.289

Table 6 presents the results of comparative statistics and they confirm that there were no statistically significant differences before and after the preparatory period i.e. after 7 weeks of training. However, when we compare separately the results of experimental and control group, it can be asserted that there were no statistically significant difference between the results of flexibility measures at initial and final measurement. In other words, after the completion of the preparatory period, the players of control group did not manifest more significant changes in flexibility measures. (SiR – sig = .161, a ISKRET – sig = 1.00) (Table 7).

Table 7. Results of comparative statistics of initial and final measurement of flexibility measures in the control group

	Paired Differences					t	df	Sig
	Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
SIR_i - SIR_f	-.10000	.14907	.04714	-.21	.01	-2.12	9	.161
ISKRET_i - ISKRET_f	.00000	.66667	.21082	-.47	.47	.000	9	1.00

On the other hand, Table 8. presents the results of the comparative statistics in the experimental group and based on them, it can be concluded that there were statistically significant differences in flexibility measures i.e. that the additional training process of 7 weeks resulted in positive outcomes and improved flexibility in shoulder girdle (ISKRET – sig = .002) and hamstring, lumbar back and pelvic girdle (SiR – sig = .000).

Table 8. Results of comparative statistics of initial and final measurement of flexibility measures in the experimental group

	Paired Differences					t	df	Sig
	Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
SIR - SIR_f	-.413	.410	.105	-.640	-.186	-1.90	14	.002
ISKRET - ISKRET_f	1.666	1.175	.303	1.015	2.317	1.49	14	.000

Conclusion

Based on the obtained results, it can be concluded that there are statistically significant differences in both variables for flexibility assessment (the variable for assessment of shoulder girdle flexibility and the variable for assessment of hamstring, lumbar back and pelvic girdle flexibility). Therefore, it can be said that positive statistically significant partial effects occurred in preparatory period which confirmed the set hypothesis i.e. the partial quantitative effects (changes) in all flexibility variables were obtained as variables changes occurred as a result of the applied training program in preparatory period.

In volleyball, flexibility alone does not mean a lot and cannot result in particular efficiency or winning of the match, but it is very important as prevention from injuries, especially the chronic ones (accumulation of micro traumas, caused by training i.e. number of repetition). No matter that there are no contacts with the opponent in volleyball, there are numerous injuries, and one of the reasons could be found in reduced flexibility of the studied joints. It is, therefore, recommended to include obligatory exercises for development and maintenance of flexibility in training sessions, especially for the most loaded joints in the volleyball.

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EFEKTI PROGRAMIRANOG TRENAŽNOG RADA NA TRANSFORMACIJU FLEKSIBILNOSTI KOD ODBOJKAŠICA UZRASTA 14 GODINA

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Uvod

Odbojka je sportska grana koju karakterišu raznovrsne i brojne složene dinamičke kineziološke aktivnosti (pripada grupi *visoko-intenzivnih intermitentnih sportskih igara* (engl. HIIE – High-Intensity Intermittent Exercise). Analizirajući strukturu odbojkaške igre (Nešić at al., 2011), može se konstatovati da realizacija akcija zavisi od mogućnosti igrača/ice da izvede određene pokrete i kretanja različitog intenziteta, u različitim pravcima i različitim delovima tela, koje zahtevaju optimalno razvijene sve motoričke sposobnosti (Nešić at al., 2013). Najčešća istraživanja u odbojci su iz prostora brzinsko-snažnih sposobnosti, a mnogo manje su prisutna ispitivanja fleksibilnosti, za koje se ne može reći da su manje važna (Stojanović at al., 2005).

Fleksibilnost predstavlja sposobnost izvođenja pokreta maksimalnom amplitudom u jednom ili više zglobova, jednom ili više puta (Nešić, 2002; Gardašević at al., 2016). Ona zavisi i od nekih morfoloških obeležja, od vrste i građe zglobova, od elastičnosti zglobnih veza, ligamenata i tetiva (Hunter at al., 2002). Naime, potrebno je istaći da prevelika fleksibilnost, pre može da šteti odbojkašici, jer je tada brzinsko-snažno ispoljavanje prilično umanjeno, a ono je od presudne važnosti za odbojkašku igru (Nešić, 2005). Samo optimalna fleksibilnost odbojkašica, može omogućiti da se do maksimalnih granica daju iskoristiti sve potencijalne mogućnosti u drugim motoričkim sposobnostima, (eksplozivnost, koordinacija, brzina, brzinska snaga, agilnost...). Takođe, da bi igračica kvalitetno mogla da ispoljava odbojkašku tehniku, mora posedovati određeni nivo fleksibilnosti (Lee at al., 1989).

U primarnom smislu, problemska orijentacija istraživanja odnosila se na utvrđivanje efekata ponuđenog modela trenažnih stimulusa u okviru pripremnog perioda u trajanju od šest nedelja i njihovog uticaja na kvantitativne promene fleksibilnosti odbojkašica, uzrasta 14 godina. U sekundarnom smislu, problem istraživanja je predstavljao i sagledavanje nivoa fleksibilnosti odbojkašica uzrasta 14 godina pre i posle pripremnog perioda.

Predmet ovog istraživanja je fleksibilnost odbojkašica uzrasta 14 godina, kao i njena varijabilnost izazvana ponuđenim modelom treninga u pripremnom periodu. Osnovni cilj istraživanja je bio da se utvrdi nivo kvantitativnih promena fleksibilnosti kod odbojkašica uzrasta 14 godina, pod uticajem programiranog odbojkaškog treninga, koji je obuhvatio jedan pripremini period u trajanju od šest nedelja.

Na osnovu cilja istraživanja postavljena je jedna hipoteza:

H₁: Očekuje se da će poduticajem programiranog odbojkaškog trenažnog procesa doći do značajnih kvantitativnih promena fleksibilnosti kod odbojkašica uzrasta 14 godina.

Metod istraživanja

Metod rada je eksperimentalni, a prema vremenskoj usmerenosti je longitudinalno istraživanje, sa ciljem da se u vremenski različite dve tačke utvrde kvantitativne promene fleksibilnosti kod odbojkašica uzrasta 14 godina pod uticajem programiranog trenažnog rada, koji je obuhvatio pripremini period za takmičarsku sezonu u pionirskoj ligi Beograda.

Eksperimentalni tretman je trajao 7 nedelja. Obe grupe su imale 5 puta nedeljno trening. Treningu su radile obe grupe zajedno, sa razlikom što je eksperimentalna grupa u uvodno-pripremnoj fazi treninga pored atletskog dela (trčanje) i vežbi oblikovanja sprovodila i:

- vežbe sa motkom za rameni pojas, kao i
- vežbe koje su podrazumevale dinamičko istežanje zadnje lože nadkolenice, lumbalnog dela leđa i karličnog pojasa.

Glavni i završni deo treninga su obe grupe izvodile zajedno, odnosno sproveden je isti tretman na obe grupe.

Za obradu podataka su uzeti samo rezultati onih ispitanika koji su prošli kompletan program rada.

Uzorak ispitanika je podeljen u dva subuzorka:

- eksperimentalni – 15 odbojkašica i
- kontrolni – 10 odbojkašica.

Obe grupe su odbojkašice škole odbojke DIF iz Beograda, uzrasta 14 godina. Svi ispitanici su pre programiranog rada uredno prošli sistematske preglede da bi sa sigurnošću mogli pristupiti trenažnom procesu. Takođe, pre sprovedenog eksperimenta, dobijene su pismene dozvole od roditelja ili zakonitih zastupnika odbojkašica.

Uzorak varijabli su mera fleksibilnosti ramenog pojasa i fleksibilnost zadnje lože nadkolenice, lumbalnog dela leđa i karličnog pojasa.

Prilikom izbora mernih instrumenata (testova) vodilo se računa da oni zadovoljavaju osnovne metrijske karakteristike, da su prikladni uzrastu i objektivnim materijalnim i prostornim uslovima (Milišić, 2003). Testovi primenjeni za ovo istraživanje, pored *antropometrijskih merenja* (TV, TM, BMI, RR, MVDJ i MVDO), su standardizovani testovi za procenu fleksibilnosti:

- *iskret palicom* (ISKRET) (sl. 1) i
- *Sit and reach test* (SIR) (sl. 2).



Slika 1. Prikaz izvođenja testa *iskret palicom* (preuzeto od Fratrić, http://www.senta-zentasport.rs/old/reci_nauke/teorija-sportskog-treninga-fratric/3deo8.pdf)



Slika 2. Test izvođenja testa Sit and Reach (preuzeto od Fratrić, http://www.sentasport.rs/old/reci_nauke/teorija-sportskog-treninga-fratric/3deo8.pdf)

Eksperimentalni tretman: Koristeći dugogodišnja lična iskustva u radu sa svim uzrasnim kategorijama odbojkašica, poznavajući metode rada koje se odnose na obučavanje i usavršavanje elemenata odbojkaške igre, zatim na razvoj motoričkih sposobnosti, autori ovog rada su odlučili da u uvodno-pripreмноj fazi treninga sprovedu na eksperimentalnoj grupi dodatnu aktivnost (Bompa, 2005), u smislu rada sa motkom za rameni pojas i vežbe koje su podrazumevale dinamičko istežanje zadnje lože nadkolenice, lumbalnog dela leđa i karličnog pojasa (izvodeći ih samostalno i uz pomoć partnera).

Glavni i završni deo treninga su obe grupe (eksperimentalna i kontrolna) izvodile zajedno i bez razlike (svi su radili iste vežbe). U glavnom delu treninga je, pre svega, rad bio usmeren na elementarnu odbojkašku tehniku, ali i na određene taktičke varijante, potrebne za podizanje efikasnosti u toku takmičenja, tako da taj rad nije mogao da utiče na rezultate merenja. U završnom delu treninga zadatak je bio spuštavanje fiziološke krive na optimalan nivo, a korišćeni su sadržaji niskog intenziteta: vežbe istežanja i relaksacije, takmičarske igre servisa – pogađanje loptom u određeni cilj...

Statistička obrada podataka: Podaci dobijeni istraživanjem obrađeni su postupcima deskriptivne i komparativne statistike. U segment deskriptivne statistike, za svaku varijablu i u inicijalnom i u finalnom testiranju obrađeni su:

- Aritmetička sredina - Mean
- Minimum - Min
- Maksimum – Max
- Standardna devijacija – SD
- Mera simetrije – Skewness i
- Mera spljoštenosti – Kurtosis

U segment komparativne statistike, za utvrđivanje razlika primenjenih varijabli za procenu fleksibilnosti na početku (inicijalno stanje) i kraju (finalno stanje) trenažnog programa u pripremnom periodu, korišćena je diskriminativna parametrijska procedura t-test za male zavisne uzorke.

Rezultati i diskusija

Tabela 1. Rezultati deskriptivne statistike - eksperimentalna grupa - inicijalno merenje za varijable antropometrijskih dimenzija i mera fleksibilnosti

	N	Mean	Min	Max	SD	Skewness	Kurtosis
TV_e_i	15	166,15	158,30	175,50	4,48	0,31	0,05
TM_e_i	15	59,03	45,80	82,20	8,71	1,08	2,84
BMI_e_i	15	21,43	16,97	31,59	3,52	1,71	4,34
RR_e_i	15	166,55	154,50	183,80	7,09	0,77	1,58
MVDJ_e_i	15	215,43	206,00	230,70	6,46	0,63	1,01
MVDO_e_i	15	212,98	202,00	230,00	6,70	0,75	2,27
SiR_e_i	15	21,41	11,00	35,00	7,19	0,40	-0,49
Iskret_e_i	15	69,80	10,00	98,00	5,70	-1,62	4,59

Tabela 2. Rezultati deskriptivne statistike - kontrolna grupa - inicijalno merenje za varijable antropometrijskih dimenzija i mera fleksibilnosti

	N	Mean	Min	Max	SD	Skewness	Kurtosis
TV_k_i	10	160,92	150,70	169,40	6,61	-0,04	-1,12
TM_k_i	10	51,94	41,60	63,30	7,00	-0,09	-0,59
BMI_k_i	10	19,99	17,90	22,35	1,72	0,35	-1,65
RR_k_i	10	159,19	148,00	173,00	7,51	0,53	-0,21
MVDJ_k_i	10	207,87	198,40	222,70	7,74	0,78	-0,10
MVDO_k_i	10	204,67	193,00	219,90	8,14	0,63	-0,10
SiR_k_i	10	19,43	9,70	24,00	4,63	-1,06	0,75
Iskret_k_i	10	72,40	56,00	87,00	9,95	-0,43	-0,46

Tabela 3. Rezultati deskriptivne statistike - ekperimentalna grupa - finalno merenje za varijable antropometrijskih dimenzija i mera fleksibilnosti

	N	Mean	Min	Max	SD	Skewness	Kurtosis
TV_e_f	15	166,14	158,20	175,40	4,44	,27	,09
TM_e_f	15	59,24	45,80	82,10	8,68	,99	2,68
BMI_e_f	15	21,50	16,97	31,56	3,46	1,74	4,56
RR_e_f	15	166,58	154,50	183,70	7,05	,75	1,57
MVDJ_e_f	15	215,46	206,10	230,50	6,41	,61	,92
MVDO_e_f	15	213,06	203,70	228,10	6,41	,61	,92
SiR_e_f	15	21,82	12,00	35,00	7,10	,43	-,42
Iskret_e_f	15	68,13	10,00	98,00	20,58	-1,46	4,03

Tabela 4. Rezultati deskriptivne statistike - kontrolna grupa - finalno merenje za varijable antropometrijskih dimenzija i mera fleksibilnosti

	N	Mean	Min	Max	SD	Skewness	Kurtosis
TV_k_f	10	160,95	150,60	169,50	6,69	-0,03	-1,12
TM_k_f	10	51,97	41,60	63,40	7,02	-0,07	-0,60
BMI_k_f	10	17,96	0,20	22,44	6,47	-2,74	8,16
RR_k_f	10	159,16	148,00	173,10	7,49	0,55	-0,11
MVDJ_k_f	10	207,87	198,50	222,80	7,75	0,82	-0,05
MVDO_k_f	10	205,47	196,10	220,40	7,75	0,82	-0,05
SiR_e_f	10	19,51	9,60	24,10	4,68	-1,11	0,87
Iskret_k_f	10	72,40	56,00	87,00	9,75	-0,36	-0,42

U tabelama 1. i 2. prikazani su osnovni deskriptivni statistički parametri skupova varijabli za procenu fleksibilnosti i antropometrijskih osobina na inicijalnom merenju i kod kontrolne i kod eksperimentalne grupe, gde su izračunate vrednosti mera centralne i disperzione tendencije i to: aritmetička sredina (Mean), standardna devijacija (SD), minimalne (Min) i maksimalne (Max) vrednosti, koeficijenti simetrije (Skewness) i spljoštenosti (Kurtosis). Takođe, u tabelama 3. i 4. su dati rezultati deskriptivne statistike finalnog merenja i kod kontrolne i kod eksperimentalne grupe za varijable antropometrijskih dimenzija i mera fleksibilnosti.

Tabela 5. Rezultati komparativne statistike između eksperimentalne i kontrolne grupe na inicijalnom merenju

	Paired Differences					t	df	Sig
	Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
SiR_e_i - SiR_k_i	2,810	11,109	3,513	-5,137	10,757	,800	9	,444
ISKRET_e_i - ISKRET_k_i	-3,50	22,461	7,102	-19,567	12,567	-,493	9	,634

Upoređujući rezultate mera fleksibilnosti između kontrolne i eksperimentalne grupe (tabela 5), može se konstatovati da na inicijalnom merenju nije bilo statistički značajnih razlika, odnosno uzorak je bio homogen. Iz ovoga proizilazi da svaka razlika uočena kod eksperimentalne grupe pre i posle pripremnog perioda su rezultat dopunskog trenažnog procesa, koji je potencirao fleksibilnost u ramenom pojasu i zadnje lože nadkolenice, lumbalnog dela leđa i karličnog pojasa.

Tabela 6. Rezultati komparativne statistike inicijalnog i finalnog merenja antropometrijskih dimenzija za ceo uzorak

	Paired Differences					t	df	Sig, 2-tailed
	Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
TV_i - TV_f	-60,952	4,781	,956	-1,759	2,855	-1,000	24	,327
TM_i - TM_f	-,136	,624	,125	-,394	,122	-1,089	24	,287
BMI_i - BMI_f	,767	4,073	,815	-,914	2,448	,942	24	,356
RR_i - RR_f	-,008	,119	,024	-,057	,041	-,337	24	,739
MVDJ_i - MVDJ_f	-,020	,132	,026	-,075	,035	-,756	24	,457
MVDO_i - MVDO_f	-,368	1,699	,340	-1,069	,333	-1,083	24	,289

U tabeli 6. su prikazani rezultati komparativne statistike i govore u prilog tome, da nema statistički značajnih razlika pre i posle pripremnog perioda, odnosno nakon 7 nedelja treninga. Ipak, kada se uporede rezultati, posebno eksperimentalne, a posebno kontrolne grupe, može se konstatovati da kod kontrolne grupe nije bilo statistički značajne razlike između rezultata mera fleksibilnosti kod inicijalnog i finalnog merenja. Drugim rečima, nakon završenog pripremnog perioda odbojkašice kontrolne grupe, nisu pokazale značajnije promene u merama fleksibilnosti (SiR – sig = .161, a ISKRET – sig = 1.00) (tabela 7).

Tabela 7. Rezultati komparativne statistike inicijalnog i finalnog merenja kontrolne grupe za mere fleksibilnosti

	Paired Differences					t	df	Sig
	Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
SIR_i - SIR_f	-,10000	,14907	,04714	-,21	,01	-2,12	9	,161
ISKRET_i - ISKRET_f	,00000	,66667	,21082	-,47	,47	,000	9	1,00

S druge strane, tabela 8. prikazuje rezultate komparativne statistike kod eksperimentalne grupe, odnosno na osnovu nje se može izvesti zaključak da je došlo da statistički značajnih razlika u merama fleksibilnosti, tj, sprovedeni dodatni trenažni proces u trajanju od 7 nedelja je dao pozitivne rezultate i poboljšao fleksibilnost u ramenom pojasu (ISKRET – sig = .002) i zadnje lože nadkolenice, lumbalnog dela leđa i karličnog pojasa (SiR – sig = .000).

Tabela 8. Rezultati komparativne statistike inicijalnog i finalnog merenja eksperimentalne grupe za mere fleksibilnosti

	Paired Differences					t	df	Sig
	Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
SIR - SIR_f	-,413	,410	,105	-,640	-,186	-1,90	14	,002
ISKRET - ISKRET_f	1,666	1,175	,303	1,015	2,317	1,49	14	,000

Zaključak

Na osnovu dobijenih rezultata, može se konstatovati da postoje statistički značajne razlike kod obe varijable za procenu fleksibilnosti (varijabla za procenu fleksibilnosti ramenog pojasa i varijabla za procenu fleksibilnosti zadnje lože nadkolenice, lumbalnog dela leđa i karličnog pojasa), te se stoga može reći da je došlo do pozitivnih statistički značajnih parcijalnih efekata trenažnog programa u pripremnom periodu, čime je potvrđena postavljena hipoteza, odnosno parcijalni kvantitativni efekti (promene) kod svih varijabli u prostoru fleksibilnosti, dobijeni su kao rezultat primenjenog trenažnog programa u pripremnom periodu.

Fleksibilnost u odbojci, sama po sebi, ne znači mnogo i ne može doneti neke posebne rezultate u smislu efikasnosti ili pobede na utakmici, ali je veoma važna u preventivi od povređivanja, posebno hroničnih povreda (nagomilavanje mikro trauma, izazvanih treningom, odnosno brojem ponavljanja). Bez obzira što u odbojci nema kontakta sa protivnikom, povreda ima jako puno, a jedan od razloga je svakako i smanjena fleksibilnost u istraživanim zglobovima. Dakle, preporuka je da se u trening uvedu obavezne vežbe za razvoj i održavanje fleksibilnosti, a posebno u u najopterećenijim zglobovima u odbojkaškom sportu.

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PHYSICAL DEVELOPMENT FACTOR STRUCTURE AND SPECIFIC PERFORMANCE OF 15-16 -YEAR –OLD CYCLISTS FROM BULGARIA

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Introduction

Factor structure disclosure and identifying the main factors of physical development and specific performance is a task of particular importance. Бопукова, М. [2013]. Its solution allows to quantify the influence (importance) of each physical development and specific development sings because it is more profitable to work more on qualities represented by the performance of greater importance than on those with littler influence on the sport result. Ценов, И. [2015].

Unfortunately, in Bulgaria there is still not established methodology for objective measure of basic physical characteristics and specific motor abilities skills as a criterion from assessing athletes' development in cycling and help predicting development of sport result.

By this logic, using factor analysis can be identified certain essential criteria for successful sport selection for athletes training cycling and help optimization of educational and training process during future training sessions with young cyclists.

The **aim** of the following study is to reveal the factor structure and identify the main factors of physical development and specific sport performance in 15-16-year-old cyclists (boys) from Bulgaria.

Method

The study was conducted during 2014-2016.

Subject of the following study is the system for sport selection and orientation and initial training of young cyclists.

We analyze the physical development, the level of physical preparedness and technical and tactical abilities of young cyclists from the Republic of Bulgaria.

Respondents of the study are 20 boys, training cycling in Bulgaria cycling clubs.

For the purposes of the study we implemented the following test methods:

- theoretical and logical analysis of specialized scientific literature;
- anthropometry;
- sport-pedagogical testing;

The applied test battery includes 15 indexes divided into the following characteristic groups:

- assessment of physical development – 2 indexes (incl. BMI – Body Mass Index);
- assessment of physical preparedness level – 7 indexes;
- assessment of specific technical and tactical preparedness level – 5 indexes.

The obtained results were subject to specific mathematical and statistical processing through variance and factor analysis.

Results analysis

The results from the factor analysis from the baseline testing with the respondents (aged 15-16-year-old) are presented as a part of special factor matrix (see Table 1). As stated above, in this age group, after

application of factor analysis procedures we outlined four main factors which generally explain high percentage of the starting dispersion of studied phenomenon (75,44%). Table 1 and Figure 1 present relative shares of the explained by each factor output dispersion of studied phenomenon – physical development and specific sport performance of 15-16-year-old cyclists.

When identifying and ranking the factors we taken into account the following parameters and criteria:

- the percentage of explained by any factor output dispersion of studied phenomenon (Σa^2);
- the level of expression of factor in the overall factors structure, which reveals information about values of h^2 ;
- the factor weight of each index in a given factor and its direction (sign) that reveal the strength and character of relationship (positive or negative) between indexes within the individual factor.

Table 1. Physical development and specific sport performance factor structure of 15-16 years old cyclists.

Nº	indexes \ factors	I	II	III	IV	h^2	$1-h^2$
1.	30 m - crouch start	0.645	-0.408	0.141	-0.119	0.617	0.383
2.	30 m - standing start	0.653	-0.238	-0.006	-0.04	0.485	0.515
3.	100 m	0.851	0.095	-0.305	-0.181	0.859	0.141
4.	200 m	0.878	0.008	-0.115	-0.241	0.842	0.158
5.	500 m	0.88	0.037	-0.289	-0.217	0.906	0.094
6.	1000 m	0.874	-0.222	-0.074	-0.183	0.853	0.147
7.	2000 m	-0.109	0.034	0.048	0.419	0.191	0.809
8.	Hand dynamometry - strong upper limb	0.031	0.823	0.248	-0.013	0.74	0.26
9.	Hand dynamometry - weak upper limb	-0.525	0.688	0.071	0.098	0.763	0.237
10.	Forward body incline	-0.102	0.822	0.015	0.141	0.707	0.293
11.	Standing long jump	-0.771	0.08	-0.043	0.21	0.647	0.353
12.	Vertical jump	-0.797	0.222	0.316	-0.063	0.788	0.212
13.	Height	-0.255	0.16	-0.338	0.883	0.984	0.016
14.	Weight	-0.397	0.32	0.73	0.37	0.93	0.07
15.	BMI	-0.143	0.136	0.911	-0.365	0.999	0.001
Σa^2 (%)		37.66%	15.43%	12.42%	9.93%	75.44%	

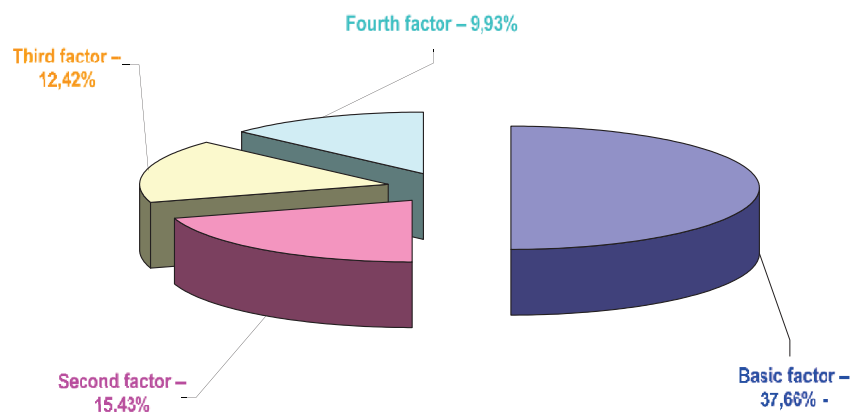


Figure 1. Relative shares of explained by every factor output dispersion for 15-16-year-old cyclists.

Analysis of the presented above Table 1 and Figure 1 show that the basic factor explains the extremely high percentage (37.66%) of start dispersion of studied phenomenon. The next three factors have

lower contribution to the overall physical development and specific performance of boys in the studied age group (respectively 15.43%, 12.42% and 9.9%).

The first factor in the age 15-16-year-old cyclists (Fig. 2) explains the high percentage of starting dispersion for respondents (37.66%).

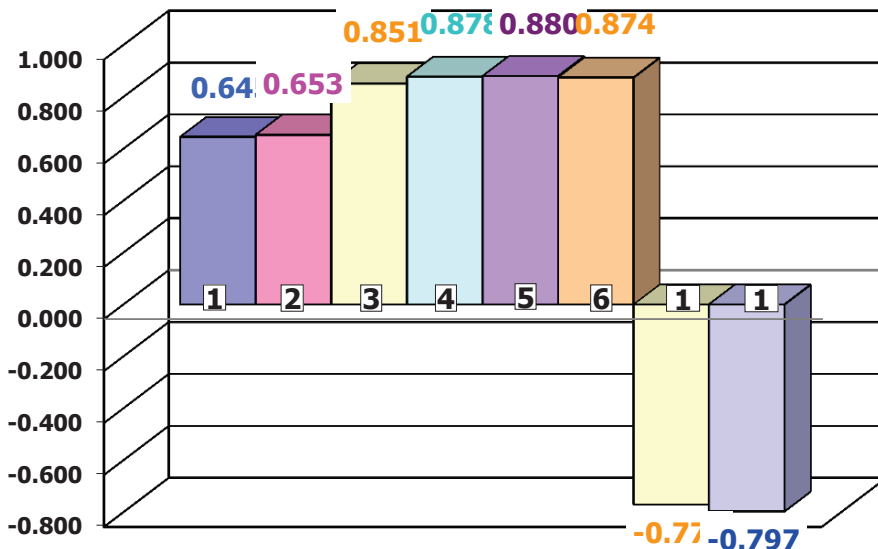


Figure 2. Factor structure of physical development and specific workability of 15-16-year-old cyclists – 1st factor.

The second factor (15.43%) determines the place of grip strength and body flexibility in the factor structure of physical development and specific workability of 15-16-year-old cyclists (see Fig. 3).

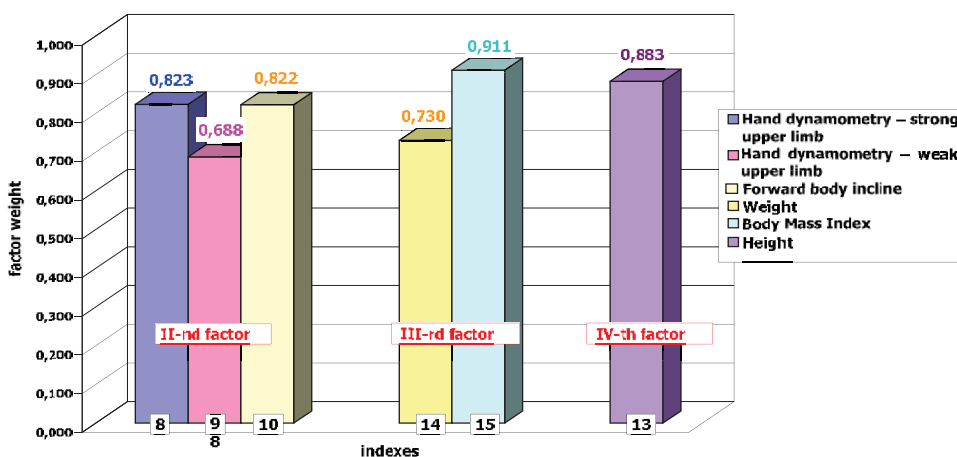


Figure 3. Factor structure of physical development and specific workability of 15-16-year-old cyclists: II-nd, III-rd and IV-th factors.

The third factor (see Fig. 3) – the morphological factor explaining 12.42% of the initial dispersion. It can be identified as “Body Mass Index”. It reveals the advantage given to boys of that age group more massive body structure.

The fourth factor (see Fig. 3) explains the lowest percentage of initial dispersion (9.93%). It determines the importance of cyclists’ height as a factor from which depends the specific performance.

The factor analysis results can be applied as criterion for optimization of educational and training process during future training sessions with young Bulgaria cyclists.

Conclusion

1. With high level of significance are so called morphological factors that reveal the importance of human body growth and Body Mass structure development for development in cycling sport.
2. The displayed factors determine the features which should be mainly developed during studied period. Efforts for raising the level of other studied signs will not have the same training effect and will not lead to significant increase in the level of specific sport performance of young cyclists.
3. Specific sport performance is a determining component of factor structure in the 15-16-year-old cyclists. It is known that the process of multi-annual training process in all sports are subject to rigorous methodological logic.

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REGULATORY FRAMEWORK FOR THE CONTROL AND OPTIMIZATION OF PHYSICAL DEVELOPMENT AND THE SPECIFIC ABILITY OF CYCLISTS IN THE AGE OF 15-16 YEARS

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Introduction

The effort to gather wider, richer and more objective information on the level of sport preparedness leads to the search for and use of highly effective ways and means of registration of specific workability individual parameters and specific working capacity. Any omission in the information flow reduces the effectiveness of the overall control analysis and management of sport training process (Брогли, Я., 2012; Църова, Р., 2013).

It is known (Желязков, Ц., Дашева, Д., 2011, 2017) that the cumulative effect of the training load is characterized by the accumulation of “traces, reflections” in the body of the athlete, leading to lasting, persistent, characteristics of the general and specific workability.

The development of norms base is one of the most important conditions for optimization of sport straining process. While the factor weights allow optimization of the training process in a strategic aspect (depending on the importance of the individual performance indexes), the evaluation of the results through normative tables allows for tactical (current) optimization of the training, depending on the current level of preparedness (Желязков, Ц., 1978).

The aim of the following study is to optimize the training process of 15-16-year-old cyclists by development of norms base for control of physical development and cyclists’ specific workability.

Method

The study was conducted in the period 2014-2016.

Subject of the study is the system for sport selection and orientation, as well as the initial training of young cyclists in the age 15-16-years.

Object of the study is the physical development physical training and both technical and tactical skills of young cyclists from the Republic of Bulgaria.

Respondents of the study are 20 boys training cycling in cycling clubs in Bulgaria.

In order to solve the aim and purpose of the study we applied the following research methods: methodical literature overview, anthropometry, sport-pedagogical testing.

The test included in the study reveals physical development, sport training and help the assessment of the young cyclists’ development.

The set of tests includes 15 indexes revealing information about respondents anthropometric and motor abilities, which are divided into the following characteristic groups:

- Physical development assessment – 3 indexes (including additionally calculated Body Mass Index);
- Physical fitness – 7 indexes;
- For specific technical training – 5 indexes.

Collected information was processed using appropriate mathematical and statistical methods: variance analysis, evaluation using signal method, index method.

Results

For the purpose of the study we analyze the average values and variability of research indexes. On this basis a normative table was developed, which allows easy and quick assessment of each sign, giving information about physical, specific sport and technical training aspects of cyclists from the studied age group (15-16-years).

The applied evaluation system makes possible to compare the results of differently dimensioned tests and indexes (measured in m, cm, sec. or kg).

As an example, here we show only a part of the normative evaluation table, in which are presented only five of the analyzed indexes (Table 1).

Table 1. Normative evaluation table for physical development and specific performance assessment of 15-16-year-old cyclists (sample).

points	1	2	3	4	5
	30 m crouch start	30 m standing start	100 m flying start	200 m flying start	500 m start from place
50	4.94	4.05	6.46	12.74	36.34
49	4.95	4.06	6.51	12.80	36.59
48	4.96	4.07	6.55	12.86	36.84
47	4.97	4.08	6.60	12.92	37.09
46	4.98	4.09	6.64	12.98	37.34
45	5.00	4.10	6.69	13.04	37.59
44	5.01	4.11	6.73	13.10	37.84
43	5.02	4.12	6.78	13.17	38.09
42	5.03	4.13	6.82	13.24	38.34
41	5.04	4.14	6.87	13.31	38.59
40	5.05	4.15	6.91	13.38	38.84
39	5.06	4.16	6.96	13.45	39.09
38	5.07	4.17	7.01	13.55	39.35
37	5.09	4.18	7.06	13.65	39.61
36	5.10	4.19	7.11	13.75	39.87
35	5.11	4.20	7.16	13.85	40.13
34	5.12	4.21	7.21	13.95	40.39
33	5.13	4.22	7.26	14.07	40.66
32	5.14	4.23	7.32	14.18	40.93
31	5.15	4.24	7.37	14.29	41.20
30	5.16	4.25	7.43	14.40	41.47
29	5.18	4.26	7.48	14.51	41.74
28	5.19	4.27	7.54	14.62	42.01
27	5.20	4.28	7.59	14.74	42.28
26	5.21	4.29	7.65	14.85	42.55
25	5.22	4.30	7.70	14.96	42.82
24	5.24	4.33	7.75	15.07	43.08
23	5.26	4.36	7.80	15.18	43.34
22	5.28	4.40	7.85	15.29	43.60
21	5.30	4.43	7.90	15.40	43.86
20	5.32	4.46	7.95	15.51	44.12
19	5.34	4.49	8.00	15.62	44.38
18	5.35	4.52	8.05	15.73	44.64
17	5.37	4.56	8.10	15.84	44.90
16	5.39	4.59	8.15	15.95	45.16
15	5.41	4.62	8.20	16.05	45.41
14	5.43	4.65	8.24	16.15	45.66
13	5.45	4.68	8.29	16.25	45.91
12	5.47	4.72	8.33	16.35	46.16
11	5.49	4.75	8.38	16.45	46.41
10	5.51	4.78	8.42	16.51	46.65
9	5.53	4.81	8.47	16.57	46.89
8	5.55	4.84	8.51	16.63	47.13
7	5.57	4.88	8.56	16.69	47.37
6	5.58	4.91	8.60	16.75	47.61
5	5.60	4.94	8.65	16.81	47.85
4	5.62	4.97	8.69	16.87	48.09
3	5.64	5.00	8.74	16.93	48.33
2	5.66	5.04	8.78	16.99	48.57
1	5.68	5.07	8.83	17.05	48.81

The applied 50-point scoring system allows accurate counting of the training indexes improvement even in shorter periods of time, which in turns allows on time adjustment of training means and loads.

The average survey level corresponds to 25 points. If performance is better than average the score will be above 25 points and vice versa – for worse results, the marks are lower than 25 points.

For achieving effective control over the physical and sport-technical training of cyclists (from studied age group), a number of activities need to be carried out, following the sequence:

1. To apply the entire set of tests, as follows:
 - Initially – in the first two training sessions of the respective sport-competitive year;
 - Interim – at the end of December;
 - Excessively – in the last two training session for the season.
2. For the implementation of the operative control, other intermediate tests may be conducted only on part of the test, determined by the head coach.
3. All operations regarding results registration and their evaluation are done by the coach or his assistant (possibly cycling specialist).
4. The obtained data from the test shall be recorded in specially developed forms and stored in the sport club archives for the purpose of long-term follow-up of the results from the training progress with adolescent cyclists.
5. When working with the normative tables, you need to know the following:
 - The column numbers correspond to the index number;
 - The evaluation of a results is done by finding the relevant index in the corresponding table and the result compared with the values indicated in the column. Against this horizontal value in the first column (“Points”), the score gives to the respondent points valid for the relevant index.
 - If the evaluated result falls between two values, it equals to the weaker results (by quality) value;
 - In the cases where $T=25$ points, the evaluated result corresponds to the average level of development of given attribute for the respective age group;
 - In cases where the score is beyond the limit of the scoring table (from 1 to 50 points), it is score with 51 points if it is higher in quality, and with 0 points if it is lower in quality.

Applying the T-scores assessment, as a private criterion for training optimization (Гъошева, К., Църков, К., Църкова, Р., 1990), allows to identify the highlights of the future training process of young cyclists' part of the study. The logic of using sigmal scores requires the efforts of both cyclists and coaches to be directed to raising the level of those signs that each of the respondents has the lowest score. It is clear that in order to achieve positive result in the future, it is extremely important to take care of the individual training work with each of the respondents. It is also necessary for the coaches to realize that efforts aimed at developing the signs in which the assessments are high will not have the same effect on the specific working capacity of young cyclists.

According to the sport science theory (Желязков, Ц., Дашева, Д., 2011, 2017) the adaptation process is a non-linear function of the physical loads – the dependence “dose-effect” dependence is evolving through the so-called logistic curve. This means that, depending on the current state of the sign for which the relevant indexes carry information, a similar training load will have a different effect. The higher the level of development, that is, the better the achievement, the lesser the increase that can be expected in a unit of workout. This gives us a reason to believe that during training process it is more appropriate to focus on improving the performance of those indexes that are lower at the time of the preparation – the estimates of T-scores using the normative tables are lower.

The summary assessments of young cyclists from the age group 15-16 years are presented on fig. 1. The analysis shows that this is carried out relatively good selection for cycling activities. The presence of low summary evaluations in this age however, in our view, means that holders of these assessments do not fulfil

the specific requirements of the sport, and probably it's too late for them to compensate for the lag, which means dropping out of the group.

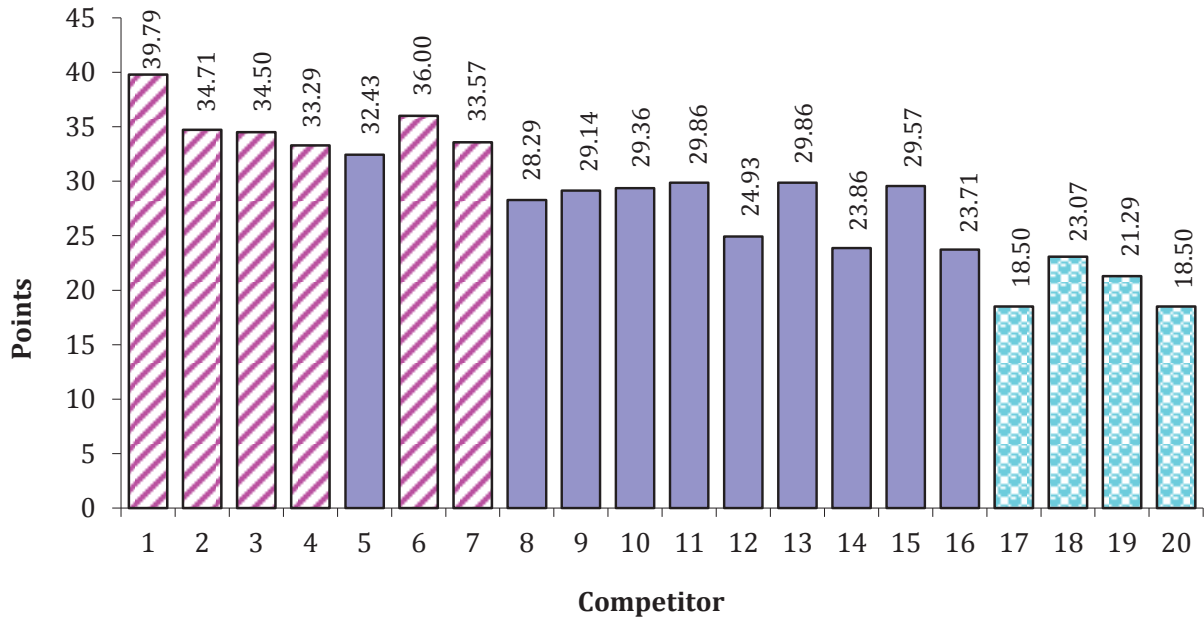


Fig. 1. Generalized individual assessments of physical development and specific working ability of 15-16 years old cyclists.

Conclusion

1. The most informative indexes for selection and sports orientation in cycling in the age group 15-16-years have been identified.
2. Statistical verification of the reliability and reproducibility of the indexes include in the test battery was made.
3. A legal basis for assessment of physical development and specific working capacity of young 15-16-year-old cyclists has been developed.
4. Assessing the level of observed signs allows to identify the strengths of future training with each young cyclist.
5. Developed individual models allows optimization of the selection process and sport orientation in cycling.

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DEVELOPMENT MOTOR SKILLS IN YOUNGER SCHOOLCHILDREN DURING A THREE-MONTH VOLLEYBALL PRACTICE

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Introduction

Physical activity of younger schoolchildren is an indispensable educational component. Anthropological development takes place at that age, and children need to focus on various forms of kinesiological activities that contribute to the child's overall growth and development (Badrić and Gašparić Baniček, 2016).

Physical activity, especially physical exercise, which implies systematic physical activity that has its purpose and volume of workload, has a significant impact not only on the health status but also on the development of all anthropological characteristics in all developmental phases of life as well as on the motor abilities that are part of them. During each exercise process, it is crucial to determine the participant's initial and final kinesiological condition. The exercise plan and program can be realized and the goals defined based on the initial condition, while the final status provides the final analysis and evaluation of the effectiveness of the applied kinesiological program (Bompa, 2006). Various extracurricular and out of school activities improve student development and enhance their growth. One of the main characteristics of a child's organism is the adaptability that is characterized as the ability to easily modify under the influence of volatile or unfavorable conditions (Findak, 1995).

Volleyball is a polystructural complex sport that involves many different moves, such as hop steps, cross steps, jumps, throws, falls, sprints, static stance or strokes, and demands for a broad spectrum of motor activities are set accordingly. It is essential that each practice session be carefully planned and programmed to have a positive impact on the child's physical and mental development and to avoid negative consequences on the child's health status.

Numerous studies have examined how sport affects the transformation of basic motor skills. In the research of Šmigalović, Bajrić, and Lolić (2012), a statistically significant difference was found in the students' general motor skills before and after the implementation of the volleyball program. Consequently, improvement of the students' general motor skills has been established after participating in the applied volleyball program. Selmanović, Milanović, and Hrženjak (2008) researched the influence of a supplemental volleyball program on changes in the variables for the assessment of motor skills on a sample of 87 male students aged 11 years. Out of the total number of students, 42 students (control group) attended only physical and health education classes following the regular fifth-grade curriculum, and 45 students (experimental group) attended physical and health education classes supplemented with an additional hour, which was based on games and volleyball elements. According to the obtained results, progress was apparent in both groups of participants, although the weekly progress was more significant in the group that attended an additional hour of PE, particularly in the explosive power. Džibrić, D., Pojskić, H., Ferhatbegović, A., Ganić, E., Hasanbegović, S., & Terzić, A. (2011) studied the effects of physical and health education on the students' basic motor skills. The sample consisted of 153 students aged eight years; two experimental groups and one control group were formed. The first experimental group comprised 48 students participating in regular physical and health education classes two hours a week, and the other experimental group included 56

participants, who attended an additional hour per week besides regular classes. Significant progress was made by the group of participants who attended an extra hour of PE. Nešić, Ilić, Majstorović, Grbić, and Osmankač (2013) explored the influence of sports practice on general and specific motor skills of female volleyball players aged 13-14 years. The sample comprised 40 participants, who attended the volleyball school. The research aimed to present and analyze the influence of volleyball practice on the changes in some general and specific motor skills. Based on the obtained results, the authors concluded that there were no significant changes in the body height, body mass, and BMI, but that the applied model of volleyball practice had a significant impact on specific motor skills as opposed to general skills.

Besides volleyball, a positive impact of kinesiological activities has been observed with other sports programs. Privitello, Jogunica, Gulan, and Boschi (2007) conducted a research on a total of 136 children (61 girls and 75 boys) aged 4-6 years from several preschool institutions in the city of Rijeka, where a sports program was being conducted. Based on the research results, insight is given into the meaning of physical exercise for the youngest children, especially for their growth and development, and therefore their health, as well as that motor skills are only one segment that can be influenced by a customized sports program during preschool age. Džajić and Kuna (2012) researched the effect of a sports games program (basketball, handball, volleyball) on improving the situation-motor skills in physical education and health education in 50 boys aged 12 years. While analyzing the findings, they discovered that progress had been made and suggested a comparison of the used program with other physical exercise programs that could affect basic motor skills. Ohnjec, Vuleta, and Gruić (2006) analyzed the impact of a specially programmed sports practice on the changes in some basic and motor skills on a sample of 25 young cadet handball players. The results showed that the six-month training process resulted in changes in the majority of the studied variables (long distance jump, 30-meter running speeds, 30-meter running speed while ball-handling, and push-ups). In their research conducted with 14 students (6 girls and eight boys), members of the gymnastics section for ten years and seven months, Markuš and Markuš (2006) researched the impact of a specifically programmed 30-minute gymnastics practice on quantitative changes in the motor abilities of strength, coordination, and flexibility. Gymnastics practice significantly improved the results in all strength and coordination dimensions and all flexibility measures, with the most significant quantitative changes being recorded in the area of coordination.

The aforementioned research shows that, over a certain period, various kinesiological programs positively influence the participants' motor and functional development. All of the abovementioned research came to the same conclusion – physical exercise and sports activity have a positive impact on children's development.

Therefore, this research aimed at determining the impact of the three-month volleyball program on the motor skills of younger school-aged children with the hypothesis that the volleyball program would have a statistically significant effect on the changes in the observed motor skills.

Method

The sample consisted of 18 younger school-aged girls, who were members of the Women's Volleyball Club "Bizovac" with an average body height of $150.62\text{cm} \pm 10.41$ and a body mass of $45.38\text{kg} \pm 12.70$.

The data were collected in the first and last trimester of the three-month cycle. The sample of variables comprised eight tests for motor skills (Body height (cm), Body weight (kg), Sit-ups (60s), Standing broad jump (cm), Sit and reach (cm), Bent arm hang (s), Polygon backwards (s), Side steps (s), Medicine ball 1kg throwing (m), and Pull down skittles (s)).

The three-month long volleyball program was carried out three times a week. Girls between 7 and 11 years of age (1st to 4th grade of elementary school) practiced three times a week for 60 minutes, i.e., 180

minutes (3 hours) a week. During the three months, they completed a total of 33 practice sessions (33 hours). Girls between the ages of 12 and 15 (5th to 8th grade of elementary school) practiced three times a week for 90 minutes, totaling 270 minutes a week. They also took part in 33 training sessions (49.5 hours) for three months. Volleyball practice was mainly based on learning and improving the elements of the volleyball techniques, and the exercises for improving the motor skills were: jumping hurdles, jumping onto a bench and landing, speed running, ball catching, strength exercises (sit-ups, push-ups, squat-up-down), jumps, triceps exercises, wall sit, Polygon backward, foot speed (ladder drills).

Basic descriptive parameters (arithmetic mean and standard deviation, minimum and maximum score) were calculated in the initial and final testing. Wilcoxon matched pair test was used to determine the difference between the initial and final testing. The level of significance was $p=0.05$.

Results

Results of initial and final measurement are shown in Table 1 and 2.

Table 1. Results of initial measurement

	N	AS	SD	Min	Max
Body height	17.00	150.62	10.41	129.00	162.00
Body weight	17.00	45.38	12.70	30.00	77.50
Sit - ups	17.00	53.29	10.05	37.00	70.00
Standing broad jump	17.00	145.12	17.40	120.00	180.00
Sit and reach	17.00	69.00	11.14	50.00	90.00
Bent arm hang	17.00	19.12	16.95	1.06	46.81
Polygon backwards	17.00	17.16	5.37	11.53	27.85
Side steps	17.00	15.57	1.63	13.42	18.69
Medicine ball 1kg throwing	17.00	6.50	1.13	4.05	7.94
Pull down skittles	17.00	38.84	3.99	33.33	49.89

Table 2. Results of the final measurement

	N	AS	SD	Min	Max
Body height	17.00	150.62	10.41	129.00	162.00
Body weight	17.00	45.38	12.70	30.00	77.50
Sit - ups	17.00	62.76	10.00	50.00	85.00
Standing broad jump	17.00	155.88	17.59	130.00	190.00
Sit and reach	17.00	74.18	12.80	50.00	93.00
Bent arm hang	17.00	22.17	17.58	4.15	65.00
Polygon backwards	17.00	15.97	3.42	11.57	21.80
Side steps	17.00	14.73	1.59	12.46	18.66
Medicine ball 1kg throwing	17.00	6.98	1.17	4.05	8.50
Pull down skittles	17.00	37.00	2.98	32.83	43.89

Table 3 shows the differences in the initial and final measurement results obtained with the Wilcoxon matched pair test.

Table 3. Differences between the initial and final measurements

	N	T	Z	p-value
Sit-ups I & Sit-ups F	17.0	4.50	3.408	0.001*
Standing broad jump I & Standing broad jump F	17.0	5.50	3.361	0.001*
Sit and reach I & Sit and reach F	17.0	13.5	2.982	0.003*
Bent arm hang I & Bent arm hang F	17.0	35.0	1.965	0.049*
Polygon backward I & Polygon backward F	16.0	41.0	1.396	0.163
Side steps I & Side steps F	17.0	20.0	2.675	0.007*
Medicine ball 1kg throwing I & Medicine ball 1kg throwing F	16.0	15.0	2.741	0.006*
Pull down skittles I & Pull down skittles F	17.0	12.0	3.053	0.002*

Discussion

The results show statistically significant progress in all variables except in the Polygon backward. Volleyball as a kinesiological activity has a positive effect on the development of motor skills such as explosive power, repetitive force, and speed. Success at playing volleyball depends to a great extent on the speed of movement without a ball, the speed of the change of pace, and the direction of movement, agility, and rhythm (Telebar, 2009). The results of the conducted research were similar to the previous researches which determined the positive impact of the sports program on motor skills. Thus, Šmigalović, Bajrić, and Lolić (2012) discovered an improvement in the students' general motor skills after participating in the applied volleyball program. Also, Selmanović, Milanović, and Hrženjak (2008) concluded that a group of students attending an additional weekly volleyball program achieved significant improvement in their motor skills, especially in explosive power, while Nešić, Ilić, Majstorović, Grbić, and Osmankac (2013) found that the applied model of volleyball practice has a significant impact on specific motor skills when compared to general skills. Research into additional extra-curricular and out of school programs suggests that other program forms have a significant impact on improving motor skills. Ohnjec, Vuleta, and Gruić (2006) achieved significant changes in most studied variables, such as explosive power, speed, and repetitive power, during the extra-curricular handball program. Such results are similar to the results of our research; significant progress has been made in the said variables. Furthermore, Markuš and Markuš (2006) achieved significant changes during gymnastics practice in all manifestations of strength, flexibility, and especially coordination.

Conclusion

This research points to the importance of sports activities for children due to their positive influence not only on children's motor skills, but also on their growth, development, socialization, quality of life, and physical and mental health. Given the hypothesis that is based on the assumption that a three-month-long volleyball practice affects the development of motor skills in younger schoolchildren, the research results confirm that active sports, in this case, volleyball practice, have a positive impact on the development of motor skills. The results indicate that there has been significant development of motor skills, even though the three-month-long volleyball practice did not rely solely on motor skills practice, but on the exercises to improve the volleyball technique and the volleyball game itself. Of course, there were exercises for the development of motor skills, but not as volleyball elements. This proves that volleyball itself is a complex sport and in and of itself has a positive impact on children and their development.

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DIFFERENCES IN MORPHOLOGICAL CHARACTERISTICS AND MOTOR ABILITIES BETWEEN FEMALE VOLLEYBALL AND HANDBALL CADET PLAYERS

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Introduction

Volleyball and handball, as related team games in which the ball is manipulated by hands, involve a number of similar characteristics of the players themselves (Bayios, 2006). In addition, these two sports branches have a lot of similar characteristics when it comes to natural forms of movement, such as walking, running, jumping, throwing. At certain stages of the game both in handball and in volleyball, similar movements and body stands are in a certain position. In the defense stage, the handball players have a similar defensive attitude and movement as well as volleyball players during the reception of the service. When jumping in the handball, the movement of the arm and the shoulder is similar to that of a hand in the performance of volleyball services. The main difference between these two sports branches is the contact between handball players which doesn't exist in volleyball. There are other minor differences in the performance of certain technical elements, such as jumping from one leg, throwing instead of spike, catching or rejecting the ball, and so on.

Today's handball involves a set of fast and extremely complex movements and actions, solving problems in a given situation, which together mark the level of intensity of activity (Bulava et al., 2013). That level of activity of intensity requires player to have highly developed basic and specific abilities (Bulava et al., 2013).

Handball as a contact game is based on natural forms of movement and belongs to a semi-structured sport that has unpredictable dynamics of cyclic and acyclic type activities (Goranović, 2002). It should be emphasized that success in handball depends on a variety of factors, both internal (endogenous) and external (exogenous).

Factors that play a significant role in achieving results in handball are morphological characteristics, functional abilities of organs and organic systems (anaerobic and aerobic capacity), motor skills, social characteristics of personality, as well as conative and cognitive characteristics (Gabrijelić, 1977; Pokrajac, 1983; Ilić, 1993).

Modern volleyball is a sport of high demands for expressing activity; players with high-level of motor-functional abilities can display appropriate technical-tactical characteristics throughout the entire duration of the game (Borras et al., 2011). The effectiveness of volleyball, whether coaching or competition, is influenced by two important factors: specific motor skills (Strahonja, 1983) and situational-motor knowledge (Bzduh i sar., 1976; Janković, 1988). In order to successfully participate in the competition and to master the situational tasks in the game, it is necessary to connect certain abilities in one system in a certain way (Keramichiev, 1991). Motor skills (coordination, explosive power, agility) are some of the factors that, certainly, influence the quality of performance of a particular technique in volleyball with high coefficient.

The morphological characteristics of anthropological status of a man are usually information about his body dimensions (Perić, 2011). In a certain number of sports morphological characteristics have a very significant, or we could even say a decisive influence on the result. Morphological characteristics are to a large degree conditioned by inheritance, but are also under a greater or lesser influence of external factors, primarily under the influence of training. The longitudinal dimensionality defines the following measures:

body height, seat height, leg length, arm length, etc., while the transversal dimensionality defines: shoulder width, plexus width, planimetric parameter of the hand, wrist diameter, knee diameter, etc. Body volume and body weight define: body weight, waist size, upper leg size, size of the lower legs, upper arm size, size of the forearm, etc., and the subcutaneous fat tissue define: the skin wrinkles on the back, the skin wrinkle of the abdomen, the skin wrinkles of the forearm, the skin wrinkles of the upper arm and others.

Motor skills are conditionally defined as latent motor structures that are responsible for the infinite number of manifest motor responses and can be measured and described (Findak, 2003). The development of motor skills is one of the most important and most complex processes on the way of creating a versatile personality of athletes, who will be capable of creative self-realization and competitive process (Vranić, 2013).

According to Zaciorsky (1975), motor skills represent the motor of a man with the entire motion complexity, which can be described by the same parametric system, and can be measured by an identical group of measures in which analogous physiological, biological and psychological processes or mechanisms occur.

Motor skills are all those skills of a person involved in solving motor assignments, and in doing so, they condition a successful movement, regardless of whether they have been acquired by certain training or not.

During the adolescence period, the sport has a relevant and unavoidable role in the life of a young athlete. The age of 13, according to the periodisations found in the literature, belongs to the period of "adolescence". The concept of physical development implies changes in size (growth process), structure (tissue differentiation) and functions (functional regeneration) of individual organ systems and the organism as a whole (Gajović, 2009).

The physical development of a person is conditioned by a number of different internal (endogenous) and external (exogenous) factors. The basic internal factors are: heritage, race, sex, endocrine system and effector tissues and organs. Among the basic external factors are geographical and economic conditions and seasons, socio-economic conditions, illnesses and injuries, physical exercise.

Changes in physical development are particularly intense in the period of "adolescence", which extends to female subjects from 10-13 to 15-16 years. By the beginning of the mature age, most of the process of mental and physical development has been completed, although some developing characteristics have achieved their maximum development much earlier. Girls whose motor skills are tracked for the purposes of this work belong to a period of puberty in which intense development and full maturation continue. In this period, the height of the body begins to increase rapidly, especially the limbs. The annual increase in body height of girls between the age of 13 and 15 is slightly less than 4 cm, and the body weight gain is about 3 kg (Kurelić and associates, 1975). By increasing body height, body weight increases proportionally. Limbs are elongated, although their size depends on the constitutional type. As the body's growth in width and the growth of the hull lag compareing to the growth of limbs, the girls get a tall and skinny appearance. The ossification has not been completed yet, so the danger of the possibility of deformation is high. Musculature is getting bigger and it is 32% of body weight.

The aim of this study is to determine the differences in morphological characteristics and motor skills between volleyball players and handball cadet players. Based on the defined goal, the tasks of the research are: to measure and evaluate the morphological characteristics and general motor abilities of volleyball players, as well as the morphological characteristics and general motor skills of handball players and to compare the morphological characteristics and general motor skills of handball players and volleyball players aged 13-14 years.

Physical exercise and sports training can significantly affect harmonious morphological, motor and psychological development. It is known that children of this age successfully master the basic techniques of sports branches, so it is possible to narrow specialization in disciplines dominated by speed and agility. Special trainings should be adapted to the characteristics of this period, because in that case it will not have a negative impact on the development of the organism. As volleyball and handball are similar team sport games, similarities between them lead to frequent mistakes in the selection for children to train one of these two sports. The special interest of this research is to, from the overall psychomotor space, research the morphological characteristics and motor abilities of handball and volleyball cadet payers.

Method

The sample of the participants consisted of 20 volleyball players (13.83 ± 0.75 years) of the DIF School volleyball team and 20 handball players (13.98 ± 0.24) of the RK „Junior“ from Belgrade. Both groups of participants actively do their chosen sport. A battery of tests was selected that can be easily performed in field conditions, which evaluates the morphological characteristics and motor skills that are most commonly used in these sports branches.

The sample of the variables is divided into two groups of variables:

- Variable for morphological characteristics.
- Variables for motor skills.

Estimation of morphological characteristics is based on the following variables:

- Body height (TV, m);
- Body mass(TM, kg);
- Body mass index (BMI), (kg/m^2);
- Arm span (RR, cm)

The following tests were used to evaluate motor skills in this study:

- To evaluate the elasticity of the hamstrings of thighs and wrist mobility in hip bone – „Sergeant test“ (PuS).
- For evaluation of the speed of the power of the lower limb stretchers - the "Sergeant test".
- For evaluation of arm and shoulder muscle strength – „Medicine ball throw“ (BM).
- For evaluation of agility - "X test". This agility assessment test was selected for similar movements made by defense players in both sports branches.

For the measurement of morphological characteristics the digital scale and Martin's anthropometer were used

For measurement of motor abilities, we used: stopwatch, meter, Sit and Reach test box, sticky tape, strings, chunks, medicine ball of 2kg.

All tests were carried out with a standardized apparatus. The results obtained during the survey were processed by descriptive statistics. From the point of descriptive statistics, the parameters for both groups of subjects were calculated, for each variable separately. The calculated parameters include minimum (MIN), maximum (MAX), and mean (MEAN), standard deviation (STDEV) and coefficient of variation (cV%)

A comparative statistical analysis was performed using the data analysis package SPSS 20, and used statistical procedure was the T-test for independent samples.

Results

The following results were obtained.

Table 1. Results of descriptive statistics of morphological characteristics of volleyball players for the age of 13-14 years.

Variables	TV	TM	BMI	RR	Age
Mean	157	42.9	16.1	158.5	13.8
Max	180.5	78.5	27.7	180	14.72
Min	168.9	58.6	20.5	170.1	13.2
StDev	6.5	11.4	3.2	6.6	0.7
cV%	3.8	19.4	15.8	3.8	5.4

Table 1 shows the results of tests of morphological characteristics of volleyball players. The body weight for volleyball players ranged from 42.9 kg (MIN) to 78.5 kg (MAX). The average value for this variable (MEAN) was 58.60, and the average deviation from the mean value (STDEV) was 11.393. Body mass test at the same time had the highest variability in morphological characteristics of volleyball players (cv%) 19.4. The lowest variability in the tests had body height and arm span (cv%) 3.8.

Table 2. Results of descriptive statistics morphological characteristics of handball players for age 13-14 years.

Variables	TV	TM	BMI	RR	Age
Mean	152.1	38.4	15.2	152	13.9
Max	172	76	28.9	174	14.3
Min	164.2	58.3	21.6	163.2	13.6
StDev	5.4	9.2	3.5	5.9	0.2
cV%	3.2	15.7	16.2	3.6	1.7

Based on the results shown in table 2. it can be noticed that the highest variability in morphological characteristics of handball players had a body mass index (cV%) 16.2, while the smallest variability had a body height (cv%) 3.2. The mediu value of body height of all handball players ranges from 152 cm (MIN) to 172 cm (MAX), while the average value for the given variable (MEAN) is 164.2 cm.

Table 3. Descriptive statistics for motor skills of sub-volleyball volleyball.

Variables	PuS	S	BM	X
Mean	25.1	25.4	6.5	9.7
Max	33	33.2	7.8	8.1
Min	18	16.7	4.9	10.7
StDev	4.2	7.3	1.1	0.7
cV%	16.8	28.7	15.8	6.9

Based on the results obtained in table 3 the highest variability in the volleyball players motor abilities tests had a test for the estimation of the velocity of the lower limbs springss – Sergeant test (cV%) 16.2, while the smallest variability had the „x“ test (cV%) 6.9.

Table 4. Descriptive statistics for motor skills of sub-sample for handball players.

Variables	PuS	S	BM	X
Mean	18.5	20.1	7	9.6
Max	30	30.2	9.7	8.2
Min	6.5	11.6	5.2	11.2
StDev	6.4	7.8	1.3	0.852
cV%	34.9	38.8	19.2	8.8

Table 4 shows the results of descriptive statistics for motor skills of handball players aged 13-14 years. Tests have shown, as with volleyball players, that the highest variability in the test for assessing the

speed of the strength of the lower limbs springs is the Sergeant test (cV%) 38.8, and the least variability in the agility test (X test) (cv%) 8.8.

Table 5. Comparative analysis of both subsamples.

Variables	TV	TM	BMI	RR	Age	PuS	S	BM	X
p value	0.043	0.933	0.348	0.005	0.481	0.003	0.101	0.263	0.917

The average height of the volleyball team is 168.9 cm (Table 1), while the average height of the handball team is 164.2. (Table 2.) There is a statistically significant difference in body height ($p = 0.04$) between the two sub-samples at the significance level of 0.05 in favor of volleyball players (Table 5). The average value of the hand span for volleyball players is 171.1 cm (Table 1) and 163.2 cm (Table 2). According to the results, it can be concluded that there is a statistically significant difference between the volleyball players and the handball players in the measured length of the hand span in favor of volleyball players. The achieved level of statistical significance is ($p=0.005$), (Table5).

The average value of the mobility assessment variable (PuS test) for volleyball players is 25.06 cm (Table 3.) and for handball players is 19.15 cm (Table 4). There are statistically significant differences between the volleyball players and the handball player in the examined variable „sit and reach test“ in favor of volleyball players. The achieved level of statistical significance is ($p = 0.003$) (Table 5).

Discussion

Based on the conducted research, the results showed that there are no statistically significant differences in morphological characteristics of body mass (BM) and body mass index (BMI), while differences are spotted in body height and arm span. For these two variables (TV and RR) significant differences were established at the level ($p = 0.04$) and ($p = 0.005$) in the favour of subjects from the volleyball team. The obtained results of body height are somewhat expected in favor of volleyball players, because in this sport the selection is, among other things, done in relation to the body height required for certain playing positions. Body height is of great importance in volleyball, while in handball it does not have to be. As the arm's span is biologically directly linked to body height, this is also the reason for the statistically significant difference in favor of volleyball players. The obtained results from the point of the body dimensions are in accordance with the previous studies (Pion, 2015).

After the results, it can also be noticed that the physical development of volleyball players in relation to handball (as far as motor skills are concerned) are characterized by significant differences in only one test for assessment of motor skills in favor of volleyball players. These differences were spotted in the test for the assessment of the flexibility, i.e. mobility at the level ($p = 0.003$). The results of the „sit and reach test“ (PuS) showed a higher value in favor of volleyball, which can be explained by the greater role of flexibility in the elements of volleyball defense compared to handball. In volleyball, greater flexibility is the result of the movement of larger amplitudes. In the training technique, there is a little higher distribution of stretching (dynamic stretching as part of warming up training) for volleyball players than for handball players.

The handballers showed better results in two motor tests (Medicine ball throw and "x" test), but the results were not statistically significant. The results are expected for several reasons, and one of the most important is that these two sports branches are very similar. In addition to the contact, which is present in the handball (and which is likely to have a higher muscle tonus that directly affects mobility), all other movements are almost identical in both sports branches.

Further research should include a larger number of respondents, as well as an extended battery of tests that would maintain the headings of simple performance in field conditions. Expressed body longitudinality, presented through TV and RR, provides a good determinant in the direction of the volleyball

game. The conducted research contributes to the recognition of important characteristics that can help both trainers and participants in the selection of one of the mentioned sports games.

Conclusion

Volleyball and handball, as well as all other sports, require a certain level of morphological and motor characteristics, in order to better and more efficiently perform in situational conditions and achieve results. Improving motor skills and harmonious physical development are important components for optimal physical exercises. In particular, it is necessary to put emphasis on: more objective diagnosis, programming, direct implementation and control of the effects of the given training process.

Expressed body longitudinality, represented through TV and RR, provides a good determinant in the direction of the volleyball game. The conducted research contributes to the recognition of important characteristics that can help both trainers and participants in the selection of one of the mentioned sports games.

Based on continuous monitoring of the impact of training programs and adaptation for athletes, we receive feedback that can be used in later modification of training. Based on the obtained results, the quality of the current training program can be accurately assessed. In addition, it is possible to make corrections of existing program and increase the quality of work.

Based on the test results, it is necessary to create work programs that will influence the versatile development of athletes. We realize that successful planning and programming of the training process is a complex and highly demanding process that requires the full attention and knowledge of the experts involved in its creation and realization.

Of crucial importance is the understanding of the conditions in which athletes are educated, as this contributes to successful planning and programming through providing conditions for training and establishment of continuous insights into the development of physical abilities.

The prime goal is reflected in the emphasis on that content that will significantly influence the development of the exact abilities in which athletes lag behind. Therefore, further research should involve a larger number of respondents, as well as an expanded battery of tests that would include guidelines for simple performance in field conditions, because like that it would provide a wider approach that is essential for the success of athletes.

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RAZLIKE U MORFOLOŠKIM KARAKTERISTIKAMA I MOTORIČKIM SPOSOBNOSTIMA IZMEĐU ODBOJKAŠICA I RUKOMETAŠICA KADETSKOG UZRASTA

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Uvod

Odbojka i rukomet, kao srodne timske sportske igre u kojima se loptom manipuliše rukama, podrazumevaju veliki broj sličnih karakteristika samih igrača (Bayios, 2006). Pored toga ove dve sportske grane imaju i dosta sličnih karakteristika kada su u pitanju prirodni oblici kretanja, kao što su hodanje, trčanje, skokovi, bacanja. U određenim fazama igre i u rukometu i u odbojci slične su kretnje i postavke tela u određeni položaj. U fazi odbrane rukometašice imaju sličan odbrambeni stav i kretanje kao i odbojkašice u toku prijema servisa. Prilikom skok šuta u rukometu, putanja kretanja ruke i ramenog pojasa je slična kretanju ruke kod izvođenja smeč servisa u odbojci. Glavna razlika između ove dve sportske grane je kontakt između igrača u rukometu kojeg nema u odbojci. Postoje i druge manje razlike u izvođenju pojedinih tehničkih elemenata, kao što su skok sa jedne noge, bacanje umesto udarci po lopti, hvatanja odnosno odbijanja lopte i dr.

Današnji rukomet podrazumeva skup brzih i izuzetno složenih pokreta i akcija, rešavanje problema u datoj situaciji, koji zajedno označavaju nivo intenziteta aktivnosti (Bulava i sar., 2013). Takav nivo intenziteta aktivnosti zahteva od igrača visoko razvijene bazične i specifične sposobnosti (Bulava i sar., 2013).

Rukomet kao kontakt igra se zasniva na prirodnim oblicima kretanja i spada u polustrukturirani sport koji ima nepredvidivu dinamiku aktivnosti cikličnog i acikličnog tipa (Goranović, 2002). Potrebno je naglasiti da uspeh u rukometu zavisi od niza različitih faktora, kako unutrašnjih (endogenih) tako i spoljašnjih (egzogenih).

Faktori koji imaju značajnu ulogu u postizanju rezultata u rukometu su morfološke karakteristike, funkcionalne sposobnosti organa i organskih sistema (anaerobni i aerobni kapacitet), motoričke sposobnosti, socijalne karakteristike ličnosti, kao i konativne i kognitivne karakteristike (Gabrijelić, 1977; Pokrajac, 1983; Ilić, 1993).

Savremena odbojka je sport visokih zahteva za ispoljavanje kretnih aktivnosti; igrači visokog nivoa motoričko-funkcionalnih sposobnosti mogu da ispolje odgovarajuće tehničko-taktičke karakteristike tokom celokupnog trajanja utakmice (Borras i sar., 2011). Na efikasnost u odbojci, bilo da se radi o treniranju ili takmičenju, utiču dva značajna faktora: specifične motoričke sposobnosti (Strahonja, 1983) i situaciono-motoričko znanje (Bzduh i sar., 1976; Janković, 1988). Za uspešno učešće na takmičenju i savladavanje situacionih zadataka u igri, potrebno je na određen način povezati navedene sposobnosti u jedan sistem (Keramičiev, 1991). Motoričke sposobnosti (koordinacija, eksplozivna snaga, agilnost) jedan su od faktora koji sigurno visokim koeficijentom utiču na kvalitetno izvođenje određene tehnike kod odbojkaša.

Morfološke karakteristike antropološkog statusa čoveka najčešće predstavljaju informacije o njegovim telesnim dimenzijama (Perić, 2011). U određenom broju sportova morfološke karakteristike imaju veoma značajan, moglo bi se reći i presudan uticaj na sportski rezultat. Morfološke karakteristike su u velikoj meri uslovljene nasleđem, ali su i pod većim ili manjim uticajem spoljašnjih faktora, prevashodno pod uticajem treninga. Longitudinalnu dimenzionalnost definišu sledeće mere: visina tela, sedeća visina, dužina noge, dužina ruke i dr., dok transverzalnu dimenzionalnost definišu: širina ramena, širina karlice,

planimetrijski parametar šake, dijametar ručnog zgloba, dijametar kolena i dr. Volumen i masu tela definišu: težina tela, obim struka, obim nadkolenice, obim potkolenice, obim nadlaktice, obim podlaktice i dr., a potkožno masno tkivo definišu: kožni nabor leđa, kožni nabor trbuha, kožni nabor nadlaktice, kožni nabor podlaktice i dr.

Motoričke sposobnosti uslovno se definišu kao latentne motoričke strukture koje su odgovorne za beskonačan broj manifestnih motoričkih reakcija i mogu se izmeriti i opisati (Findak, 2003). Razvoj motoričkih sposobnosti jedan je od najvažnijih i najkompleksnijih procesa na putu stvaranja svestrane ličnosti sportista, koji će biti sposobni za stvaralačku samorealizaciju i takmičarski proces (Vranić, 2013). Prema Zaciorskom (1975), motoričke sposobnosti predstavljaju motoriku čoveka sa celokupnom kompleksnošću kretanja, koja se mogu opisati jednakim parametarskim sistemom, i mogu se izmeriti istovetnom grupom mera u kojima nastupaju analogni fiziološki, biološki i psihološki procesi, odnosno mehanizmi.

Motoričkim sposobnostima se nazivaju sve one sposobnosti čoveka koje učestvuju u rešavanju motornih zadataka i pritom uslovljavaju uspešno kretanje, bez obzira na to da li su stečene određenim treningom ili ne.

Tokom perioda adolescencije sport ima relevantnu i nezaobilaznu ulogu u životu mladog sportiste. Uzrast od 13 godina, prema periodizacijama koje se mogu naći u literaturi, spada u period „adolescencije“. Pod pojmom telesnog razvoja podrazumevaju se promene veličine (proces rasta), strukture (diferencijacija tkiva) i funkcije (funkcionalno dozrevanje) pojedinih organskih sistema i organizma u celini (Gajović, 2009).

Telesni razvoj osobe uslovljen je nizom različitih unutrašnjih (endogenih) i spoljašnjih (egzogenih) faktora. Osnovni unutrašnji faktori su: nasleđe, rasa, pol, endokrini sistem i efektorna tkiva i organi. Među osnovne spoljašnje faktore ubrajaju se geografsko-ekonomski uslovi i godišnje doba, socijalno-ekonomski uslovi, bolesti i povrede, telesno vežbanje.

Promene u okviru telesnog razvoja naročito su intenzivne u periodu „adolescencije“, koji se proteže kod ženskih osoba od 10-13 do 15-16 godina. Do početka zrelog doba, većina procesa psihičkog i fizičkog razvoja je završena, mada neke razvojne karakteristike svoj maksimum razvoja postižu i znatno ranije. Devojčice čije su motoričke sposobnosti praćene za potrebe ovog rada, pripadaju periodu puberteta u kojem se nastavlja intenzivan razvoj i polno sazrevanje. U ovom periodu porast visine tela počinje naglo da se uvećava, naročito na račun izduživanja ekstremiteta. Godišnji prirast visine tela kod devojčica u periodu između 13. i 15. godine iznosi nešto manje od 4 cm, a prirast težine tela iznosi oko 3 kg (Kurelić i saradnici, 1975.). Porastom visine tela srazmerno se povećava i težina tela. Ekstremiteti se izdužuju, mada njihova veličina zavisi od konstitucionalnog tipa. Kako porast tela u širinu i rasteenje trupa zaostaje za porastom ekstremiteta, devojčice dobijaju visok i štrkljast izgled. Okoštavanje još nije završeno, pa je i opasnost od mogućnosti nastajanja deformiteta velika. Muskulatura se uvećava i iznosi 32% od telesne težine.

Cilj ove studije je utvrđivanje razlika u morfološkim karakteristikama i motoričkim sposobnostima između odbojkašica i rukometašica kadetskog uzrasta. Na osnovu definisanog cilja, zadaci istraživanja su: izmeriti i proceniti morfološke karakteristike i opšte motoričke sposobnosti odbojkašica, kao i morfološke karakteristike i opšte motoričke sposobnosti rukometašica i uporediti morfološke karakteristike i opšte motoričke sposobnosti rukometašica i odbojkašica uzrasta 13-14 godina.

Fizičkim vežbanjem i sportskim treningom može se znatno uticati na harmoničan morfološki, motorički i psihički razvoj. Poznato je da deca ovog uzrasta, uspešno savladaju osnovne tehnike sportskih grana, pa je moguća i uža specijalizacija, u disciplinama u kojima dominiraju brzina i okretnost. Specijalistički trening treba prilagoditi osobenostima ovog perioda, jer u tom slučaju neće imati negativan uticaj na razvoj organizma. Kako su odbojka i rukomet srodne timske sportske igre sličnosti među njima dovode do čestih grešaka u selekciji dece za bavljenje jednim od ova dva sporta. Posebno interesovanje ovog istraživanja je da

se iz ukupnog psihomotornog prostora, posebno istraže morfološke karakteristike i motoričke sposobnosti rukometašica i odbojkašica kadetskog uzrasta.

Metode

Uzorak ispitanica se sastojao od 20 odbojkašica (13.83 ± 0.75 godina) članica Škole odbojke "DIF" i 20 rukometašica (13.98 ± 0.24) članica RK "Junior" iz Beograda. Obe grupe ispitanica se aktivno bave svojim izabranim sportom. Odabrana je baterija testova koja može jednostavno da se izvede u terenskim uslovima, a kojom se procenjuju morfološke karakteristike i motoričke sposobnosti koje su najzastupljenije u ovim sportskim granama.

Uzorak varijabli je podeljen u dve grupe varijabli i to:

-Varijable za morfoloških karateristika

-Varijable za procenu motoričkog sposobnosti.

Procenjivanje morfoloških karakteristika izvršeno je na osnovu sledećih varijabli:

-Visina tela (TV, m);

-Masa tela (TM, kg);

-Telesno maseni indeks (BMI), (kg/m^2);

-Raspon ruku (RR, cm)

Za procenu motoričkih sposobnosti u ovom istraživanju primenjeni su sledeći testovi:

-Za procenu elastičnosti zadnje lože natkolenice i pokretljivosti u zglobu

kuka – Pretklon u sedu (PuS).

-Za procenu brzinske snage opružača donjih ekstremiteta – „Sardžent test“.

-Za procenu snage mišića ruku i ramenog pojasa – Bacanje medicinke (BM).

-Za procenu agilnosti – „X test“. Ovaj test za procenu agilnosti izabran je zbog sličnog kretanja koje čine igračice u odbrani u obe sportske grane.

Za merenje morfoloških karakteristika korišćeni su: digitalna vaga i antropometar po Martinu.

Za merenje motoričkih sposobnosti korišćeni su: štoperica, metar, kutija za Sit and Reach test, lepljiva traka, strunjače, čunjevi, medicinka od 2kg.

Svi testovi su sprovedeni standardizovanom aparaturom. Rezultati koji su dobijeni tokom istrživanja, obrađeni su postupcima deskriptivne statistike. Iz prostora deskriptivne statistike izračunati su parametri za obe grupe ispitanika, za svaku varijablu posebno. U izračunate parametre spadaju minimalna (MIN), maksimalna (MAX), i srednja vrednost (MEAN), standardna devijacija (STDEV) i koeficijent varijacije (cV%). Upporedna statistička analiza je izvršena uz pomoć paketa za analizu podataka SPSS 20, a korišćena statistička procedura je T-test za nezavisne uzorke.

Rezultati

Dobijeni su sledeći rezultati.

Tabela 1. Rezultati deskriptivne statistike morfoloških karakteristika odbojkašica za uzrast 13-14 godina.

Varijable	TV	TM	BMI	RR	Age
Mean	157	42,9	16,1	158,5	13,8
Max	180,5	78,5	27,7	180	14,72
Min	168,9	58,6	20,5	170,1	13,2
StDev	6,5	11,4	3,2	6,6	0,7
cV%	3,8	19,4	15,8	3,8	5,4

U tabeli 1. prikazani su rezultati testova morfoloških karakteristika odbojkašica. Vrednost telesne mase za odbojkašice kretala se od 42.9 kg (MIN), do 78.5kg (MAX). Prosečna vrednost za ovu varijablu (MEAN) iznosila je 58.60, a prosečno odstupanje od srednje vrednosti (STDEV) je 11.393. Test telesne mase ujedno je imao najveću varijabilnost u testovima morfoloških karakteristika odbojkašica (cV%) 19.4. Najmanju varijabilnost u testovima imale su telesna visina i raspon ruku (cV%) 3.8.

Tabela 2. Rezultati deskriptivne statistike morfoloških karakteristika rukometašica za uzrast 13-14 godina.

Varijable	TV	TM	BMI	RR	Age
Mean	152,1	38,4	15,2	152	13,9
Max	172	76	28,9	174	14,3
Min	164,2	58,3	21,6	163,2	13,6
StDev	5,4	9,2	3,5	5,9	0,2
cV%	3,2	15,7	16,2	3,6	1,7

Na osnovu rezultata prikazanih u tabeli 2. može se uočiti da je najveću varijabilnost u testovima morfoloških karakteristika rukometašica imao telesno maseni indeks (cV%) 16.2, dok je najmanju varijabilnost imala telesna visina (cV%) 3.2. Srednja vrednost telesne visine svih rukometašica kreće se od 152 cm (MIN) do 172 cm (MAX), dok prosečna vrednost za datu varijablu (MEAN) iznosi 164.2 cm.

Tabela 3. Deskriptivna statistika za motoričke sposobnosti subuzorka odbojkašica.

Varijable	PuS	S	BM	X
Mean	25,1	25,4	6,5	9,7
Max	33	33,2	7,8	8,1
Min	18	16,7	4,9	10,7
StDev	4,2	7,3	1,1	0,7
cV%	16,8	28,7	15,8	6,9

Na osnovu dobijenih rezultata u tabeli 3. Najveću varijabilnost u testovima motoričkih sposobnosti odbojkašica imao je test za procenu brzinske snage opružača donjih ekstremiteta – Sardžent test (cV%) 16.2, dok je najmanju varijabilnost imao X test za procenu agilnosti (cV%) 6.9.

Tabela 4. Deskriptivna statistika za motoričke sposobnosti subuzorka za rukometašice.

Varijable	PuS	S	BM	X
Mean	18,5	20,1	7	9,6
Max	30	30,2	9,7	8,2
Min	6,5	11,6	5,2	11,2
StDev	6,4	7,8	1,3	0,852
cV%	34,9	38,8	19,2	8,8

U tabeli 4. prikazani su rezultati deskriptivne statistike za motoričke sposobnosti rukometašica uzrasta od 13-14 godina. Testovi su pokazali kao i kod odbojkašica da su najveće varijabilnosti kod testa za procenu brzinske snage opružača donjih ekstremiteta – Sardžent testa (cV%) 38.8, a najmanje varijabilnosti kod testa za procenu agilnosti (X test) (cV%) 8.8.

Tabela 5. Komparativna analiza oba subuzorka.

Varijable	TV	TM	BMI	RR	Age	PuS	S	BM	X
p value	0,043	0,933	0,348	0,005	0,481	0,003	0,101	0,263	0,917

Prosečna telesna visina kod odbojkašica iznosi 168.9 cm (Tabela 1) dok je prosečna visina kod rukometašica 164.2. (Tabela 2) Između ova dva subuzorka postoji statistički značajna razlika u telesnoj visini ($p=0.04$) na nivou značajnosti 0.05 u korist odbojkašica (Tabela 5).

Prosečna vrednost raspona ruku kod odbojkašica iznosi 171.1 cm (Tabela 1) a kod rukometašica 163.2 cm (Tabela 2) Prema dobijenim rezultatima može se zaključiti da između odbojkašica i rukometašica postoji statistički značajna razlika u merenoj dužini raspona ruku u korist odbojkašica. Ostvareni nivo statističke značajnosti je ($p=0.005$) (Tabela 5).

Prosečna vrednost varijable za procenu pokretljivosti (PuS test) kod odbojkašica iznosi 25.06 cm (Tabela 3.) a kod rukometašica iznosi 19.15 cm (Tabela 4.). Između odbojkašica i rukometašica postoje statistički značajne razlike u istraživanoj varijabli test sedećeg pretklona u korist odbojkašica. Ostvareni nivo statističke značajnosti je ($p=0.003$) (Tabela 5).

Diskusija

Na osnovu realizovanog istraživanja rezultati su pokazali da za morfološke karakteristike statistički značajne razlike u telesnoj masi (TM) i indeksu telesne mase (BMI) ne postoje, dok su razlike uočene kod telesne visine i kod raspona ruku. Za ove dve varijable (TV i RR) značajne razlike su utvrđene na nivou ($p=0.04$) i ($p=0.005$) u korist ispitanica iz uzorka odbojkašica. Dobijeni rezultati telesne visine su donekle očekivani u korist odbojkašica, jer se u ovom sportu selekcija, između ostalog, vrši u odnosu na telesnu visinu koja je potrebna za određene igračke pozicije. Telesna visina je od velikog značaja u odbojci, dok u rukometu ne mora da bude. Kako je raspon ruku biološki direktno vezan za telesnu visinu, to je i razlog za statistički značajnu razliku u korist odbojkašica. Dobijeni rezultati iz prostora telesnih dimenzija su u skladu sa prethodnim studijama (Pion, 2015).

Nakon utvrđenih rezultata takođe se može uočiti da fizički razvoj odbojkašica u odnosu na rukometašice (što se tiče motoričkih sposobnosti) karakterišu značajne razlike u samo jednom testu za procenu motoričkih sposobnosti u korist odbojkašica. Te razlike su uočene u testu za procenu gipkosti tj. pokretljivosti, na nivou ($p=0.003$). Rezultati testa pretklon u sedu (PuS) pokazali su veću vrednost u korist odbojkašica što se može objasniti većom ulogom fleksibilnosti u elementima igranja odbrane u odbojci u odnosu na rukomet. U odbojci veća fleksibilnost je posledica pokreta većih amplituda. U samoj trenažnoj tehnologiji malo je veća zastupljenost rastezanja (dinamičko rastezanje kao deo zagrevanja za trening) kod odbojkašica nego kod rukometašica.

Rukometašice su pokazale bolje rezultate u dva motorička testa (Bacanje medicinke i „x“ test), ali rezultati nisu statistički značajni. Pokazani rezultati su očekivani iz više razloga, a jedan od najvažnijih je to što su ove dve sportske grane veoma slične. Osim kontakta, koji je prisutan u rukometu (i zbog kog je najverovatnije prisutniji veći mišićni tonus koji direktno utiče na pokretljivost), sva ostala kretanja i pokreti su gotovo identični u obe sportske grane.

Dalja istraživanja bi trebalo da uključe veći broj ispitanika, kao i proširenu bateriju testova koja bi zadržala odrednice jednostavnog izvođenja u terenskim uslovima. Izražena telesna longitudinalnost, predstavljena kroz TV i RR, pruža dobru odrednicu u usmeravanju ka odbojkaškoj igri. Sprovedeno istraživanje doprinosi prepoznavanju značajnih karakteristika koje mogu pomoći, kako trenerima, tako i samim polaznicima u odabiru jedne od pomenutih sportskih igara.

Zaključak

Odbojka i rukomet, kao i svi ostali sportovi, zahtevaju određeni nivo morfoloških i motoričkih karakteristika, radi što boljeg i uspešnijeg delovanja u situacionim uslovima i ostvarivanju rezultata. Unapređenje motoričkih sposobnosti i harmoničan fizički razvoj, značajne su komponente na koje se može

delovati optimalnim fizičkim vežbanjem. Konkretno, potrebno je staviti akcenat na: objektivnije dijagnostifikovanje, programiranje, neposredno sprovođenje i kontrolisanje efekata datog trenažnog procesa.

Izražena telesna longitudinalnost, predstavljena kroz TV i RR, pruža dobru odrednicu u usmeravanju ka odbojkaškoj igri. Sprovedeno istraživanje doprinosi prepoznavanju značajnih karakteristika koje mogu pomoći, kako trenerima, tako i samim polaznicima u odabiru jedne od pomenutih sportskih igara.

Na osnovu permanentnog praćenja uticaja trenažnih programa i adaptacije kod sportista, dobijamo povratnu informaciju koja nam može poslužiti u kasnijoj modifikaciji treninga. Na osnovu dobijenih rezultata, može se egzaktno oceniti kvalitet trenutnog trenažnog programa. Pored toga, moguće je izvršiti eventualne korekcije postojećih programa te povećati kvalitet rada.

Potrebno je na osnovu rezultata testiranja kreirati programe rada koji će uticati na svestrani razvoj sportistkinja. Uviđamo da uspešno planiranje i programiranje trenažnog procesa predstavlja složen i veoma zahtevan proces koji iziskuje celokupnu pažnju i znanje stručnjaka koji učestvuju u njegovom stvaranju i realizovanju.

Od ključne važnosti je i sagledavanje uslova u kojima se sportisti vaspitavaju, jer to doprinosi uspešnom planiranju i programiranju kroz obezbeđivanje uslova za intezifikaciju treninga, uspostavljanje stalnih uvida u razvoj fizičkih sposobnosti.

Iskonski cilj se ogleda u akcentovanju onih sadržaja koji će bitno uticati na razvijanje upravo onih sposobnosti u kojima sportisti zaostaju. Te stoga, dalja istraživanja bi trebalo da uključe veći broj ispitanika, kao i proširenu bateriju testova koja bi sadržala odrednice jednostavnog izvođenja u terenskim uslovima jer bi se na taj način obezbedio širi pristup koji je esencijalan za uspešnost sportista.

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Social-humanistic aspects of physical education, sport and recreation

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SOURCES AND MAGNITUDE OF PERCEIVED COMPETITIVE STRESS IN WOMEN'S VOLLEYBALL

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Introduction

In the last three decades, there has been a growing interest in studying stress in sport psychology. Understanding the athletes' experiences of stress is important because stress might influence the athletes' well-being and athletic performance (McKay, Niven, Lavallee, & White, 2008). In addition to mental health concerns such as excessive anxiety, frustration and conflict, feelings of irritation and fear, many athletes report physical health concerns as well, such as lack of sleep, continuous tension, fatigue, headaches, and digestive problems. Furthermore, competitive stress may have a significant impact on the effectiveness of performance: it can produce protracted slumps in performance, demotivation, chronic stress, as well as burnout syndrome.

The term *stress* is defined and conceptualized inconsistently in the literature: as an environmental stimulus, a person's response, a result of an interaction between a person and an environment or as a meaning assigned by a person to his or her relationship with an environment (Fletcher, Hanton, & Mellalieu, 2006; Neil, Fletcher, Hanton, & Mellalieu, 2007). A participation in sports can serve as a buffer to stress, but on the other hand, a participation in sports (both training and competition) can be source of stress (Kimball & Freysinger, 2003). Reactions to stress, or symptoms that indicate the presence of stress, can be physiological, behavioural, cognitive and emotional, as well as a combination of them (Wilson, & Pritchard, 2005). Although the competitive experience is only a fraction of the overall sporting experience, athletic competition is challenging itself, and the stress athletes experience during competitions is often intense. Therefore, it isn't surprising that the research on stress in sports was predominantly focused on competitive stress. *Competitive stress* can be defined as an *ongoing exchange* between an individual and an environment, where the environmental demands are primarily and directly associated with a competitive performance (Fletcher et al., 2006; Mellalieu et al., 2006). There are two different perspectives in competitive stress studies: one with a focus on identifying what athletes perceive to be competitive stressors – sources of stress, and the other with a focus on cognitions, emotions and coping strategies adopted by athletes (Abedalhafiz, Altahayneh, & Al-Haliq, 2010). The available literature offers several classifications of sources of stress in sports. For example, according to their origin (Fletcher, Hanton, & Mellalieu, 2006), it is possible to distinguish organizational stressors (issues that are not normally related to sports performance, e.g. finances) and competitive stressors (issues directly related to sports performance, e.g. opponents, preparation). The *competitive stressors* (i.e. specific demands or sources of stress) are directly related to sports performance (Hanton et al., 2005). In numerous quantitative and qualitative studies (Noblet, & Gifford, 2002; O'Neil, & Steyn, 2007; Nicholls, Holt, Polman, & Bloomfield, 2006; Vredenburg, 2007; Scanlan, Stein, & Ravizza, 1991; Holt, & Hogg, 2002), a large list of stressors perceived by the athletes from various sports and with different samples of subjects: athletes in sampling years, professional athletes, top athletes, and athletes from different sociocultural backgrounds, was identified. There is evidence of a core group of stressors experienced by all athletes. Based on the analysis of the various research results, a group of authors (McKay, Niven, Lavallee & White, 2008) cite the following: pressure to perform in accordance with high

standards, worries about performing poorly, and difficulties in balancing sport and non-sport commitments. Another group of authors (Abedalhafiz et al., 2010) similarly concluded that some sources of competitive stressors appear to be common throughout various sports: pressure to perform in accordance with high standards, concerns about training and competition environment, lack of confidence, worries about performing poorly, worries about injury, coaches' behaviours and coaching styles, and difficulties in balancing sport and non-sport commitments. There is also evidence that some stressors are unique for certain sports (Abedalhafiz, Alahayneh, & Al-Haliq, 2010; Noblet, & Gifford, 2002; Scanlan, Stein, & Ravizza, 1991), for example, there is a probability that athletes in team sports are exposed to some stressors that differ from the ones included in individual sports (Holt, & Hogg, 2002). Particularly, athletes in team sports have to rely on one another to achieve success, participate in highly frequent competitive and non-competitive interactions with teammates, and may experience less individualized coaching activities.

In comparison with other sports games, a uniqueness of volleyball is reflected in the rules of winning points, sets and matches. According to the rules of other sports games (soccer, handball, basketball), when a player misses or does not point, the previous result remains, and in volleyball the point goes to the opponent. So far, researchers have not identified specific stressors and their perceived intensity in volleyball. The purpose of this exploratory study is dual. One, it attempts to create a questionnaire to assess the sources of competitive stressors in volleyball. Two, it aims to identifying the sources of stress and comparing the intensity of various competition stressors.

Methods

Sample

The sample consisted of 59 female volleyball players. The participants' age ranged from 14 to 30, with the mean age of $18,8 \pm 4,1$ years. Their sport experience ranged from 1 to 15 years, with the mean value of $8,8 \pm 3,3$ years.

Instrument

The study was conducted in two phases. In the first phase, the participants (independent sample $N=28$) were asked to list the three most common competitive stressors in volleyball and to assess their frequency. Analysing the obtained answers and based on the analysis of the previous research results we created a survey on competitive stressors in volleyball. The survey contained 22 items. In the second phase, subjects (independent sample $N=59$) evaluated degrees of stressfulness of the listed competitive situations on a 5-point Likert scale (from 1- not at all to 5 - extremely).

Procedure

Prior to distributing the surveys, telephone calls were made to the coaches to obtain the permission to conduct the study. The athletes who agreed to participate were given a survey. The participation in the research was voluntary and anonymous. The paper-pencil questionnaires were administered in the group settings in sport clubs.

Data analysis

Exploratory factor analysis (Principal Component Analysis with a varimax rotation), Cronbach's alpha coefficient of reliability, descriptive statistics, MANOVA and ANOVA for repeated measures, were used for the processing of the survey data and metrics.

Results

Survey metrics were assessed using factor analysis, Principal Component Analysis (PCA) with a varimax rotation (Table 1) and Cronbach's alpha coefficient of reliability (Table 2). The initial factor extraction produced six factors. The factors with at least three items, with factor loading of at least .40, and

no loadings on more than one factor, were retained. This resulted in six items being discarded, leaving a four-factor solution. The scree plot analysis also revealed a breakpoint after the fourth component. The Kaiser-Meyer-Olkin measure of sampling adequacy was .77, and it is above the commonly recommended value of .6. Bartlett's test of sphericity was significant ($\chi^2(120) = 417.35, p < .05$). The communalities were all above .3 (see Table 1), that further confirming that each item shared some common variance with other items. The four-factor solution accounted for 64.9% of the variance, with the first component making up 20.1%, the second 16.6% the third 14.6% and the fourth 13.6%. Given these overall indicators, factor analysis was deemed to be suitable with all 16 items. The analysis of the four components reveals that the first one labelled *Pressure* is loaded by the variables related to feeling of pressure and control over the situation, whereas the second one labelled *Challenge* is loaded by the variables indicating different aspects of the game and performance accomplishments, the third, *Teammate's mistakes* is clearly loaded by the variables that represent teammates' failures, and the fourth, *Personal mistakes* is clearly loaded by the variables that represent personal failures (Table 1).

Table 1. Factor loadings and communalities based on a principal components analysis with a varimax rotation for 16 items

	Loadings				Communality
	Factor 1	Factor 2	Factor 3	Factor 4	
When I have no control over the game.	.642	.317		.300	.657
The match which the final placement depends on (either we stay or we fall out of the league).	.684				.521
When I think I'm not sufficiently physically prepared.	.642		.341		.544
When I lose focus.	.726				.609
When I enter the game from the bench and I'm expected to change the result.	.720	.371			.687
When the coach does not put me in the game and I think he should.	.734			.494	.821
When I enter the field from the bench.		.831			.770
When I first come into contact with the ball.		.769			.638
Constant focus of the opponents on me.		.626		.380	.584
Continuance after a bad game.		.701			.611
Poor game of a teammate.		.332	.728		.641
When a teammate loses a point.			.696		.619
When a teammate makes a mistake.			.825		.741
When I make consecutive mistakes.				.763	.603
When I make a mistake at a crucial result.			.455	.536	.589
When I incorrectly perform a certain technical element.				.806	.744

Note. Factor loadings < .3 are suppressed.

Table 2 shows number of items, Cronbach's alfa coefficient of reliability, and results of the descriptive statistics (mean and standard deviation). As can be seen, two factors *Challenge* and *Teammate's mistakes* have acceptable values for Cronbach's alpha, and two factors, *Pressure* and *Personal mistakes*, have a recommended minimum value (equal or above) of .65. It can be seen that the mean value of female volleyball players on all four factors is around and above the mean value, which means that the estimated intensity of the competitive stressors is moderate. The standard deviation is significantly higher on *Pressure* factor, which is an indicator of the increased variability of subjects in this factor.

Table 2. Number of items, Cronbach's alpha coefficients and descriptive statistics

Factors	n	α	M	SD
Pressure	6	.65	3.2	1.03
Challenge	4	.75	2.4	.74
Teammate's mistakes	3	.75	2.3	.72
Personal mistakes	3	.66	3.4	.68

Based on the analysis of variance for repeated measurements, with Bonferroni post-hoc test, it can be concluded that there is a difference in the degree of perceived competition stressors, Wilk's Λ is 0.24, $F(1,68) = 1555.7$, $p < 0.000$, whereby the most intense one is *Personal mistakes*, followed by *Pressure*, then *Challenge* and *Teammate's mistakes*, the intensity of which the subjects estimated to be equal (mean values are shown in Table 2).

In order to establish whether there is any difference in the assessment of the intensity degree in competitive stressors among younger and older volleyball players, the age variable was transformed into the category variable with two categories: younger categories (up to 18 years of age) and seniors (19 years of age and older). Table 3 shows the values of arithmetic means and standard deviations for these two categories of subjects. There is no statistically significant difference in the perceived intensity of competitive stressors among younger categories and seniors, $F(4, 53) = .453$, $p < .005$; Wilk's $\Lambda = .064$.

Table 3. Descriptive statistics for young categories and seniors

Factors	Younger categories		Seniors	
	M	SD	M	SD
Pressure	3.37	1.24	3.10	.81
Challenge	2.28	.72	2.51	.75
Teammate's mistakes	2.28	.76	2.32	.69
Personal mistakes	3.55	.63	3.32	.71

Discussion

The first objective of this research was to create a survey for estimate of competition stressors in volleyball and to assess its metrics. The results of the explorative factor analysis (method of Principal Component Analysis with a varimax rotation) revealed a four-factor structure, with sixteen items. The factors were labelled as Pressure, Challenge, Teammate's mistakes and Personal mistakes. The scales' reliability goes from the recommended minimum to the acceptable level.

The extraction of two factors, one related to personal mistakes and omissions, and the other related to the teammates' mistakes and omissions, on one hand, provides a support for the assumption that the athletes who train team sports are exposed to some different and specific stressors compared to athletes who train individual sports (Holt, & Hogg, 2002). In addition, the extraction of these two factors can be related to the specificities of winning points in volleyball. Namely, every volleyball serve does not only represent a possibility for a change of a result (which is a feature of other team sports - soccer, basketball, handball), but the change is sure to happen – for each omission and error, the opponent gets a point.

According to the results obtained, the most intensive stressor is the factor labelled as Personal mistakes. The second one by intensity is Pressure, followed by Challenge and Teammate's mistakes the intensity of which is equal. The research finding that Personal mistakes are the most intensive stressor is in line with the previous findings. Holt & Hogg (2002) reported that female soccer players who compete at the international level perceive the mistakes made during the international matches as the most intensive source of competitive stress. According to Nicholls et al., (2006) study, elite rugby players perceive mental and

physical errors during competition as the major stressor. Similar findings from the qualitative study (Scanlan, et al., 1991) indicate that "not playing well" represents a principal source of stress.

The second objective of this research was to compare the intensity of competition stressors. The sources of stress identified in this research are consistent with the previous research (Holt, & Hogg, 2002; Noblet & Gifford, 2002; McKay, et al., 2008), and this provides a support for the assumption that there is a core group of stressors experienced by all athletes. No significant differences were obtained in the perceived intensity of stressors among younger categories and senior volleyball players. This finding is supported by the previous research. In the research by North (1996) there are no differences shown in the perceived competitive stressors among non-elite and elite tennis players. Another research results (Mellalieu, Neil, Hanton, & Fletcher, 2009) suggest that there are some common stressors encountered by both athletes competing at major national and international championships and non-elite performers. This is an interesting finding, since senior volleyball players have more demanding training sessions and experience greater pressure for achieving a successful competitive performance and winning. A plausible explanation would be that the competition demands faced by athletes at different competition and age levels are similar - already at younger age the importance of the results prevails over the game and the enjoyment.

Conclusion

In summary, this initial research provided an insight into the sources of competitive stress experienced by female volleyball players who are at different skill and competition levels. Identifying sources of stress and their intensity is important because it provides necessary information for development of effective stress management programs. The results from this research indicate that female volleyball players, observed at a general level, experience similar competitive stressors as the athletes training other sports disciplines. We can assume that the specificities of winning points in volleyball can be in relation with extracting of two different factors related to mistakes. An additional research is required to provide a more accurate understanding and verification of such assumption. Further findings indicate that both skill levels (younger categories and seniors) estimate the intensity of competitive stressors in a similar manner, which can be connected to similar competition demands.

This research is not without limitations. First, the future research in this area should focus on development and improvement of the survey's metrics, verify its factorial validity and promote its internal reliability. It would be useful for the researchers in this area to include a variety of items describing numerous situations that usually occur during the volleyball competitions, and then to re-determine the factorial structure of the survey, which would lead to more holistic understanding of the sources of competitive stress. The future research should include larger samples of subjects of both sexes. It would be particularly important for sport psychology practitioners to determine the connection between these stressors and the efficiency of the coping mechanisms.

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IZVORI I INTENZITET OPAŽENOG TAKMIČARSKOG STRESA U ŽENSKOJ ODBOJCI

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Uvod

U poslednje tri decenije interesovanje za proučavanje stresa u psihologiji sporta je sve veće. Razumevanje iskustva koje sportisti doživljavaju u vezi sa stresom veoma je važno zato što stres može da utiče i na njihovu dobrobit i na sportsko izvođenje (McKay, Niven, Lavallee & White, 2008). Pored uticaja na mentalno zdravlje, na primer, na pojavu prekomerne anksioznosti, frustracija i konflikata, osećanja iritiranosti i straha, mnogi sportisti izveštavaju o problemima sa fizičkim zdravljem, poput nedostatka sna, kontinuiranog osećanja napetosti, umora, glavobolja i problema sa probavom. I dodatno, takmičarski stres može značajno uticati na efikasnost performansi: može izazvati produžene padove u izvođenju, demotivaciju, hroničan stres, ali i sindrom izgaranja.

U literaturi termin *stres* se definiše i konceptualizuje nekonzistentno: kao stimulus iz sredine, kao karakteristika osobe, kao rezultat interakcije između osobe i sredine ili kao značenje koje osoba daje svom odnosu prema sredini (Fletcher, Hanton, & Mellalieu, 2006; Neil, Fletcher, Hanton, & Mellalieu, 2007). Učestvovanje u sportu može da bude zaštita od stresa ali sa druge strane, učestvovanje u sportu (uključujući i treninge i takmičenja) može biti značajan izvor stresa (Kimball & Freysinger, 2003). Reagovanje na stres ili simptomi koji ukazuju na prisustvo stresa mogu biti psihološki, ponašajni, kognitivni, emocionalni ili njihova kombinacija (Wilson & Pritchard, 2005). Mada je takmičenje samo deo celokupnog iskustva vezanog za učestvovanje u sportu, ono je izazovno, a stres koji sportisti mogu da iskuse tokom takmičenja često je intenzivan. Upravo zbog toga ne iznenađuje činjenica što je interesovanje istraživača dominantno usmereno na proučavanje takmičarskog stresa. *Takmičarski stres* se može definisati kao *tekuća razmena* između osobe i sredine pri čemu su zahtevi sredine prvenstveno i direktno povezani sa nastupom na takmičenju (Fletcher et al., 2006; Mellalieu et al., 2006). U proučavanju takmičarskog stresa izdvajaju se dva pristupa: u okviru jednog, fokus je na identifikovanju stresora – opaženih izvora stresa od strane sportista, dok je u okviru drugog, fokus na kogniciji, osećanjima i strategijama prevladavanja sportista (Abedalhafiz, Altahayneh, & Al-Haliq, 2010). U literaturi se može pronaći nekoliko klasifikacija izvora stresa u sportu. Na primer, prema poretku (Fletcher, Hanton, & Mellalieu, 2006), moguće je razlikovati organizacione stresore (pitanja koja nisu neposredno povezana sa sportskim izvođenjem, na primer, finansiranje) i takmičarske stresore (pitanja koja su direktno povezana sa sporskim izvođenjem, na primer, protivnici, priprema). Takmičarski stresori (tzv. zahtevi ili izvori stresa) direktno su povezani sa sportskim izvođenjem (Hanton et al., 2005). U brojnim kvantitativnim i kvalitativnim istraživanjima (Noblet & Gifford, 2002; O'Neil & Steyn, 2007; Nicholls, Holt, Polman, & Bloomfield, 2006; Vredenburg, 2007; Scanlan, Stein, & Ravizza, 1991; Holt & Hogg, 2002) identifikovan je dugačak spisak izvora stresa koje navode sportisti koji treniraju različite discipline i u koje su bili uključeni ispitanici sa različitim karakteristikama: sportisti selekcionog uzrasta, profesionalni i vrhunski sportisti, sportisti koji potiču iz različitih sociokulturnih sredina. Ima dokaza da postoji grupa stresora koju iskuse svi sportisti. Na osnovu analize rezultata različitih istraživanja, grupa autora (McKay, Niven, Lavallee, & White, 2008) navodi sledeće: pritisak da nastup bude na visokom standardu uspešnosti, zabrinutost zbog lošeg izvođenja, teškoće balansiranja u ispunjavanju obaveza koje jesu i koje nisu vezane za sport. Druga grupa autora (Abedalhafiz et al., 2010) takođe je došla do zaključka da su određeni izvori takmičarskog

stresa zajednički za sve sportove: pritisak da nastup bude na visokom standardu uspešnosti, brige u vezi sa trenažnom i takmičarskom sredinom, nedostatak samopouzdanja, zabrinutost zbog lošeg izvođenja, zabrinutost zbog mogućeg povređivanja, ponašanje i stil vođstva trenera, teškoće balansiranja između sportskih obaveza i obaveza izvan sporta. Neki stresori su jedinstveni za pojedine sportove (Abedalhafiz, Altahayneh, & Al-Haliq, 2010; Noblet & Gifford, 2002; Scanlan, Stein, & Ravizza, 1991), npr. postoje dokazi za to da su neki stresori prisutni kod timskih sportova, ali ne i kod individualnih (Holt & Hogg, 2002). Tako, postoji veća verovatnoća da sportisti koji treniraju timske sportove moraju da se oslanjaju jedni na druge, učestvuju u velikom broju takmičarskih i netakmičarskih interakcija sa saigračima i najverovatnije mogu imati manje individualizovanih trenažnih aktivnosti.

U poređenju sa drugim sportskim igrama, jedinstvena karakteristika odbojke odnosi se na pravila za osvajanje bodova, setova i utakmica. Prema pravilima drugih sportskih igara (fudbal, rukomet, košarka), kada igrač pogreši ili ne poentira, ostaje prethodni rezultat, dok u odbojci poen dobija protivnik. Do sada, istraživači nisu identifikovali jedinstvene stresore i njihov opaženi intenzitet u odbojci. Ovo eksplorativno istraživanje ima dvostruki cilj. Prvi je kreiranje upitnika za procenu izvora takmičarskih stresora u odbojci. Drugi cilj je upoređivanje intenziteta različitih takmičarskih stresora.

Metod

Uzorak

Uzorak je činilo 59 odbojkašica. Ispitanice su uzrasta od 14 do 30 godina, prosečne starosti $18,8 \pm 4,1$ godina. Njihovo iskustvo u sportu je od 1 do 15 godina, a prosečno je $8,8 \pm 3,3$ godine.

Instrument

Istraživanje je izvedeno u dve faze. U prvoj fazi od ispitanika (nezavisni uzorak $N = 28$) je zatraženo da navedu tri najčešća takmičarska stresora i da procene učestalost njihovog javljanja. Analizom dobijenih odgovora i na osnovu analize rezultata prethodnih istraživanja kreiran je upitnik takmičarskih stresora u odbojci. Upitnik je sadržao 22 stavke. U drugoj fazi, ispitanice (nezavisni uzorak $N = 59$) su procenjivale stepen stresogenosti navedenih situacija na takmičenju na petostepenoj Likertovoj skali (od 1 - uopšte ne do 5 - ekstremno).

Postupak

Pre zadavanja upitnika telefonom su kontaktirani treneri u cilju dobijanja saglasnosti za izvođenje istraživanja. Sportistima, koji su bili saglasni da učestvuju u istraživanju, dat je upitnik. Učestvovanje u istraživanju je bio dobrovoljno i anonimno. Upitnici tipa papir-olovka zadati su u grupi u prostorijama sportskih klubova.

Analiza podataka

Za obradu podataka i metrijskih karakteristika primenjena je eksplorativna faktorska analiza (metod Glavnih komponenti sa Varimax rotacijom), Cronbach alfa koeficijenti pouzdanosti, deskriptivna statistika, MANOVA i ANOVA za ponovljena merenja.

Rezultati

Metrijske karakteristike instrumenta proverene su primenom faktorske analize (PCA), metodom glavnih komponenti uz varimax rotaciju (Tabela 1) i izračunati su Kronbah alfa koeficijenti pouzdanosti (Tabela 2). Početna faktorska analiza dala je šest komponenti. Oni faktori koji imaju najmanje tri stavke, sa faktorskim zasićenjem .40 i većim, koji se nisu visoko projektovali na više od jednog faktora su zadržane. Usled toga, iz dalje analize je isključeno šest stavki, što je rezultiralo četvoro-faktorskim rešenjem. Analiza skri plotova otkrila je da je prelomna tačka posle četvrtog faktora. Kajzer-Majer-Olkinova mera adekvatnosti uzorka je .77 što je iznad preporučene vrednosti od .60. i Bartletov test sferičnosti je značajan ($\chi^2(120) =$

417.35, $p < .05$). Komunaliteti su iznad vrednosti .30 (videti u Tabeli 1), koji dalje potvrđuju da stavke imaju zajedničku varijansu. Četvoro-faktorsko rešenje objašnjava 64.9% ukupne varijanse, pri čemu prva komponenta objašnjava 20.1%, druga 16.6% treća 14.6% a četvrta 13.6%. Dobijeni indikatori faktorske analize ukazuju na to da je rešenje sa 16 stavki zadovoljavajuće. Analiza četiri dobijene komponente ukazuje na to da je prvi faktor *Pritisak* zasićen varijablama koje se odnose na osećanje pritiska i kontrolu situacije, dok je drugi faktor *Izazov* zasićen varijablama koje su indikatori izazova i dostizanja određenih performansi, treći faktor *Greške saigrača* jasno je zasićen varijablama koje se tiču grešaka drugih igrača, a četvrti *Lične greške* je jasno zasićen stavkama koje se odnose na lične propuste (Tabela 1).

Tabela 1. Faktorska zasićenja i komunaliteti zasnovani na metodu glavnih komponenti sa varimax rotacijom za 16 stavki

	Zasićenja				Komunaliteti
	Faktor 1	Faktor 2	Faktor 3	Faktor 4	
Kada nemam kontrolu nad igrom, Utakmica od koje zavisi konačni plasman (ostajemo ili ispadamo iz lige),	,642	,317		,300	,657
Kada mislim da nisam dovoljno fizički pripremljen/a,	,684				,521
Kada gubim koncentraciju,	,642		,341		,544
Kada sa klupe uđem u igru i očekuje se da ću promeniti rezultat,	,726				,609
Kada me trener ne uvede u igru a mislim da bi trebalo,	,720	,371			,687
Kada ulazim na teren sa klupe,	,734			,494	,821
Kada imam prvi kontakt sa loptom,		,831			,770
Konstantna usmerenost protivnika na mene,		,769			,638
Nastavak posle loše igre,		,626		,380	,584
Loša igra saigrača,		,701			,611
Kada saigrač izgubi poen,		,332	,728		,641
Kada saigrač pogreši,			,696		,619
Kada pravim uzastopne greške,			,825		,741
Kad pogrešim na ključnom rezultatu,				,763	,603
Kada pogrešno izvedem određeni tehnički element,			,455	,536	,589
				,806	,744

Napomena. Faktorska zasićenja < .30 su isključena.

U Tabeli 2 prikazan je broj stavki, Kronbah alfa koeficijent pouzdanosti i rezultati deskriptivne analize (prosečne vrednosti i standardne devijacije). Kao što se može videti, dva faktora *Izazov* i *Greške saigrača* imaju zadovoljavajuće vrednosti Kronbahovog alfa, dok dva faktora *Pritisak* i *Lične greške* imaju preporučeni minimum (jednak ili iznad) vrednosti od .65. Može se videti da su odgovori odbojkašica na sva četiri faktora oko i iznad prosečne vrednosti, što znači da je procenjen intenzitet takmičarskih stresora umeren. Standardna devijacija je značajno veća na faktoru *Pritisak*, što je pokazatelj povišene varijabilnosti odgovora ispitanica na ovom faktoru.

Tabela 2. Broj stavki, Kronbah alfa koeficijenti i deskriptivna statistika

Faktori	n	α	M	SD
Pritisak	6	,65	3,20	1,03
Izazov	4	,75	2,40	,74
Greške saigrača	3	,75	2,30	,72
Lične greške	3	,66	3,40	,68

Na osnovu analize varijanse za ponovljena merenja, uz Bonferroni post-hoc test, možemo zaključiti da postoji statistički značajna razlika u intenzitetu stresora na uzorku u celini, Wilk's Λ is 0.24, $F(1,68) = 1555.7$, $p < 0.000$, pri čemu je najintenzivniji Lične greške, zatim sledi Pritisak, Izazov i Greške saigrača čiji intenzitet je jednak (srednje vrednosti prikazane su u tabeli 2).

Da bi se utvrdilo da li postoji razlika u proceni stepena intenziteta takmičarskih stresora između mlađih selekcija i seniorke, varijabla uzrast je transformisana u kategoričku varijablu sa dve kategorije: mlađe kategorije (do 18 godina) i seniorke (od 19 i starije). U tabeli 3 prikazane su vrednosti aritmetičkih sredina i standardnih devijacija ove dve kategorije ispitanica. Razlika između mlađih selekcija i seniorke u opaženom intenzitetu takmičarskih stresora nije statistički značajna, $F(4, 53) = .453$, $p < .005$; Wilk's $\Lambda = .064$.

Table 3. Deskriptivna statistika za mlađe kategorije i seniorke

Faktori	Mlađe kategorije		Seniorke	
	M	SD	M	SD
Pritisak	3,37	1,24	3,10	,81
Izazov	2,28	,72	2,51	,75
Greške saigrača	2,28	,76	2,32	,69
Lične greške	3,55	,63	3,32	,71

Diskusija

Prvi cilj ovog istraživanja bio je da se kreira upitnik za procenu takmičarskih stresora u odbojci i da se provere njegove metrijske karakteristike. Rezultati eksplorativne faktorske analize (metod Glavnih komponenti sa varimax rotacijom) otkrili su četvorofaktorsku strukturu, sa šesnaest stavki. Faktori su nazvani: Pritisak, Izazov, Greške saigrača i Lične greške. Pouzdanost dobijenih skala kreće se od preporučenog minimuma do prihvatljivog stepena.

Izvori stresa identifikovani u ovom istraživanju su konzistentni sa rezultatima prethodnih istraživanja (Holt & Hogg, 2002; Noblet & Gifford, 2002; McKay, et al., 2008) i daju podršku pretpostavci da postoji osnovna grupa stresora koje doživljavaju svi sportisti. Izdvajanje dva faktora, jednog koji se odnosi na lične greške i propuste, i drugog koji se odnosi na greške i propuste saigrača, sa jedne strane predstavlja podršku pretpostavci da su sportisti koji treniraju timske sportove izloženi nekim drugačijim i specifičnim stresorima u poređenju sa sportistima koji treniraju individualne sportove (Holt & Hogg, 2002). Osim toga, izdvajanje ova dva faktora može da se dovede u vezu sa specifičnostima osvajanja poena u odbojci. Naime, svaki servis u odbojci ne predstavlja samo mogućnost da dođe do promene rezultata (što je karakteristika drugim timskih sportova - fudbala, košarke, rukometa), već do promene nužno dolazi – za svaki učinjeni propust i grešku, protivnik dobija poen.

Drugi cilj ovog istraživanja bio je da se uporedi intenzitet takmičarskih stresora. Prema dobijenim rezultatima, najintenzivniji stresor predstavlja faktor nazvan Lične greške. Sledeći prema intenzitetu je Pritisak, zatim slede Izazov i Greške saigrača koji su podjednakog intenziteta. Istraživački nalaz da Lične greške predstavljaju najintenzivniji izvor stresa u skladu je sa prethodnim istraživanjima. Holt i Hog (2002) su saopštili da fudbalerke koje se takmiče na međunarodnom nivou, greške tokom međunarodnih mečeva procenjuju kao najintenzivniji izvor takmičarskog stresa. Prema rezultatima istraživanja Nikolsa i saradnika (2006), vrhunski ragbisti mentalne i fizičke greške tokom takmičenja opažaju kao najveći stresor. Slični nalazi kvalitativne studije (Scanlan et al., 1991.) ukazuju na to da je „ne igrati dobro“ glavni izvor stresa.

Između mlađih selekcija i seniorke nisu dobijene značajne razlike u opaženom intenzitetu stresora. Ovaj nalaz ima podršku u prethodnim istraživanjima. U istraživanju Norta (1996) nisu pokazane razlike u intenzitetu opaženih takmičarskih stresora između neelitnih i elitnih teniskih igrača. Rezultati drugog istraživanja (Mellalieu, Neil, Hanton, & Fletcher, 2009) ukazuju na to da postoje zajednički izvori stresa za sportiste koji se takmiče na glavnim nacionalnim i međunarodnim takmičenjima i za neelitne sportiste. Ovo

je zanimljiv nalaz ako se ima u vidu da odbojkašice seniorke prolaze kroz zahtevniji trenažni proces i doživljavaju veći pritisak za dostizanje uspešnog izvođenja na takmičenju i pobede. Jedno verovatno objašnjenje može biti u tome da se sportisti različitog takmičarskog nivoa i uzrasta suočavaju sa sličnim zahtevima takmičenja – da već u mlađim uzrastima značaj rezultata dominira nad igrom i uživanjem.

Zaključak

Ovo istraživanje dalo je uvid u izvore takmičarskog stresa kod odbojkašica koje nastupaju u okviru različitih takmičarskih nivoa. Identifikovanje izvora stresa i njihovog intenziteta je veoma važno zato što pruža neophodne informacije za razvoj efikasnih programa namenjenih upravljanju stresom. Rezultati ovog istraživanja ukazuju na to da odbojkašice, posmatrano na opštem nivou, doživljavaju slične takmičarske stresore kao i sportisti koji treniraju druge sportske discipline. Možemo pretpostaviti da su specifičnosti osvajanja poena u odbojci povezani sa ekstrakcijom dva različita faktora povezanih sa greškama. Neophodna su dalja istraživanja da bi se postiglo preciznije razumevanje i proveravanje ove pretpostavke. Ostali rezultati ukazuju na to da odbojkašice oba takmičarska ranga (mlađe selekcije i seniorke) slično procenjuju intenzitet takmičarskog stresa, što se može povezati sa sličnim zahtevima takmičenja.

Ovo istraživanje ima neka ograničenja. Prvo, naredna istraživanja u ovoj oblasti treba da se usmere na razvoj i unapređivanje metrijskih karakteristika upitnika, da provere njegovu faktorsku validnost i unaprede unutrašnju pouzdanost. Bilo bi korisno da istraživači u ovoj oblasti uključe različite stavke koje opisuju brojne situacije koje se obično dešavaju tokom takmičenja u odbojci i da onda ponovo utvrde faktorsku strukturu upitnika, što bi dovelo do potpunijeg razumevanja izvora takmičarskog stresa. Naredna istraživanja bi trebalo da budu izvedena na većim uzorcima ispitanika oba pola. Od posebne važnosti za sportske psihologe praktičare je da se utvrdi povezanost između takmičarskih stresora i efikasnosti mehanizama suočavanja.

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RELATIONS BETWEEN PHYSICAL SELF-CONCEPT AND PHYSICAL ACTIVITY IN ADOLESCENTS

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Introduction

According to the World Health Organization, one of the most important factors that can contribute to the improvement of a population's health status is a global increase in the level of physical activity (World Health Organization, 2010). Physical activity can be defined as any type of body movements that occurs using skeletal muscles and leads to energy consumption (Caspersen, Powell, & Christenson, 1985). Various studies have shown that the level of physical activity in adolescence is one of the significant predictors of the level of physical activity in adulthood (Barnekow-Bergkvist, Hedberg, Janlert, & Jansson, 1998; Cleland, Dwyer, & Venn, 2012; Nogueira, et al., 2009; Tammelin, et al., 2014). On the other hand, it has been also determined that adolescence is a period during which a considerable decrease in the level of physical activity occurs, especially in girls (Dumith, Gigante, Domingues, & Kohl, 2011; Kimm, et al., 2001; Nader, Bradley, Houts, McRitchie, & O'Brien, 2008; Nelson, Neumark-Stsainer, Hannan, Sirard, & Story, 2006; Riddoch, et al., 2004). Taking this into account, it is of utmost importance to know the factors that affect the level of physical activity in adolescents.

The authors have pointed out that one of the most significant psychological factors associated with the level of physical activity in adolescents is physical self-concept, as one of the domains of general self-concept (Marsh, Richards, Johnson, Roche, & Tremayne, 1994; Marsh & Craven, 2006). Self-concept can be defined as a person's self-assessment developed through personal experience and based on evaluation and assessment by others, which includes self-acceptance, self-worth and competence (Shavelson, Hubner, & Stanton, 1976; Marsh, 2007). It is a multidimensional construct, on the top of which there is general self-concept including the sub-components of academic and non-academic self-concept (Marsh, 1989; Marsh, 1994; Marsh, 1996; Marsh et al., 1994). As a part of non-academic self-concept, physical self-concept includes the perception of one's own physical abilities and physical appearance. Having started from this multidimensional model, Marsh et al. have developed an instrument for measuring physical self-concept - Physical Self-Description Questionnaire (PSDQ), comprising nine specific components of physical self-concept (health, coordination, physical activity, body fat, sport competence, appearance, strength, flexibility and endurance) and two general components (general physical self-concept and self-esteem) (Marsh et al., 1994; Marsh, 1996).

The studies conducted so far have shown that a positive physical self-concept, measured by the PSDQ instrument, is associated with a higher level of physical activity in young people (Chanal, Marsh, Sarrazin, & Bois, 2005; Jekauc, Wagner, Herrmann, Hegazy, & Woll, 2017; Lazarević, Radisavljević, Milanović, 2008; Marsh, Papaioannou, & Theodorakis, 2006). Similar results were also obtained in the studies where physical self-concept has been operationalized in a slightly different way (Fox, 2000; 2002; Moreno & Cervello, 2005; Trautwein, Gerlach, & Lüdtke, 2008; Tubić, Đorđić, & Poček, 2012). These findings have been confirmed by a recent meta-analytical research which has shown that physical self-concept, examined in various studies, is consistently related to the level of physical activity in adolescents (Babic, et al., 2014). Considering the mechanism of interrelation between physical self-concept and physical activity, Marsh et al. have developed the Reciprocal Effects Model (Marsh & Craven, 2006; Marsh, et al., 2006). According to this model, it is

assumed that the causal relation between physical self-concept and physical activity is dynamic and reciprocal: physical self-concept is formed on the basis of previous experiences related to the engagement in various physical activities, but it also has a reciprocal effect on the engagement in subsequent physical activities. In other words, positive experiences related to the engagement in physical activities lead to the formation of a positive physical self-concept, and the positive self-concept leads to the adolescents' long-term, more frequent and more persistent engagement in physical activity, and vice versa.

The aim of this study was to determine the contribution of various factors, which, in recent studies, have been found to correlate with physical activity, to the prediction of the level of physical activity in adolescents. The first group of factors included the socio-demographic characteristics of adolescents (age and gender) and the second one included the dimensions of physical self-concept, defined by the application of the multidimensional model offered by Marsh et al. (Marsh, 1989; Marsh et al., 1994; Marsh, 1996). In accordance with the previous research, it may be assumed that gender and age will be significant predictors of physical activity levels, i.e. level of physical activity will be higher in male adolescents and in younger adolescents as well. In addition, the assumption is that physical self-concept will have an incremental contribution to the prediction of the level of physical activity in adolescents in relation to the socio-demographic characteristics.

Method

Sample

The sample included 268 primary school pupils (seventh grade, $N = 80$) and secondary school pupils (first grade, $N = 91$; third grade, $N = 97$), of the average age of 15.47 ($SD = 1.75$). According to gender, the sample included 108 boys (40.1%) and 160 girls (59.9%).

Instruments

In order to measure the levels of physical activity of the examined pupils, the Physical Activity Questionnaire for Adolescents - PAQ-A, which is recommended for the application at the age of 14 to 20, was used (Kowalski, Crocker, & Donen, 2004). The questionnaire consists of nine questions by which pupils should assess their physical activity in the previous seven days starting from the date of the survey. The score is calculated as an average of the answers given to the first eight questions, with a higher score indicating a higher level of physical activity. The reliability of the PAQ-A questionnaire in this study (Cronbach α) was .82.

In order to examine physical self-concept, the Physical Self-Description Questionnaire - PSDQ-S, (Marsh, Martin, & Jackson, 2010) was used, consisting of 40 items selected from the original form of the PSDQ instrument developed by Marsh et al. (Marsh, et al., 1994). The PSDQ-S has been translated into Serbian and adapted for use in our context. The items were followed by the six-point Likert-type scales (1 - completely false, 6 - completely true). They were grouped into 11 sub-scales: 9 for measuring the specific components of physical self-concept (health, coordination, physical activity, body fat, sport competence, appearance, strength, flexibility and endurance) and 2 general scales (general physical self-concept and self-esteem). The score for each sub-scale is calculated as an average of the answers given to the questions belonging to that specific sub-scale, with a higher score indicating a more positive physical self-concept. The reliability of the sub-scales used in this study (Cronbach α) for most sub-scales ranged from .76 to .91, except for the health sub-scale, where reliability was somewhat lower and amounted to .59. The data about the pupils' age, gender and grade were collected by the additional questions.

Procedure

The research was conducted in the primary and secondary schools in Sombor. In each school, a previous consent for conducting the research was obtained from the school principals. The pupils participated in the research voluntarily and anonymously. It took them about 20 minutes to fill in the questionnaires.

Data processing

Descriptive statistics, correlation and regression analyses were applied for the data processing.

Results

Table 1 shows the results of descriptive statistics (minimum, maximum, mean and standard deviation) regarding the PAQ-A and PSDQ-S questionnaires. The results have indicated that the pupils' self-assessment of their own physical activity was slightly below the average level. The average scores achieved on the PSDQ-S sub-scales have indicated that the pupils have a positive physical self-concept, with the exception of the Body fat sub-scale, where the results were below the average.

Table 1: Descriptive statistics regarding PAQ-A and PSDQ-S questionnaires

Questionnaire	N	Min	Max	M	SD
PAQ-A	268	1.02	4.44	2.58	0.75
PSDQ-S – Health	268	1.00	6.00	4.07	0.68
PSDQ-S – Coordination	268	1.20	6.00	4.23	1.03
PSDQ-S – Physical activity	268	1.00	6.00	3.54	1.35
PSDQ-S – Body fat	268	1.00	6.00	2.37	1.39
PSDQ-S – Sport competence	268	1.00	6.00	4.00	1.37
PSDQ-S – General Physical Self-Concept	268	1.65	6.00	4.35	1.22
PSDQ-S – Appearance	268	1.00	6.00	4.16	1.17
PSDQ-S – Strenght	268	1.67	6.00	4.13	1.23
PSDQ-S – Flexibility	268	1.00	6.00	3.71	1.34
PSDQ-S – Endurance	268	1.25	6.00	3.75	1.27
PSDQ-S – Self-Esteem	268	1.25	6.00	4.55	0.98

The results of the correlation analysis have shown that the pupils' levels of physical activity were in a positive correlation with the majority of the PSDQ-S sub-scales: coordination, physical activity, sport competence, general physical self-concept, appearance, strength, flexibility, endurance and self-esteem (Table 2). There was a negative correlation found between the physical activity level and the body fat sub-scale, whereas there was no correlation determined between the level of physical activity and the health sub-scale.

Table 2: Intercorrelation matrix between the PAQ-A scores and the PSDQ-S questionnaire sub-scales

	PAQ A	Hth	Coor	FA	BF	SC	GFSC	App	Str	Fle	En
Hth	.00										
Coor	.26**	-.02									
FA	.70**	-.02	.40**								
BF	-.13*	.61**	-.28**	-.08							
SC	.54**	-.09	.52**	.53**	-.28**						
GFSC	.47**	-.17**	.55**	.49**	-.45**	.65**					
App	.22**	-.22**	.31**	.19**	-.40**	.44**	.53**				
Str	.45**	-.07	.45**	.50**	-.24**	.68**	.67**	.51**			
Fle	.17**	-.14*	.51**	.20**	-.21**	.35**	.42**	.32**	.40**		
En	.55**	-.16**	.49**	.61**	-.29**	.62**	.58**	.29**	.54**	.34**	
Sp	.35**	-.07	.51**	.34**	-.41**	.62**	.71**	.57**	.61**	.39**	.44**

Note: ** - $p < .01$; * - $p < .05$; Hth - health; Coor - coordination; FA - physical activity; BF - body fat; SC - sport competence; GFSC - General physical self-concept; App - Appearance; Str - strength; Fle - flexibility; En - endurance; SE - self-esteem.

In order to determine the predictive value of gender, age and the dimensions of physical self-concept for the pupils' level of physical activity, a hierarchical multiple regression analysis (enter method) was conducted, whereby a score achieved in the PAQ-A questionnaire was considered a criterion variable (Table 3). The first block included the pupils' age and gender as the predictors, and the second one included all the PSDQ-S sub-scales. This regression function was found to be significant in relation to the first block, $R = .51$, $R^2 = .26$, $F(2, 265) = 45.90$, $p = .00$, and the pupils' age and gender were also determined as significant predictors. By introducing the sub-scales, which are used to measure physical self-concept, into the second block, the percentage of variance explained increased significantly, $R = .81$, $R^2 = .66$, $F(13, 254) = 38.50$, $p = .00$, $\Delta R^2 = .41$, $p = .00$. In addition to the pupils' age and gender, the significant predictors included in this block were the following sub-scales: health, coordination, physical activity and endurance.

Table 3: Hierarchical multiple regression: prediction of the level of physical activity

Block	Predictor	β	t	p
1	Constant		16.43	.00
	Gender	-.20	-3.78	.00
	Age	-.45	-8.46	.00
2	Constant		8.59	.00
	Gender	-.12	-3.17	.00
	Age	-.32	-8.16	.00
	Health	.13	2.61	.01
	Coordination	-.11	-2.22	.03
	Physical activity	.49	9.74	.00
	Body fat	-.06	-1.05	.29
	Sport competence	.10	1.70	.09
	General Physical Self-Concept	.04	0.55	.58
	Appearance	.07	1.33	.18
	Strength	-.04	-0.63	.53
	Flexibility	.05	1.18	.24
	Endurance	.12	2.19	.03
Self-Esteem	.05	0.76	.45	

Note: β - partial correlation; t - Student t-test, p - significance; Codes for gender: 1 - male, 2 - female

Discussion

The aim of this study was to determine the extent to which the physical activity in adolescents can be predicted on the basis of their socio-demographic characteristics (gender and age) and the dimensions of physical self-concept defined by the multidimensional model developed by Marsh et al. (Marsh et al., 1994;

Marsh, 1996). According to the results of the previous research, it has been assumed that the level of physical activity will be higher in young adolescents and male adolescents as well as that physical self-concept will have an incremental contribution to the prediction of the level of physical activity in adolescents. In accordance with the expectations, the results of the hierarchical multiple regression analysis have shown that gender and age are significant predictors of the physical activity in adolescents, i.e. the younger and the male adolescents have assessed that they are more frequently engaged in different types of physical activity. In addition, it has been shown that the introduction of the dimensions of physical self-concept into the regression equation significantly increases the percentage of variance explained, whereas the dimensions of health, coordination, physical activity and endurance have been singled out as significant predictors. These findings have confirmed the assumption that physical self-concept has an incremental contribution to the prediction of the level of physical activity in adolescents in regard to age and gender.

The findings on the correlation between the level of physical activity and age and gender are in line with the results of the previous research which have consistently shown that younger pupils are more often engaged in physical activities compared to older pupils, and that male pupils demonstrate a higher level of physical activity in relation to female ones (Aaron, et al., 1993; Crocker, Eklund, & Kowalski, 2000; Dumith, et al., 2011; Nader, et al., 2008; Nelson, et al., 2006; Radisavljević-Janic, Milanović, & Lazarević, 2012; Riddoch, et al., 2004). The aforementioned studies suggest that a period of transition from early to middle adolescence represents the critical period during which a decrease in the level of physical activity occurs, given that major developmental changes, including the changes in pupils' interests, occur exactly during this period. Also, the findings indicating that age and gender may have an interactive effect on the level of physical activity, i.e. a decline in physical activity during adolescence is greater in female pupils than in male ones, have been found interesting (Dumith, et al., 2011; Riddoch, et al., 2004). On the other hand, the strength of the prediction of the physical activity level in adulthood based on the physical activity level in adolescence has been found to be greater in female respondents compared to male ones (Azevedo, Araújo, Silva, and Hallal, 2007). Taking the described findings into account, it may be concluded that the programs aimed at improving the physical activity in young people should be targeted and oriented toward the period of early and middle adolescence, taking into consideration the specificities of female population

The results of this study have shown that some of the dimensions of physical self-concept, in addition to age and gender, significantly contribute to the prediction of the physical activity in adolescents. Although, at the correlation level, all the dimensions of physical self-concept (excluding body fat) were in a positive correlation with the level of physical activity, the dimensions of health, coordination, physical activity and endurance have been determined as independent predictors. The obtained results have indicated that the adolescents who perceive and assess themselves as healthier, stronger and more physically active will demonstrate a higher level of physical activity. It should be noted that the dimension of coordination, which was in a positive correlation with the level of physical activity, according to the correlation analysis ($r = .25$), was found to be a negative predictor in the regression analysis ($r = -.11$), indicating that the adolescents who have assessed their coordination as poor showed a higher level of physical activity. This finding is not in accordance with the expectations, and it might be explained by the fact that this dimension was highly correlated with most other dimensions of physical self-concept, therefore, a suppressor effect was manifested in the regression analysis.

The obtained results are, generally, in accordance with the previous studies which have indicated a positive correlation between physical self-concept and physical activity in adolescents (Babic, et al., 2014; Chanal, et al., 2005; Fox, 2002, Jekauc, et al., 2017, Lazarević et al., 2008; Marsh, et al., 2006; Radisavljević-Janić, 2010; Trautwein, et al., 2008; Tubić, et al., 2012). Although the findings of this study have specified the dimensions of physical self-concept that contribute to the prediction of physical activity in young people

most, it should be noted that the dimensions of physical self-concept were intercorrelated, which could lead to the conclusion that the entire physical self-concept should be strengthened in order to raise the level of physical activity in adolescents.

Conclusion

The findings of this study have shown that the level of physical activity in adolescents can be predicted on the basis of their age and gender as well as on the basis of some of the dimensions of physical self-concept. The obtained results have implied that the physical self-concept in adolescents should be strengthened in order to raise the level of physical activity, taking into consideration the age and gender specificities. The Reciprocal Effects Model (Marsh & Craven, 2006; Marsh, et al., 2006), which assumes a reciprocal relation between physical self-concept and physical activity, can be used as the starting point for strengthening physical self-concept. According to this model, a positive physical self-concept is formed through positive experiences related to the engagement in physical activities, and it also has a reciprocal effect on the engagement in subsequent physical activities. Positive experiences related to physical activity and physical exercise can be ensured best through the participation in physical education classes, which, as a part of the compulsory education system, include almost the entire adolescent population. The physical education classes, which would be suitable for physical self-concept strengthening, should be organized so as to provide adolescents with the experience of competence to engage in physical activity and physical exercise, as well as oriented toward personal progress rather than focused on the comparison between pupils. The findings about the age and gender differences related to the level of physical activity have indicated that the changes in pupils' interests that occur during this period, especially in female adolescents, should be taken into account within the teaching process.

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RELACIJE FIZIČKOG SELF-KONCEPTA I FIZIČKE AKTIVNOSTI ADOLESCENATA

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Uvod

Prema Svetskoj zdravstvenoj organizaciji, jedan od najznačajnijih faktora koji mogu da doprinesu unapređenju zdravstvenog statusa populacije je globalno podizanje nivoa fizičke aktivnosti (World Health Organization, 2010). Fizička aktivnost se može definisati kao svako telesno kretanje koje nastaje posredstvom skeletne muskulature i dovodi do potrošnje energije (Caspersen, Powell, & Christenson, 1985). Različita istraživanja su pokazala da je nivo fizičke aktivnosti u adolescenciji jedan od važnih prediktora nivoa fizičke aktivnosti u odraslom dobu (Barnekow-Bergkvist, Hedberg, Janlert, & Jansson, 1998; Cleland, Dwyer, & Venn, 2012; Nogueira, et al., 2009; Tammelin, et al., 2014). Sa druge strane, pokazano je da je upravo adolescencija period u kome dolazi do značajnog opadanja nivoa fizičke aktivnosti, naročito kod devojčica (Dumith, Gigante, Domingues, & Kohl, 2011; Kimm, et al., 2001; Nader, Bradley, Houts, McRitchie, & O'Brien, 2008; Nelson, Neumark-Stzainer, Hannan, Sirard, & Story, 2006; Riddoch, et al., 2004). Uzimajući ovo u obzir, veoma je važno poznavati faktore koji utiču na nivo fizičke aktivnosti adolescenata.

Autori ukazuju da je jedan od najznačajnijih psiholoških faktora koji je povezan sa nivoom fizičke aktivnosti adolescenata fizički self-koncept, kao jedan od domena opšteg self-koncepta (Marsh, Richards, Johnson, Roche, & Tremayne, 1994; Marsh & Craven, 2006). Self-koncept se može definisati kao samoopažanje osobe, koje je nastalo kroz lično iskustvo i na osnovu evaluacije od strane drugih, a koje obuhvata i osećanja samoprihvatanja, samocenjenja i kompetentnosti (Shavelson, Hubner, & Stanton, 1976; Marsh, 2007). To je multidimenzionalni konstrukt na čijem se vrhu nalazi opšti self-koncept, a čije su podkomponente akademski i neakademski self-koncept (Marsh, 1989; Marsh, 1994; Marsh, 1996; Marsh et al., 1994;). Kao deo neakademskog self-koncepta, fizički self-koncept obuhvata percepciju sopstvenih fizičkih sposobnosti i fizičkog izgleda. Polazeći od ovakvog multidimenzionalnog modela, Marš i saradnici su razvili instrument za merenje fizičkog self-koncepta – Physical Self Description Questionnaire (PSDQ), koji obuhvata devet specifičnih komponenti fizičkog self-koncepta (zdravlje, koordinacija, fizička aktivnost, telesna debljina, sportska kompetentnost, izgled, snaga, fleksibilnost i izdržljivost) i dve opšte komponente (opšti fizički self-koncept i samopoštovanje) (Marsh et al., 1994; Marsh, 1996).

Dosadašnje studije su pokazale da je pozitivan fizički self-koncept, meren instrumentom PSDQ, povezan sa višim nivoom fizičke aktivnosti mladih (Chanal, Marsh, Sarrazin, & Bois, 2005; Jekauc, Wagner, Herrmann, Hegazy, & Woll, 2017; Lazarević, Radisavljević, & Milanović, 2008; Marsh, Papaioannou, & Theodorakis, 2006). Slični rezultati dobijeni su i u istraživanjima u kojima je fizički self-koncept operacionalizovan na nešto drugačiji način (Fox, 2000; 2002; Moreno & Cervello, 2005; Trautwein, Gerlach, & Lüdtke, 2008; Tubić, Đorđić, & Poček, 2012). Navedeni nalazi su svoju potvrdu našli u skorašnjoj metaanalitičkoj studiji koja je pokazala da je fizički self-koncept u različitim studijama dosledno povezan sa nivoom fizičke aktivnosti mladih (Babic, et al., 2014). Razmatrajući mehanizam povezanosti između fizičkog self-koncepta i fizičke aktivnosti, Marš i saradnici su razvili Model recipročnih efekata (eng. Reciprocal Effect model) (Marsh & Craven, 2006; Marsh, et al., 2006). Ovaj model pretpostavlja da je uzročna veza između fizičkog self-koncepta i fizičke aktivnosti dinamična i recipročna: fizički self-koncept se formira na osnovu prethodnih iskustava vezanih za učestvovanje u različitim fizičkim aktivnostima, ali i deluje povratno na učešće u narednim fizičkim aktivnostima. Drugim rečima, pozitivna iskustva vezana za učešće u fizičkim

aktivnostima vode formiranju pozitivnog fizičkog self-koncepta, a pozitivan self-koncept vodi ka tome da se mladi češće, duže i sa većom istrajnošću bave fizičkim aktivnostima, i obrnuto.

Cilj ovog istraživanja bio je da se utvrdi doprinos različitih faktora, koji su se u dosadašnjim istraživanjima pokazali kao korelati fizičke aktivnosti, u predikciji nivoa fizičke aktivnosti adolescenata. Prvu grupu faktora činile su socio-demografske karakteristike adolescenata (pol i uzrast), a drugu dimenzije fizičkog self-koncepta, definisane multidimezionalnim modelom koji su ponudili Marš i saradnici (Marsh, 1989; Marsh et al., 1994; Marsh, 1996). U skladu sa dosadašnjim istraživanjima, može se pretpostaviti da će pol i uzrast biti značajni prediktori nivoa fizičke aktivnosti, odnosno da će nivo fizičke aktivnosti biti veći kod adolescenata muškog pola i mlađih adolescenata. Pored toga pretpostavka je da će fizički self-koncept imati dodatni doprinos u predikciji nivoa fizičke aktivnosti adolescenata, u odnosu na socio-demografske karakteristike.

Metod

Uzorak

Uzorak je činilo 268 učenika osnovne (sedmi razred, $N = 80$) i srednje škole (prvi razred, $N = 91$; treći razred, $N = 97$), prosečnog uzrasta 15.47 ($SD = 1.75$). Prema polnoj strukturi, uzorak je činilo 108 dečaka (40.1%) i 160 devojčica (59.9%).

Instrumenti

Za merenje nivoa fizičke aktivnosti učenika korišćen je Upitnik o fizičkoj aktivnosti za adolescente (Physical Activity Questionnaire for Adolescents – PAQ-A), koji se preporučuje za primenu na uzrastu od 14 do 20 godina (Kowalski, Crocker, & Donen, 2004). Upitnik se sastoji od devet pitanja na kojima učenici procenjuju svoju fizičku aktivnost u prethodnih sedam dana od datuma kada je sprovedeno istraživanje. Rezultat se računa kao prosek odgovora na prvih osam pitanja, a veći skor označava viši nivo fizičke aktivnosti. Pouzdanost upitnika PAQ-A u ovom istraživanju (Cronbach α) iznosi .82.

Za ispitivanje fizičkog self-koncepta korišćena je skraćena forma Upitnika fizičkog self-koncepta - Physical Self Description Questionnaire – PSDQ-S, (Marsh, Martin, & Jackson, 2010) koji se sastoji od 40 ajtema selektovanih iz originalne forme PSDQ instrumenta Marša i saradnika (Marsh, et al., 1994). PSDQ-S je preveden na srpski jezik i adaptiran za upotrebu u našoj sredini. Ajtemi su praćeni šestostepenim skalama Likertovog tipa (1 – potpuno netačno, 6 – potpuno tačno). Grupisani u 11 supskala: 9 za merenje specifičnih komponenti fizičkog self-koncepta (zdravlje, koordinacija, fizička aktivnost, telesna debljina, sportska kompetentnost, izgled, snaga, fleksibilnost i izdržljivost) i 2 opšte skale (opšti fizički self-koncept i samopoštovanje). Rezultat za svaku supskalu se računa kao prosek odgovora na pitanja koja pripadaju toj supskali, a veći skor označava pozitivniji fizički self-koncept. Pouzdanost supskala u ovom istraživanju (Cronbach α) za većinu supskala se kreće od .76 do .91, osim za supskalu zdravlje, gde je pouzdanost nešto niža i iznosi .59. Dodatnim pitanjima, prikupljeni su podaci o uzrastu učenika, polu i razredu koji pohađaju.

Postupak

Istraživanje je sprovedeno u osnovnim i srednjim školama u Somboru. U svakoj školi, dobijena je saglasnost od direktora za sprovođenje istraživanja. Učešće učenika u istraživanju je bilo dobrovoljno i anonimno. Popunjavanje upitnika trajalo je oko 20 minuta.

Obrada podataka

Za obradu podataka upotrebljena je deskriptivna statistika, korelaciona i regresiona analiza.

Rezultati

U tabeli 1 prikazani su rezultati deskriptivne statistike (minimum, maksimum, aritmetička sredina i standardna devijacija) za upitnike PAQ-A i PSDQ-S. Rezultati pokazuju da je učenička procena sopstvene

fizičke aktivnosti nešto ispod prosečnog nivoa. Prosečni skorovi na supskalama instrumenta PSDQ-S ukazuju da učenici imaju pozitivan fizički self-koncept, osim na supskali telesna debljina, gde su rezultati ispod proseka.

Tabela 1: Deskriptivna statistika za upitnike PAQ-A i PSDQ-S

Upitnik	N	Min	Max	M	SD
PAQ A	268	1,02	4,44	2,58	0,75
PSDQ – Zdravlje	268	1,00	6,00	4,07	0,68
PSDQ – Koordinacija	268	1,20	6,00	4,23	1,03
PSDQ – Fizička aktivnost	268	1,00	6,00	3,54	1,35
PSDQ – Telesna debljina	268	1,00	6,00	2,37	1,39
PSDQ – Sportska kompetentnost	268	1,00	6,00	4,00	1,37
PSDQ – Opšti fizički self-koncept	268	1,65	6,00	4,35	1,22
PSDQ – Izgled	268	1,00	6,00	4,16	1,17
PSDQ – Snaga	268	1,67	6,00	4,13	1,23
PSDQ – Fleksibilnost	268	1,00	6,00	3,71	1,34
PSDQ – Izdržljivost	268	1,25	6,00	3,75	1,27
PSDQ – Samopoštovanje	268	1,25	6,00	4,55	0,98

Legenda: Min – Minimalna vrednost, Max – maksimalna vrednost, M – aritmetička sredina, SD – standardna devijacija

Rezultati korelacione analize pokazuju da je nivo fizičke aktivnosti učenika u pozitivnoj korelaciji sa većinom supskala instrumenta PSDQ-S: koordinacija, fizička aktivnost, sportska kompetentnost, opšti fizički self-koncept, izgled, snaga, fleksibilnost, izdržljivost i samopoštovanje (tabela 2). Između nivoa fizičke aktivnosti i supskale telesna debljina postoji negativna korelacija, dok između nivoa fizičke aktivnosti i supskale zdravlje nema korelacije.

Tabela 2: Matrica interkorelacija između skora na upitniku PAQ-A i supskala upitnika PSDQ-S

	PAQ A	Zdr	Koor	Fa	Td	Spk	Fsk	Izg	Sna	Fle	Izd
Zdr	,00										
Koor	,26**	-,02									
Fa	,70**	-,02	,40**								
Td	-,13*	,61**	-,28**	-,08							
Spk	,54**	-,09	,52**	,53**	-,28**						
Fsk	,47**	-,17**	,55**	,49**	-,45**	,65**					
Izg	,22**	-,22**	,31**	,19**	-,40**	,44**	,53**				
Sna	,45**	-,07	,45**	,50**	-,24**	,68**	,67**	,51**			
Fle	,17**	-,14*	,51**	,20**	-,21**	,35**	,42**	,32**	,40**		
Izd	,55**	-,16**	,49**	,61**	-,29**	,62**	,58**	,29**	,54**	,34**	
Sp	,35**	-,07	,51**	,34**	-,41**	,62**	,71**	,57**	,61**	,39**	,44**

Legenda: ** – značajnost na nivou .01; * – značajnost na nivou .05; PAQ-A – Upitnik o fizičkoj aktivnosti; Zdr – zdravlje; Koor – koordinacija; Fa – fizička aktivnost; Td – telesna debljina; Spk – sportska kompetentnost; Fsk – Opšti fizički self-koncept; Izg – Izgled; Sna – Snaga; Fle – fleksibilnost; Izd – izdržljivost; Sp – samopoštovanje.

Da bi se utvrdila prediktivna vrednost pola, uzrasta i dimenzija fizičkog self-koncepta za nivo fizičke aktivnosti učenika sprovedena je hijerarhijska multipla regresiona analiza (enter metod) u kojoj je kriterijumska varijabla bio skor na upitniku PAQ-A (tabela 3). U prvi blok su kao prediktori stavljani pol i uzrast učenika, a u drugi sve supskale instrumenta PSDQ-S. Ova regresiona funkcija je značajna u prvom bloku, $R = .51$, $R^2 = .26$, $F(2, 265) = 45.90$, $p = .00$, a značajni prediktori su pol i uzrast učenika. Dodavanjem supskala koje mere fizički self-koncept u drugom bloku, značajno je porastao procenat objašnjene varijanse, $R = .81$, $R^2 = .66$, $F(13, 254) = 38.50$, $p = .00$, $\Delta R^2 = .41$, $p = .00$. Značajni prediktori u ovom bloku su, pored pola i uzrasta, supskale zdravlje, koordinacija, fizička aktivnost i izdržljivost.

Tabela 3: Hijerarhijska multipla regresija: predikcija nivoa fizičke aktivnosti

Blok	Prediktor	β	t	p
1	Konstanta		16,43	,00
	Pol	-,20	-3,78	,00
	Uzrast	-,45	-8,46	,00
2	Konstanta		8,59	,00
	Pol	-,12	-3,17	,00
	Uzrast	-,32	-8,16	,00
	Zdravlje	,13	2,61	,01
	Koordinacija	-,11	-2,22	,03
	Fizička aktivnost	,49	9,74	,00
	Telesna debljina	-,06	-1,05	,29
	Sportska kompetentnost	,10	1,70	,09
	Opšti fizički self-koncept	,04	0,55	,58
	Izgled	,07	1,33	,18
	Snaga	-,04	-0,63	,53
	Fleksibilnost	,05	1,18	,24
	Izdržljivost	,12	2,19	,03
	Samopoštovanje	,05	0,76	,45

Legenda: β – parcijalna korelacija; t – studentov t-test, p – značajnost; kodovi za varijablu pol: 1 – muško, 2 – žensko

Diskusija

Cilj ovog istraživanja bio je da se ispita u kojoj meri se fizička aktivnost adolescenata može predvideti na osnovu njihovih socio-demografskih karakteristika (pol i uzrast) i dimenzija fizičkog self-koncepta definisanih multidimezionalnim modelom Marša i saradnika (Marsh et al., 1994; Marsh, 1996). Na osnovu rezultata prethodnih istraživanja formulisana je pretpostavkada će nivo fizičke aktivnosti biti veći kod mlađih adolescenata i adolescenata muškog pola, kao i da će fizički self-koncept imati dodatni doprinos u predikciji nivoa fizičke aktivnosti adolescenata. U skladu sa očekivanjima, rezultati hijerarhijske multiple regresione analize su pokazali da su pol i uzrast značajni prediktori fizičke aktivnosti adolescenata, odnosno da mlađi adolescenti i adolescenti muškog pola procenjuju da se učestalije bave različitim fizičkim aktivnostima. Pored toga, pokazano je da uvođenje dimenzija fizičkog self-koncepta u regresionu jednačinu značajno povećava procenat objašnjene varijanse, a kao značajni prediktori izdvojile su se dimenzije zdravlje, koordinacija, fizička aktivnost i izdržljivost. Ovakav rezultat potvrđuje pretpostavkuda fizički self-koncept ima dodatni doprinos u predikciji nivoa fizičke aktivnosti adolescenata u odnosu na pol i uzrast.

Nalazi o povezanosti nivoa fizičke aktivnosti sa uzrastom i polom su u skladu sa rezultatima prethodnih istraživanja koja su dosledno pokazala da mlađi učenici češće i više učestvuju u fizičkim aktivnostima u odnosu na starije učenike, kao i da učenici muškog pola ispoljavaju viši nivo fizičke aktivnosti u odnosu na učenike ženskog pola (Aaron, et al., 1993; Crocker, Eklund, & Kowalski, 2000; Dumith, et al., 2011; Nader, et al., 2008; Nelson, et al., 2006; Radisavljević-Janić, Milanović, & Lazarević, 2012; Riddoch, et al., 2004). Navedena istraživanja sugerišu da je kritični period u kome dolazi do opadanja nivoa fizičke aktivnosti prelazak iz rane u srednju adolescenciju, s obzirom na to da u tom periodu dolazi do velikih razvojnih promena, koje uključuju i promene u interesovanjima učenika. Zanimljivi su i nalazi koji ukazuju da uzrast i pol mogu imati interaktivni efekat na nivo fizičke aktivnosti, odnosno da ja pad fizičke aktivnosti tokom adolescencije veći za ženske, nego za muške učenike (Dumith, et al., 2011; Riddoch, et al., 2004). Sa druge strane, pokazano je da je jačina predikcije nivoa fizičke aktivnosti u odrasloj dobi na osnovu nivoa fizičke aktivnosti u adolescenciji veća za ispitanike ženskog pola, u odnosu na ispitanike muškog pola (Azevedo, Araújo, Silva, & Hallal, 2007). Uzimajući u obzir opisane nalaze, možemo zaključiti da programi koji

imaju za cilj unapređenje fizičke aktivnosti mladih, treba da budu ciljano usmereni na period rane i srednje adolescencije, kao i da uzmu u obzir specifičnosti ženske populacije.

Rezultati ovog istraživanja pokazuju da značajan doprinos u predikciji fizičke aktivnosti adolescenata, povrh uzrasta i pola, imaju i pojedine dimenzije fizičkog self-koncepta. Iako su na nivou korelacija sve dimezije fizičkog self-koncepta (izuzev telesne debljine) u pozitivnoj korelaciji sa nivoom fizičke aktivnosti, kao nezavisni prediktori izdvojile su se dimenzije zdravlje, koordinacija, fizička aktivnost i izdržljivost. Dobijeni rezultati ukazuju da će adolescenti koji procenjuju sebe kao zdravije, više fizički aktivne i izdržljivije ispoljavati viši nivo fizičke aktivnosti. Treba napomenuti da se dimenzija koordinacija, koja je u korelacionoj analizi pokazala pozitivnu povezanost sa nivoom fizičke aktivnosti ($r = .25$), u regresionoj analizi pokazala kao negativni prediktor ($r = -.11$), odnosno da adolescenti koji procenjuju da imaju lošiju koordinaciju pokazuju viši nivo fizičke aktivnosti. Ovakav nalaz nije u skladu sa očekivanjima, a moguće objašnjenje leži u tome što je ova dimezija visoko korelirana sa većinom ostalih dimenzija fizičkog self-koncepta, pa je u regresionoj analizi ispoljen supresorski efekat.

Dobijeni rezultati su, generalno, u skladu sa prethodnim studijama koje su ukazale na pozitivnu vezu između fizičkog self-koncepta i fizičke aktivnosti mladih (Babic, et al., 2014; Chanal, et al., 2005; Fox, 2002; Jekauc, et al., 2017; Lazarević, et al., 2008; Marsh, et al., 2006; Radisavljević-Janić, 2010; Trautwein, et al., 2008; Tubić, et al., 2012). Iako su nalazi ove studije specifikovali dimenzije fizičkog self-koncepta koje najviše doprinose predikciji fizičke aktivnosti mladih, treba imati na umu da su dimenzije fizičkog self-koncepta međusobno korelirane, što navodi na zaključak da bi i u cilju podizanja nivoa fizičke aktivnosti adolescenata, trebalo jačati celokupan fizički self-koncept.

Zaključak

Rezultati ovog istraživanja pokazuju da se nivo fizičke aktivnosti adolescenata može predvideti na osnovu njihovog pola i uzrasta, kao i na osnovu pojedinih dimenzija fizičkog self-koncepta. Dobijeni nalazi impliciraju da u cilju podizanja nivoa fizičke aktivnosti adolescenata treba jačati njihov fizički self-koncept, uzimajući u obzir uzrasne i polne specifičnosti. Kao polazna osnova za jačanje fizičkog self-koncepta može poslužiti Model recipročnih efekata Marša i saradnika (Marsh & Craven, 2006; Marsh, et al., 2006) koji pretpostavlja uzajamnu vezu između fizičkog self-koncepta i fizičke aktivnosti. Po ovom modelu, pozitivan fizički self-koncept se kreira kroz pozitivna iskustva vezana za učešće u fizičkim aktivnostima, a zatim povratno deluje na angažovanje u narednim fizičkim aktivnostima. Pozitivna iskustva vezana za fizičku aktivnost i fizičko vežbanje mogu se najbolje obezbediti kroz učešće u nastavi fizičkog vaspitanja, koja kao deo obaveznog obrazovnog sistema, obuhvata gotovo čitavu populaciju mladih. Nastava fizičkog vaspitanja koja bi pogodovala jačanju fizičkog self-koncepta treba da bude organizovana tako da adolescentima pruži doživljaj kompetentnosti za bavljenje fizičkim aktivnostima i fizičkim vežbanjem, kao i da bude usmerena na lični napredak, a ne na poređenje između učenika. Nalazi o uzrasnim i polnim razlikama u nivou fizičke aktivnosti ukazuju na potrebu da se u nastavnom procesu uzmu u obzir promene u interesovanjima koje se dešavaju u ovom periodu, naročito kod adolescenata ženskog pola.

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BELIEFS ABOUT THE MORALITY OF SPORTS PSYCHOLOGISTS BEHAVIOR

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Introduction

The ethical behavior of a psychologist is extremely important because it affects their competence. Sports psychologists meet with specific dilemmas that are characteristic for sport psychology and sports culture for which no clear rules of behavior are prescribed (Brown & Cogan, 1994; Moore, 2003; Lavalley, Kremer, Moran, & Williams, 2004; Weinberg & Gould, 2011). Ethical behavior of a psychologist depends on the ability to recognize and develop sensitivity to ethical issues and possible ethical dilemmas. When considering the ethical behavior of sports psychologists, it should be considered in the specific context of sports environment.

Sport psychology also includes the applied sport psychology, where the athletes are treated similarly to clients in psychotherapy. However, sports psychologists often carry out consultations outside of the classical psychotherapy setting (in non-traditional places, for example in the dressing room) and this may represent a border crossing. The limits within the relationship of a sports psychologist - athlete are less rigid than the boundaries in classical psychotherapy practice (Andersen, van Raalte, & Brewer, 2001). Ethical dilemmas can occur in situations where there are more opportunities for informal social interactions, such as going to sport preparations, sharing a meal, celebrating success, etc. The sports psychologist is tasked with maintaining these borders and not allowing them to be violated.

When it comes to confidentiality - the "sacred" obligation of all psychologists, some of the specificities of this discipline may be important, primarily because there is often a third interested party (management of a sports club, parents or coaches) who wishes to know confidential information about the client athletes, because they pay the sports psychologist (Vesković & Petrović, 2017). It is definitely necessary for a sports psychologist to inform the club about the limits set by his code of ethics before signing the contract, but also to discuss confidentiality restrictions with a athlete client so that the client is aware of what information can remain confidential. It is customary that all the information presented in the sessions remains between the sports psychologist and the client, or possibly his parents, if he is underage. In addition, because of the above-mentioned work in non-traditional places, one can overhear a conversation between a psychologist and an athlete, and the task of a psychologist is to pay attention to such things. Sometimes coaches or team members ask the psychologist about an athlete client regarding how this athlete achieved better results after sessions. Then the psychologist has to say that they should ask the client about what has helped him in these sessions.

Another important ethical question is the issue of autonomy, that is, the right of the client to free choice. This is a very important issue for psychologists dealing with any form of counseling (Ryan, Lynch, Vansteenkiste, & Deci, 2011). First of all, the client has the right to withdraw the informed consent he gave at the beginning of the treatment. Also, sports psychologists will not influence decisions made by athletes, but they can present them with options and consequences of certain choices. A sports psychologist should not control the conversation by setting the agenda of a session without agreement with the client or leading a conversation in the direction of an objective that the he or she thought was the best for the client without prior consultation on the goals.

The aim of this study was to examine beliefs on how a psychologist should act in dealing with certain ethically challenging situations in sports. Selected respondents were those who could become sports

psychologists in the future, but also those who will be future sports trainers and who will cooperate with sports psychologists.

Method

Sample

The sample consisted of 59 students (37 female and 22 male) of the Faculty of sport and physical education (N= 25) and Department of Psychology of The Faculty of Philosophy (N=34). The average age of the participants was 21,44 years (SD=1,34).

Instruments

The first section of the questionnaire developed for this study concerned general information about the respondents (age, sex and faculty they study). The second section contained 4 vignettes, each describing dilemmas specific for professional practice: autonomy issue (1), confidentiality problem (2) and setting boundaries (3 and 4).

Procedure and data analysis

For the processing of quantitative data, descriptive statistics and χ^2 test were applied, and for the processing of qualitative data the method of logical analysis. Questionnaires were distributed via the SurveyMonkey platform.

Results and discussion

The results of the descriptive analysis (frequencies and percentages) of respondents' responses concerning how a psychologist should act in ethically challenging situations are shown in Table 1.

Table 1. Frequency and percentage of answers of the participants for each vignette (whole sample)

Vignette	Beliefs about the behavior of a sports psychologist		
	f (%)	f (%)	f (%)
The problem of freedom of choice for an athlete	should encourage 32 (54.2)	should not encourage 22 (37.3)	depends 5 (5.5)
Parents of an athlete violate confidentiality	should say 34 (57.5)	should not say 15 (25.4)	depends 10 (16.9)
Informal behavior of a psychologist	should accept 8 (13.6)	should not accept 50 (84.7)	depends 1 (1.7)
Sexual attraction	should continue 6 (10.2)	should not continue 51 (86.4)	depends 2 (3.4)

The first vignette describes a hypothetical situation in which the athlete has a high potential to advance to achieving top-notch results, but he does not want it. The following question was asked: should a psychologist, in accordance with the parents' demands, encourage his development in sports or not? More than half of the respondents think that a psychologist should respect the choice of a client (Table 1), that is, that he should not encourage the athlete to train for greater sports results if an athlete does not want it. A significantly higher percentage of future trainers than future psychologists shares the view that a psychologist should encourage a successful athlete to continue to progress to top-level sports: 64% of future coaches think that a psychologist should encourage him, 20% think he should not be encouraged, while 16% gave the answer that it "depends" on some circumstances. The frequency of the response of future psychologists is as follows: 39.2% think that a psychologist should encourage the athlete to advance in sports, although he does not want it, 50% think the psychologist should not do it, while 11.8% answered "depends." The obtained differences are statistically significant ($\chi^2 (2) = 9.072, p <.05$). The results of the qualitative analysis that relate to the explanations of the respondents beliefs are shown in Table 2. Many

respondents indicated that it is important that the psychologist examines the reasons for the decision of the client to give up his sport. What is interesting is that very few respondents point out the respect for the autonomy of the client, which means they are not familiar with this ethical principle. Parents often have a misguided belief that they know what is best for their child. The psychologist should not become an instrument of coercion in the hands of an external authority (Koocher, 2003).

Table 2. Rationale of respondents' beliefs - vignette: the problem of freedom of choice for an athlete

Vignette	Responses of future trainers		
	should encourage	should not encourage	depends
Parents bring an athlete to a sports psychologist for his lack of motivation. This is a young perspective athlete, adolescent, whose motor skills and skills according to the most stringent criteria are classified into extremely high achievements. For many years the athlete has made an effort to better manage tasks, to overcome difficulties, to be better than others and to realize his talent. Despite achieving success, he suddenly stopped trying and reiterated that he did not want to further progress to top-notch sports. Should a sports psychologist encourage this athlete to continue to advance to top sport?	- this can be a transient phase or crisis (n=5)	-they should respect the athlete's decision (n=4)	-depends on the reasons for giving up (n=2)
	-the task of a psychologist is to motivate an athlete (n=5)	-the athlete needs to motivate himself (n=1)	-if there is love for the sport, then he should encourage him (n=1)
	-the athlete should remain engaged in sport in another way (n=4)	-he won't achieve results (n=1)	
	-he has to discover the reason for giving up (n=1)		
	-adolescents should not decide on their own (n=1)		
	Responses of future psychologists		
	should encourage	should not encourage	depends
	-he has to discover the reason for giving up (n=8)	- he has to discover the reason for giving up (n=7)	-he should not encourage him only if his interests in things changed (n=2)
	- this can be a transient phase or crisis (n=3)	-the athlete can feel very pressured (n=5)	-if there is love for the sport, then he should encourage him (n=1)
	-because of the characteristics of adolescence (n=1)	-he should respect the athlete's decision (n=3)	-he should encourage him if its not his final decision but a momentary lack of motivation (n=1)
-psychologist should act in accordance with the clients' needs (n=1)	-psychologist should not give concrete advices (n=1)		
	-because sport should represent pleasure (n=1)		

Vignette number 2 describes a hypothetical situation in which a parent unfairly violates the child's right to confidentiality at sessions with a sports psychologist. The following question was raised: should a psychologist, when he learns that parents violate the right of confidentiality, tell this to his client athlete? Just under two thirds of the respondents think that a psychologist is obliged to tell the athlete that confidentiality is impaired (Table 1). A far greater number of future psychologists than future trainers think that a psychologist needs to tell the athlete that the principle of confidentiality has been violated and this difference is statistically significant ($\chi^2(2) = 8.250, p < .05$). A high percentage of future psychologists - 70.6% thinks that he should tell, 11.8% think that he should not, while as many as 17.6% answered "depends." A little over half of sports and physical education students - 52% think that a psychologist should not tell athletes that there is a violation of his confidentiality rights, 36% think he should say something, while 12% gave the

answer "depends." The results of qualitative analysis of the explanations of the respondents' beliefs are shown in Table 3. The reasons for future trainers are very heterogeneous and are mainly related to the potential negative repercussions of this disclosure, i.e. they are not directly related to the ethical rule on securing confidentiality of the sessions. On the other hand, half of the psychology students state exactly this ethical rule as an explanation of their attitude. Parents have the right to obtain certain information if the client is underage, but not in this way, because eavesdropping of conversations is certainly not part of the agreement from the beginning of the treatment and prevents the psychologist to ensure the confidentiality of the data that was promised to the client.

Table 3. Rationale of respondents' beliefs - vignette: parents of an athlete violate confidentiality

Vignette	Responses of future trainers			
	should say	should not say	depends	
A psychologist, in agreement with a 17-year-old athlete with whom he has a good working relationship and progression according to the treatment plan, invites his parents to come to a joint session to share some information that is crucial for further progress. The parent refuses to come because a eavesdropper has been installed in his child's mobile phone, which allows him to directly listen to all sessions. So, the parent has all the information and therefore does not want to come. Should a psychologist disclose this new information to the athlete?	-he can explain to the athlete how to act (n=3)	-it would not be good for the athlete (n=3)	-depending on whether it would be a problem for the athlete (n=1)	
	-it is important to be honest (n=2)	-it would impair the parent-child relationship (n=2)	-depends, but truth is always better (n=1)	
	-they should solve the issue (n=2)	-the athlete will not be honest (n=1)	-he should be working with the parent (n=1)	
	-it is in the best interest of the athlete (n=2)	-if the treatment is progressing, then nothing should be changed (n=1)		
		-it won't be important for future work (n=1)		
		-it can lead to further problems (n=1)		
		-the parent is paying for the treatment (n=1)		
		-it is the best option (n=1)		
		-in such rare circumstances ethics should be disregarded (n=1)		
		-my personal opinion (n=1)		
		Responses of future psychologists		
		should say	should not say	depends
		-it is a breach of confidentiality (n=17)	-the parent should be guided to disclose this (n=2)	-maybe he should tell him (n=3)
		-honesty is important (n=2)	-no, the athlete is a minor (n=1)	-if the parent stops this behavior, then he should not tell (n=2)
		-the athlete is the client, not the parent (n=2)	-it would impair the progression of the treatment (n=1)	-it would not be good for the athlete (n=1)
	-the athlete deserves to know (n=1)			
	-he should find the best way to tell him (n=1)			
	-if he discovers by accident this could impair their working alliance (n=1)			

The behavior of a psychologist during a celebration is an example of a situation where there are more opportunities for informal interaction between a psychologist and athletes. The following question was posed: should a psychologist accept the invitation of athletes to climb onto a table in this "happy" atmosphere? A very high agreement was reached between the respondents (see Table 1). Almost 85% of respondents share the view that a psychologist who is attending a celebration in a restaurant should not

accept the athlete's invitation to climb up on the table. The vast majority of future psychologists believe that the psychologist should be restrained in behavior, while 17.6% think he could accept "more relaxed" behavior. A slightly higher percentage of future trainers 88%, than future psychologists, believes that a psychologist should not engage in such behavior, 8% think that he should climb onto the table, while 4% is not sure. The difference in the opinions of future psychologists and future trainers is not statistically significant ($\chi^2 (2) = 2.10, p > .05$). As can be seen in Table 4, respondents from both faculties point out that such behavior is considered unprofessional or endangering for distance in relations and further work with athletes. A study by Petitpas and colleagues found that most of the US-based sports psychologists celebrated with athletes and thought it was ethical to do so (Petitpas, Brewer, Rivera, & Van Raalte, 1994). In such situations it is important that a psychologist takes care that his behavior does not jeopardize the reputation of the profession.

Table 4. Rationale of respondents' beliefs - vignette: informal behavior of a psychologist

Vignette	Responses of future trainers			
	should accept	should not accept	depends	
The psychologist is a member of the professional staff of the national team. They unexpectedly won a gold medal at the international competition. The entire team and the expert staff go to the restaurant to celebrate. A psychologist was also called. In order not to create a greater distance in relationships with athletes, the psychologist decides to go to the celebration. Music plays, the atmosphere is "heated", and under the influence of alcohol, a part of the team climbs onto the table. They give a hand to the psychologist and invite him to get up and climb onto the table. Should a psychologist accept or not?	-the psychologist should relax and have fun (n=2)	-it is not professional behavior (n=9)	-it is not bad behavior per se (n=1)	
		-he should control his behavior (n=5)		
		-it would impair the distance in the relationship with the athletes (n=4)		
		-it is not ethical (n=2)		
		-he should not, the athletes wouldn't mind (n=1)		
		-it would be counterproductive for future work (n=1)		
		Responses of future psychologists		
		should accept	should not accept	depends
		-not to create a greater distance with the athletes (n=2)	-it is not professional behavior (n=12)	
		-this will not hurt anyone (n=2)	-it would impair the distance in the relationship with the athletes (n=8)	
	-the psychologist is part of the team (n=1)	-multiple relations (n=5)		
	-the psychologist is only human (n=1)	-he should control his behavior (n=1)		
		-further work would not be efficient (n=1)		
		-my personal opinion (n=1)		

The last vignette describes a hypothetical situation in which feelings of sexual attraction between a sports psychologist and an athlete have developed, but there was no boundary crossings. The following question was asked: should a psychologist continue his work with this female athlete or not? A very high percentage of psychology students (88.2%) think that a psychologist should discontinue co-operation with this athlete, 5.9% thinks that he should continue to see her and 5.9% answered that it depends on the

circumstances. Almost identical is the assessment of future trainers - 88% of respondents also believe that the treatment should be finished, while 12% think it is not necessary. The difference in students' opinions of these two faculties is not statistically significant ($\chi^2(2) = 2.107, p > .05$). When explaining their attitudes, the respondents are referring to the rule of not entering multiple relationships with clients and the inefficiency of further work (Table 5). Interestingly, a small number of respondents mentioned the minority of the client as a reason. In a US research, most sports psychologists reported that they felt sexual attraction towards clients, but very few engaged in sexual intercourse with them (Petitpas, Brewer, Rivera, & Van Raalte, 1994).

Table 5. Rationale of respondents' beliefs - vignette: sexual attraction

Vignette	Responses of future trainers			
	should continue	should not continue	depends	
Maya is 15 years old. She is an elite level athlete and is a candidate for entry into the national team for the upcoming Olympic Games. She is also physically very attractive. She comes to sessions with the psychologist for 4 months to master psychological skills that will help her improve her performance. The psychologist is aware that he feels sexual attraction towards her but effectively controls this. After attaining a great success, which she attributes to newly-learned psychological skills, Maya's tells the psychologist that she feels a strong sexual attraction towards him. Should the psychologist continue to work with her?	-if the psychologist can control the situation (n=1)	-work will not be efficient (n=10)		
	-it can be a source of motivation (n=1)	-multiple relations with the client (n=6)		
		-because she is a minor (n=3)		
		-it is not ethical (n=2)		
		-relations will be disturbed (n=2)		
		-he should transfer her to a colleague (n=1)		
		Responses of future psychologists		
		should continue	should not continue	depends
		-it is not a reason for ending treatment (n=1)	-multiple relations with the client (n=9)	-if the psychologist can control the situation, he can continue (n=1)
		-the psychologist can help the client to understand her feelings (n=1)	-it is not ethical (n=8)	-they can overcome this (n=1)
		-it is not professional behavior (n=5)		
		-work will not be efficient (n=3)		
		-he should transfer her to a colleague (n=4)		
		-things can get out of hand (n=2)		

Conclusion

When we look at the results, there seems to be a clear need to introduce formal education and training in professional ethics for psychologists, but it is also necessary for psychologists to inform members of other professions about the rules from their ethical code. In the context of sports psychology it is possible to provide such education at faculties where future sports psychologists and coaches are trained, but it is also necessary that psychologists who want to work in this area attend additional seminars on professional ethics.

The respondents were familiar with the rule of prohibition of entering into multiple relationships, but were not sufficiently familiar with the ethical principles of confidentiality and autonomy. On the other hand, responses to the vignette concerning the informal behavior of a psychologist indicate that it is necessary to emphasize the specificity of the psychology of sports, where each boundary crossing does not represent boundary violation. In the presented hypothetical case, the psychologist would not be entering multiple relations with athletes like some respondents thought, but would behave untraditionally if he accepted to climb onto the table. Still psychologists are, just like one respondent said, just humans.

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UVERENJA O ETIČNOSTI PONAŠANJA SPORTSKIH PSIHologa

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Uvod

Etičko ponašanje psihologa je izuzetno značajno zato što utiče na njihovu kompetentnost. Sportski psiholozi se susreću sa specifičnim dilemama karakterističnim za psihologiju sporta i sportsku kulturu za koje nisu propisana jasna pravila ponašanja (Brown & Cogan, 1994; Moore, 2003; Lavalley, Kremer, Moran, & Williams, 2004; Weinberg & Gould, 2011). Za etičko ponašanje psihologa od suštinskog značaja je sposobnost prepoznavanja i razvoja osetljivosti za etička pitanja i moguće etičke dileme (Brown & Cogan, 1994). Kada se razmatra etičnost ponašanja sportskih psihologa, ona treba da se sagleda u kontekstu specifičnog sportskog okruženja.

Psihologija sporta obuhvata i primenjenu psihologiju sporta, gde se sa sportistima postupa slično kao sa klijentima u psihoterapiji. Međutim, sportski psiholozi često obavljaju konsultacije izvan klasičnog psihoterapijskog setinga (na netradicionalnim mestima, na primer u svlačionici) koje mogu da predstavljaju prelazak granica. Granice u okviru odnosa sportski psiholog - sportista su manje rigidne nego granice u klasičnoj psihoterapijskoj praksi (Andersen, van Raalte, & Brewer, 2001). Etičke dileme mogu da nastanu u situacijama u kojima ima više mogućnosti za neformalnu socijalnu interakciju, kao što je odlazak na sportske pripreme, zajedničko obedovanje, proslava postignutog uspeha, itd. Na sportskom psihologu je zadatak da te granice održava i da ne dopusti da budu srušene.

Kada je u pitanju poverljivost - „sveta“ obaveza svih psihologa i za nju se mogu vezati neke specifičnosti ove discipline, pre svega zato što se često pojavljuje treća zainteresovana strana (uprava sportskog kluba, roditelji ili treneri) koja želi da sazna poverljive informacije o klijentu sportisti, zato što plaća sportskog psihologa (Vesković & Petrović, 2017). Svakako je potrebno da sportski psiholog obavesti klub o limitima koje mu etički kodeks postavlja pre potpisivanja ugovora, ali i da razgovara o ograničenjima poverljivosti sa klijentom sportistom, kako bi klijent bio upoznat koje informacije mogu da ostanu poverljive. Uobičajeno je da svi izneti podaci ostaju između sportskog psihologa i klijenta ili eventualno njegovih roditelja ukoliko je maloletan. Pored toga, zbog pomenutog rada na netradicionalnim mestima, neko može da čuje razgovor između psihologa i sportiste, a zadatak psihologa je da obrati pažnju na to. Dešava se i da treneri ili članovi tima pitaju psihologa kako je neki sportista, za kog znaju da je išao na seanse, posle njih postigao bolje rezultate. Tada je na psihologu da kaže da je o tome šta mu je pomoglo u razgovoru potrebno pitati samog klijenta.

Još jedno važno etičko pitanje je i pitanje autonomije, odnosno prava klijenta na slobodan izbor. Ovo je veoma važno pitanje za psihologe koji se bave bilo kojim oblikom savetovanja (Ryan, Lynch, Vansteenkiste, & Deci, 2011). Pre svega, klijent ima pravo da povuče informisani pristanak koji je dao na početku tretmana. Takođe, sportski psiholozi neće uticati na odluke koje donose sportisti, ali im mogu predočiti opcije i posledice izbora. Sportski psiholog ne treba da kontroliše razgovor tako što će postaviti agendu seanse bez dogovora sa klijentom ili da vodi konverzaciju u pravcu nekog cilja koji je zamislio da je najbolji za njegovog klijenta bez prethodne konsultacije o ciljevima.

Cilj ovog istraživanja bio je da se ispituju uverenja o tome kako bi psiholog trebalo da postupi u suočavanju sa određenim etički upitnim situacijama u sportu. Odabrani su ispitanici koji bi u budućnosti

mogli postati sportski psiholozi, ali i oni koji će biti budući sportski treneri i koji će saradivati sa sportskim psiholozima.

Metod

Uzorak

Uzorak je činilo 59 studenta (37 žena i 22 muškaraca) Fakulteta sporta i fizičkog vaspitanja ($N=25$) i Odeljenja za psihologiju Filozofskog fakulteta ($N=34$). Prosečna starost ispitanika je 21,44 godine ($SD=1,34$).

Instrumenti

Prvi deo upitnika, kreiranog za ovo istraživanje, posvećen je prikupljanju opštih informacija o ispitanicima (uzrast, pol i fakultet koji studiraju). Drugi deo sadržao je 4 vinjete koje opisuju moguće dileme profesionalne prakse: pravo na slobodan izbor (1), poverljivost (2) i postavljanje granica u odnosu (3 i 4).

Postupak i analiza podataka

Za obradu kvantitativnih podataka primenjeni su deskriptivna statistika i χ^2 test, za obradu kvalitativnih metod logičke analize. Upitnici su zadavani preko platforme SurveyMonkey.

Rezultati sa diskusijom

Rezultati deskriptivne analize (frekvence i procenti) odgovora ispitanika koji se odnose na to kako bi psiholog trebalo da postupi u etički upitnim situacijama prikazani su u tabeli 1.

Tabela 1. Odgovori ispitanika (frekvence i procenti) celog uzorka

Vinjeta	Uverenja o ponašanju sportskog psihologa		
	f (%)	f (%)	f (%)
Problem slobodnog izbora sportiste	treba da podstiče 32 (54,2)	ne treba da podstiče 22 (37,3)	zavisi 5 (5,5)
Roditelji ugrožavaju poverljivost razgovora	treba da saopšti 34 (57,5)	ne treba da saopšti 15 (25,4)	zavisi 10 (16,9)
Neformalno ponašanje psihologa	treba da prihvati 8 (13,6)	ne treba da prihvati 50 (84,7)	zavisi 1 (1,7)
Seksualna privlačnost	treba da nastavi 6 (10,2)	ne treba da nastavi 51 (86,4)	zavisi 2 (3,4)

U prvoj vinjeti opisana je hipotetička situacija u kojoj sportista ima visok potencijal da napreduje ka postizanju vrhunskih rezultata, ali to ne želi. Postavljeno je sledeće pitanje: da li bi psiholog trebalo, da u skladu sa zahtevima roditelja, podstiče njegov razvoj ka vrhunskom sportu ili ne? Nešto više od polovine ispitanika smatra da psiholog treba da podrži slobodan izbor klijenta (tabela br. 1), odnosno, da ne bi trebalo da podstiče sportistu na treniranje usmereno ka postizanju visokih sportskih rezultata, ukoliko sportista to ne želi. Znatno veći procenat budućih trenera nego budućih psihologa deli mišljenje da psiholog treba da podstiče uspešnog sportistu da nastavi da napreduje ka vrhunskom sportu: 64% budućih trenera smatra da bi psiholog trebalo da ga podstiče, 20% njih smatra da ne bi trebalo da ga podstiče, dok je 16% dalo odgovor da to „zavisi“ od nekih okolnosti. Učestalost odgovora budućih psihologa je sledeća: 39,2% smatra da bi psiholog trebalo da podstiče sportistu da napreduje prema vrhunskom rezultatu iako on to ne želi, 50% smatra da ne bi trebalo, dok je 11,8% odgovorilo sa „zavisi“. Dobijene razlike su statistički značajne ($\chi^2(2)=9.072$, $p<.05$). Rezultati kvalitativne analize koji se odnose na obrazloženja ispitanika prikazani su u tabeli 2. Više ispitanika je navodilo da je važno da psiholog ispita razloge za odluku klijenta da odustane od

vrhunskog sporta. Ono što je interesantno je da se veoma mali broj ispitanika poziva na pravo poštovanja autonomije klijenta, što znači da nisu upoznati sa ovim etičkim principom. Roditelji često imaju pogrešno uverenje da znaju šta je najbolje za njihovo dete. Psiholog ne treba da dozvoli da postane instrument prisile u rukama spoljnog autoriteta (Koocher, 2003).

Tabela 2. Obrazloženja stavova ispitanika - vinjeta: problem slobodnog izbora sportiste

Vinjeta	Odgovori studenata FSFV		
	treba da podstiče	ne treba da podstiče	zavisi
Roditelji dovode sportistu kod sportskog psihologa zbog nedostatka motivacije. Reč je o mladom perspektivnom sportisti, adolescentu, čije se motoričke sposobnosti i veštine prema najstrožijim kriterijumima svrstavaju u ekstremno visoko postignuće. Sportista je već niz godina ulagao napor da što bolje savlada zadatke, da prevlada teškoće, da bude bolji od drugih i da ostvari svoj talenat. I pored postizanja uspeha, on je odjednom prestao da se trudi i ponavlja da ne želi dalje da napreduje ka vrhunskom sportu. Da li sportski psiholog treba da podstiče ovog sportistu da nastavi da napreduje ka vrhunskom sportu?	-to može biti prolazna faza ili kriza (n=5)	-treba poštovati odluku sportiste (n=4)	-zavisi od razloga odustajanja (n=2)
	-zadatak psihologa je da motiviše sportistu (n=5)	-sportista treba sam da se motiviše (n=1)	-treba samo ako sportista voli taj sport (n=1)
	-sportista treba da ostane angažovan u sportu na drugi način (n=4)	-neće postići željene rezultate (n=1)	
	-treba da otkriju razlog odustajanja (n=1)		
	-adolescenti ne bi trebalo samostalno da odlučuju o tome (n=1)		
	Odgovori studenata FF		
	treba da podstiče	ne treba da podstiče	zavisi
	-treba da otkriju razlog odustajanja (n=8)	-treba da otkriju razlog odustajanja (n=7)	-ne treba samo ako su se promenila interesovanja (n=2)
	-to može biti prolazna faza ili kriza (n=3)	-sportista može da oseti veliki pritisak (n=5)	-treba samo ako sportista voli taj sport (n=1)
	-zbog karakteristika adolescencije (n=1)	-treba poštovati odluku sportiste (n=3)	-treba ako nije konačna odluka već trenutni pad motivacije (n=1)
	-psiholog treba da deluje u skladu sa potrebama sportiste (n=1)	-psiholog ne treba da daje konkretne savete (n=1)	
		-zato što sport treba da predstavlja zadovoljstvo (n=1)	

U vinjeti broj 2 je opisana hipotetička situacija u kojoj roditelj na nepošten način krši pravo deteta na poverljivost na seansama sa sportskim psihologom. Postavljeno je sledeće pitanje: da li bi psiholog, kada sazna da roditelji narušavaju pravo poverljivosti, trebalo to da saopšti sportisti? Nešto manje od dve trećine ispitanih smatra da je psiholog dužan da saopšti sportisti da je poverljivost narušena (tabela br. 1). Znatno veći broj budućih psihologa nego budućih trenera mišljenja je da psiholog treba sportisti da saopšti da je narušeno načelo poverljivosti i ta razlika je statistički značajna ($\chi^2(2)=8.250, p<.05$). Visok procenat budućih psihologa - 70,6% smatra da treba, 11,8% smatra da ne treba, dok je čak 17,6% dalo odgovor „zavisi“. Malo više od polovine studenata sporta i fizičkog vaspitanja - 52% mišljenja je da psiholog ne bi trebalo da saopšti sportisti da je došlo do kršenja prava poverljivosti, 36% misli da bi trebalo, dok je 12% dalo odgovor da

„zavisi“. Rezultati kvalitativne analize koji se odnose na obrazloženja stavova ispitanika prikazani su u tabeli 3. Obrazloženja budućih trenera su veoma heterogena i uglavnom se odnose na potencijalne negativne posledice saopštavanja odnosno nisu direktno povezana sa etičkim pravilom o obezbeđivanju poverljivosti razgovora. Sa druge strane, polovina studenata psihologije navodi upravo ovo etičko pravilo kao obrazloženje svog stava. Roditelji imaju pravo na određene informacije ukoliko je klijent maloletan, ali ne na ovakav način, jer prisluškivanje razgovora sigurno nije deo dogovora sa početka tretmana i sprečava psihologa da obezbedi poverljivost podataka koju je obećao klijentu.

Tabela 3. Obrazloženja stavova ispitanika - vinjeta: roditelji ugrožavaju poverljivost razgovora

Vinjeta	Odgovori studenata FSFV		
	treba da saopšti	ne treba da saopšti	zavisi
Psiholog u dogovoru sa 17-godišnjim sportistom sa kojim je ostvario dobar radni odnos i napredovanje teče po planu, poziva njegovog roditelja da dođe na zajedničku seansu kako bi razmenili neke informacije koje su ključne za dalje napredovanje. Roditelj odbija da dođe zato što je u mobilni telefon svoga deteta ugradio prisluškivač koji mu omogućava da direktno preslušava sve seanse. Dakle, roditelj ima sve informacije i zbog toga i ne želi da dođe. Da li psiholog treba da otkrije novodobijene informacije sportisti?	-može da objasni sportisti kako da postupi (n=3)	-loše bi uticalo na sportistu (n=3)	-u zavisnosti od toga da li bi to bio problem za sportistu (n=1)
	-važna je iskrenost (n=2)	-loše bi uticalo na odnos roditelj-dete (n=2)	-ali uvek je bolja istina (n=1)
	-treba da reše problem (n=2)	-sportista neće biti iskren (n=1)	-treba raditi sa roditeljem (n=1)
	-to je u najboljem interesu sportiste (n=2)	-ako je napredovanje zadovoljavajuće ne treba ništa menjati (n=1)	
		-neće biti ključno za dalji rad (n=1)	
		-može da dovede do daljih problema (n=1)	
		-roditelj finansira tretman (n=1)	
		-ako to je najbolje rešenje (n=1)	
		-u tako retkoj situaciji treba odustati od etike (n=1)	
		-moje lično mišljenje (n=1)	
	Odgovori studenata FF		
	treba da saopšti	ne treba da saopšti	zavisi
	-to je kršenje načela poverljivosti (n=17)	-treba navesti roditelja da sam kaže (n=2)	-možda treba da saopšti (n=3)
	-važna je iskrenost (n=2)	-ne, sportista je maloletan (n=1)	-ako bi roditelj prestao onda ne treba (n=2)
	-klijent je sportista, a ne roditelj (n=2)	-loše bi uticalo na napredovanje (n=1)	-loše bi uticalo na sportistu (n=1)
	-sportista zaslužuje da zna (n=1)		
	-treba da nađe najbolji način da mu saopšti (n=1)		
	-ako slučajno sazna, to može da poremeti radni odnos (n=1)		

Ponašanje psihologa tokom proslave predstavlja primer situacije u kojoj ima više mogućnosti za neformalnu interakciju između psihologa i sportista. Postavljeno je sledeće pitanje: da li bi psiholog trebalo da prihvati poziv sportista da se u „veseloj“ atmosferi sa njima popne na sto? Između ispitanika je postignuta veoma visoka saglasnost odgovora (videti tabelu br. 1). Skoro 85% ispitanika, deli mišljenje da psiholog koji

prisustvuje proslavi događaja u restoranu, ne bi trebalo da prihvati poziv sportista da se popne na sto. Velika većina budućih psihologa 82,4% smatra da psiholog treba da bude suzdržan u ponašanju, dok 17,6% smatra da bi mogao da prihvati „opuštenije“ ponašanje. Nešto veći procenat budućih trenera 88%, nego budućih psihologa, smatra da psiholog ne bi trebalo da prihvati takvo ponašanje, 8% smatra da bi trebalo da se popne na sto, dok je 4% neopredeljeno. Razlika u mišljenju budućih psihologa i budućih trenera nije statistički značajna ($\chi^2(2)=2.10$, $p>.05$). Kao što se može videti u tabeli 4 ispitanici sa oba fakulteta ističu da takvo ponašanje smatraju neprofesionalnim ili ugrožavajućim za distancu u odnosu i dalji rad sa sportistima. Istraživanje Petitpasa i saradnika je pokazalo da je većina ispitanih sportskih psihologa u SAD išlo na proslavu sa sportistima i da su smatrali da je to etično (Petitpas, Brewer, Rivera, & Van Raalte, 1994). U ovakvim situacijama važno je da psiholog vodi računa da njegovo ponašanje ne ugrozi ugled profesije.

Tabela 4. Obrazloženja stavova ispitanika - vinjeta: neformalno ponašanje psihologa

Vinjeta	Odgovori studenata FSFV		
	treba da prihvati	ne treba da prihvati	zavisi
Psiholog je član stručnog štaba reprezentacije. Neočekivano su na međunarodnom takmičenju osvojili zlatnu medalju. Ceo tim i stručni štab odlaze u restoran da proslave. Pozvan je i psiholog. Kako ne bi pravio distancu u odnosima sa sportistima, psiholog odlučuje da ode na proslavu. Muzika svira, atmosfera se „zagreva“, i pod dejstvom alkohola, deo tima se penje na sto. Daju ruku psihologu i pozivaju ga da ustane i da se i on popne na sto. Da li psiholog treba to da uradi ili ne?	-psiholog treba da se opusti i zabavi (n=2)	-nije profesionalno (n=9)	-nije samo po sebi loše ponašanje (n=1)
		-treba da vodi računa o ponašanju (n=5)	
		-to bi narušilo distancu u odnosu (n=4)	
		-nije etički (n=2)	
		-ne treba, iako neće smetati sportistima (n=1)	
		-ne bi doprinelo daljem radu (n=1)	
	Odgovori studenata FF		
	treba da prihvati	ne treba da prihvati	zavisi
	-da ne napravi veću distancu (n=2)	-nije profesionalno (n=12)	
	-neće naškoditi (n=2)	-to bi narušilo distancu u odnosu (n=8)	
	-psiholog je deo tima (n=1)	-zbog višestrukih odnosa (n=5)	
	-psiholog je čovek (n=1)	-treba da vodi računa o ponašanju (n=1)	
		-dalji rad neće biti efikasan (n=1)	
		-lično mišljenje (n=1)	

U poslednjoj vinjeti je opisana hipotetička situacija u kojoj su se razvila osećanja seksualne privlačnosti između sportskog psihologa i sportistkinje, ali nije došlo do ponašanja kojima se prelazi granica. Postavljeno je sledeće pitanje: da li bi psiholog trebalo da nastavi saradnju sa ovom sportiskinjom ili ne? Veoma visok procenat studenata psihologije (88,2%) smatra da psiholog treba da prekine saradnju sa ovom sportiskinjom, 5,9% smatra da ne treba i isti procenat 5,9% odgovorilo je da zavisi od okolnosti. Gotovo jednaka je procena budućih trenera - 88% ispitanih takođe smatra da saradnju treba prekinuti, dok 12% smatra da ne treba. Razlika u mišljenjima studenata ova dva fakulteta nije statistički značajna ($\chi^2(2)=2.107$, $p>.05$). Ispitanici se pri obrazlaganju svojih stavova pozivaju na pravilo neulaska u višestruke odnose sa klijentima i neefikasnost daljeg rada (tabela 5). Zanimljivo je da mali broj ispitanika pominje kao razlog

maloletnost klijentkinje. U pomenutom američkom istraživanju većina sportskih psihologa je izvestila da je osetila seksualnu privlačnost prema klijentima, ali se veoma mali broj upustio u seksualne odnose sa njima (Petitpas, Brewer, Rivera, & Van Raalte, 1994).

Tabela 5. Obrazloženja stavova ispitanika - vinjeta: seksualna privlačnost

Vinjeta	Odgovori studenata FSFV			
	treba da nastavi	ne treba da nastavi	zavisi	
Maja ima 15 godina. Atletičarka je elitnog nivoa i kandidat je za ulazak u reprezentaciju za predstojeće Olimpijske igre. Fizički je veoma privlačna. Kod psihologa dolazi već 4 meseca da bi ovladala psihološkim veštinama koje će joj pomoći da poboljša svoj nastup. Psiholog je svestan da oseća seksualnu privlačnost prema njoj ali je efikasno kontroliše. Nakon što je postigla veliki uspeh, koji pripisuje novo naučenim psihološkim veštinama, Maja psihologu saopštava oseća izrazitu seksualnu privlačnost prema njemu. Da li psiholog treba da nastavi saradnju sa njom?	-ako psiholog može da kontroliše situaciju (n=1)	-rad neće biti efikasan (n=10)		
	-to može biti izvor motivacije (n=1)	-višestruki odnos sa klijentom (n=6)		
		-zato što je maloletna (n=3)		
		-nije etički (n=2)		
		-zbog remećenja odnosa (n=2)		
		-treba je proslediti kolegi (n=1)		
		Odgovori studenata FF		
		treba da nastavi	ne treba da nastavi	zavisi
		-to nije razlog za prekidanje (n=1)	-višestruki odnos sa klijentom (n=9)	-ako psiholog može da kontroliše situaciju, treba da nastavi (n=1)
		-psiholog može pomoći da sportistkinja razume svoja osećanja (n=1)	-nije etički (n=8)	-može se prevazići (n=1)
		-nije profesionalno (n=5)		
		-rad neće biti efikasan (n=3)		
		-treba je proslediti kolegi (n=4)		
		-može da izmakne kontroli (n=2)		

Zaključak

Kada sagledamo rezultate, jasna je potreba uvođenja formalne edukacije i treninga iz profesionalne etike za psihologe, ali isto tako potrebno je da psiholozi obavestavaju pripadnike drugih struka o tome koja pravila su definisana etičkim kodeksom profesije. To je u kontekstu sportske psihologije moguće organizovati na fakultetima gde se obučavaju budući sportski psiholozi i treneri, ali je neophodno i da psiholozi koji žele da se bave ovom oblašću pohađaju dodatne seminare o profesionalnoj etici. Ispitanicima je poznato pravilo zabrane ulaska u višestruke odnose, ali su nedovoljno upoznati sa etičkim principima poverljivosti i autonomije. Sa druge strane, odgovori na vinjetu koja se tiče neformalnog ponašanja psihologa ukazuju da je potrebno više isticati specifičnosti psihologije sporta, gde svaki prelazak granica ne predstavlja i njihovo rušenje. U prezentovanom hipotetičkom slučaju, psiholog ne bi ušao u višestruki odnos, kao što su neki ispitanici mislili, ali bi se ponašao netradicionalno ukoliko bi se popeo na sto. Ipak psiholozi su, kako je jedan ispitanik rekao, samo ljudi.

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**Biomechanical and
methodical aspects of
physical education, sport
and recreation**

Biomehanički i metodološki
aspekti fizičkog vaspitanja,
sporta i rekreacije

SELF-ASSESSMENT OF THE LEVEL AND INTENSITY OF PHYSICAL ACTIVITIES OF VISUALLY IMPAIRED PERSONS USING THE INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

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Introduction

Physical activities represent an essential part of a healthy lifestyle, and the personal benefit derived from it is reflected in numerous domains of physical and psychological well-being. However, disabled people are not sufficiently physically active, and usually manifest passive patterns of behavior, spending their free time at home (Majnemer et al., 2008). A study into the habits of young people with different types of impairment determined that 30% of them have a sedentary lifestyle, and that this percentage increases with age (Longmuir & Bar-Or, 1994, according to Longmuir & Bar-Or, 2000). This kind of lifestyle can lead to social isolation, discontentment with quality of life (Rae-Grant et al., 1989), and an increased risk of developing health issues related to sedentary behavior (cardio-vascular illness, hypertension, diabetes mellitus type 2, etc.) (Marmeleira, Laranjo, Marques, & Pereira, 2014). Not only does it endanger one's health state and any psychological benefit, insufficient physical activity disrupts the realization of basic life and work activities; namely self-care, care for one's home and work activities during adulthood that require appropriate mobility and physical fitness levels. These two components often present a significant challenge to persons with visual impairment.

Persons with visual impairment (VI), irrespective of their age, are more prone to a sedentary lifestyle than peoples with other types of impairment (Longmuir & Bar-Or, 2000; Holbrook, Caputo, Perry, Fuller, & Morgan 2009; Starkoff, Lenz, Lieberman, & Foley, 2016; Haegele, Hodge, & Kozub, 2017). The reason for this might be that impaired vision could limit the inclusion of individuals in activities which take place outside the home (Starkoff et al., 2016). Research data indicate that 67% of blind and low vision persons avoid leaving their homes (Marston & Golledge, 2003). However, there are few empirical studies which analyzed the way persons with visual impairment spend their time, especially adults. Starkoff et al. (2016) used a specially-designed instrument (PACE+SBQ) and determined that visually impaired adults under the age of 40, irrespective of gender, on average participate in activities which are a part of a sedentary way of life 10h a day on weekdays and 8,5h a day on the weekend (working at a computer; listening to music; watching television; reading; telephoning; handicrafts and hobbies, playing an instrument), as opposed to the 7,7h a day that sighted individuals spend in these same activities. Generally speaking, empirical research (Longmuir & Bar-Or, 2000; Houwen, Hartman, & Visscher, 2008; Starkoff et al., 2016) points out that if there is visual impairment, we can expect a greater frequency of sedentary behavior, irrespective of the age of the participants.

In addition to infrequently taking part in physical activities, peoples with visual impairment on average perform physical activities of a moderate to high intensity 48% less, than sighted ones (Willis, Jefferys, Vitale, & Ramulu, 2012) per day. At the same time, only 30% of them take part in daily physical activities of (over / at least) 30 min. per day, a level which enables optimal health maintenance (Marmeleira et al., 2014). An insufficient level of physical activity can be the result of inappropriate motor development during childhood, family being overprotective, decreased mobility or eyesight problems (Barbosa Porcellis da Silva, Marques, & Reichert, 2018). Irrespective of the sample, sedentary behavior and a low level of

physical activity resulted in an increased risk of developing obesity (Holbrook et al., 2009), combined problems, depression and functional limitations (Campbell & Crews, 2001).

Of the factors related to physical activities, visual acuity is the most frequently studied one. Studies point out that the degree of visual impairment is related to the level and intensity of those activities, meaning that lower acuity leads to infrequent participation in moderate physical activities (Holbrook et al., 2009) and, in the case of children with VI, prolonged periods of time spent in sedentary activities (Houwen et al., 2008).

Due to its strong connection with quality of life, over the past few years researchers have showed increased interest in studying the characteristics of physical activities of peoples with visual impairment (Houwen et al., 2009; Marmeleira, Laranjo, Marques, & Batalha, 2013; Sadowska & Krzepota, 2015) or barriers preventing them from performing these activities (Jaarsma, Dekker, Koopmans, Dijkstra, & Geertzen, 2014; Marmeleira et al., 2014; Haegele, Zhu, Lee, & Lieberman, 2016). Special interest was focused on the study of the physical activities of peoples with visual impairment as part of their usual, daily activities at work, at home, or during their leisure time.

The methods used to study the physical activities of persons with visual impairment

Various methods are used to evaluate the level of physical activities, including objective measurements (heart rate, accelerometry and pedometry), indirect measurements (calorimetry), direct observation and subjective evaluations using a questionnaire, or a daily physical activities log. However, questionnaires are the most frequently used means of evaluating physical activities as part of everyday life, due to their low cost and simplicity of use which enables broad application (Lee et al., 2011; Marmeleira et al., 2013).

The existing literature on the study of physical activities of adults with visual impairment cites the use of accelerometry (Kozub, 2006; Marmeleira et al., 2013; Sadowska & Krzepota, 2015), pedometry (Holbrook et al., 2009; Holbrook, Stevens, Kang, & Morgan, 2011; Holbrook, Kang, & Morgan, 2013) and various questionnaires, among which the most frequently used is the International Physical Activity Questionnaire – IPAQ, its short form (Marmeleira et al., 2013; Bláha, Frömel, & Válková, 2013) and long form (Sadowska & Krzepota, 2015; Wrzesińska, Lipert, Urzędowicz, & Pawlicki, 2018). The World Health Organization recommends the use of this questionnaire when evaluating physical activities in relation to health. However, an analysis of 23 empirical studies has determined that the correlation between physical activity (the overall weekly level and intensity) measured using the IPAQ (short form) and the objective standards indicate great variability (Lee, Macfarlane, Lam, & Stewart, 2011).

In the case of persons with visual impairment, the use of the IPAQ provides overrated data compared to the data obtained by objective methods (Marmeleira et al., 2013). Out of the six studies which focused on the comparison of the levels of physical activity of persons with visual impairment obtained from the IPAQ and accelerometry, five (Lee et al., 2011) indicated that the IPAQ significantly overrates the level of physical activity (from 36 to 173%), while one study (Ekelund et al., 2006, according to Lee et al., 2011) determined that it underrated them, by 28%. On the other hand, accelerometry, even though an objective method of evaluating physical activity, is not suitable for use when it comes to aquatic activities, and might not give precise information related to the intensity of activity such as carrying heavy loads, walking up the stairs, riding stationary bikes, or weight lifting (Hagstromer et al., 2008).

This paper presents a part of a more extensive research aimed at evaluating the connections between physical activities of young adults with visual impairment and factors that determine them. The aim of this paper was to determine the level and intensity of physical activities which adults with visual impairment perform in daily life activities, including work, transport, home and leisure time.

Sample

The participants were persons with visual impairment (N=45), aged 18 to 39 (AS=28), of both genders. The cut-off point for participation, the age of 40, was set only so that younger adults would be included in the study, and to reduce the factors associated with the aging process, namely, the emergence of chronic illness which additionally impedes physical activity. Most of the participants (88,9%), in addition to their visual impairments, did not suffer from any other conditions which would have a negative impact on their physical activities. However, 11% of the participants considered that the presence of various illnesses and conditions (such as neurological and cardiac disorders, frequent hospitalization or contraindications for excessive fatigue) could limit their mobility.

The sample was relatively homogenous in terms of gender (53% women and 47% men) and the degree of visual impairment (53% blind and 47% low vision participants). By evaluating their mobility (and) independence (based on participants' self-evaluation), it was determined that almost 40% of them effectively use a white cane (blind participants). The same percentage of participants with low vision believes that their visual impairment does not represent an obstacle to their mobility. One quarter (24,44%) of the participants cited that, when it comes to mobility, they depend on the help of a sighted guide, and if they do not have adequate help, they rarely go out. A further analysis divides the participants into two groups: persons who walked independently (N=34, 75,6%) and persons who were not able to walk independently (N=11, 24,4%).

Method

The participants were directly contacted through the Association of the Blind of Serbia and invited to take part in the study. The general questionnaire and IPAQ were adapted for internet surveys using the Google forms platforms. The data were compiled during April and May of 2018.

Instrument

A general questionnaire was designed for the purpose of this study, in order to collect the following data: age, gender, degree of visual impairment, independence in mobility, work status, and level of education.

Research was conducted using the long form of the *International Physical Activity Questionnaire – IPAQ-LF*, meant for persons aged from 15 to 69. This questionnaire consists of 27 open-ended questions for self-evaluation of the intensity and duration of physical activity on a weekly basis within four domains, including the workplace, transportation, work in and around the house, and leisure time. The evaluation of physical activity on a weekly basis is expressed in MET units (metabolic equivalents expressing the rate of energy consumption), which represent the relation between the energy needed to perform the activities and energy that the body consumes at rest. The weekly level (MET-minutes) is obtained by any combination of activities which result in the increased energy consumption (manifested as rapid breathing, increased heart rate, etc.), provided that they last longer than 10 minutes a day, while activities which last less than 10 minutes are not taken into consideration. The obtained results are represented in three categories: high, moderate and low-level of physical activities.

A level of physical activity is classified as high if an individual takes part in physical activities for at least one hour every day, or if they meet any of the following criteria:

- if they participate in energetic activities three or more days a week, for an overall duration of 1500 MET minutes,
- if they achieve a minimum of 3000 MET minutes a week, through any combination of physical activities of various intensity, or walking.

A level of physical activity is classified as moderate if an individual spends most of his days during the week taking part in physical activities which last approximately half an hour, or if they meet any of the following criteria:

- for three or more days a week they take part in energetic activities and/or walking, for at least 20 minutes a day,
- for five or more days a week they take part in activities of moderate intensity and/or walking for at least 30 minutes a day,
- for five or more days a week they take part in any combination of the aforementioned activities which in the overall score provides a minimum of 600 MET minutes.

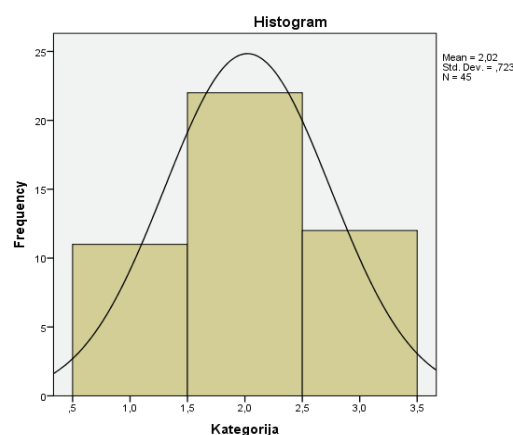
If the individual does not fulfill any of the aforementioned criteria, their overall level of physical activity is classified as low.

Results

The results indicate that the overall weekly level of physical activity of younger adults with visual impairment expressed through a MET score is very high (AS=3808,10; SD=4095,04). The maximal value was as high as 18534 MET min/week, which is almost five times greater than the average value.

We wanted to determine whether there were any statistically significant differences between the level of physical activities on a weekly basis and certain general characteristics of the participants (the degree of visual impairment, gender, work status, independence in mobility). The analyses have indicated that the participants with low vision have higher overall scores than the blind, men higher scores than the women, the employed higher than the unemployed, and persons who walk independently had higher scores than the participants who do not. However, the noted differences were not statistically significant (the degree of visual impairment: $\chi^2=0,690$, $df=1$, $p=0,406$; gender: $\chi^2=0,047$, $df=1$, $p=0,829$; work status: $\chi^2=0,419$, $df=1$, $p=0,518$; independence in mobility: $\chi^2=1,476$, $df=1$, $p=0,224$).

What followed was a categorization of participants based on the intensity of the realized physical activities on a weekly basis, which is shown in Graph 1.



Graph 1. The intensity of physical activities of persons with visual impairment

The distribution of the participants based on their level of physical activity (presented through the overall MET score) is even and similar to the normal distribution. Most of the participants (almost 50% of them) manifested a moderate level of physical activity (MET>600), while the participants whose level of physical activity was low or high were evenly distributed (24.44%; 26.68%). From a more general point of

view, persons with visual impairment have shown a satisfactory level of physical activity, while there is room for improvement for one quarter of the studied sample.

Table 1. The results and differences between the groups of participants based on the manifested intensity of their physical activities

		Category			TOTAL	χ^2	df	p
		Low FA	Moderate FA	High FA				
Degree of visual impairment	Blind	N 9 % 20.0%	8 17.8%	7 15.6%	24 53.3%	6.252	2	0.042*
	Visually impaired	N 2 % 4.4%	14 31.1%	5 11.1%	21 46.7%			
Gender	Male	N 4 % 8.9%	11 24.4%	6 13.3%	21 46.7%	0.621	2	0.796
	Female	N 7 % 15.6%	11 24.4%	6 13.3%	24 53.3%			
Work status	Employed	N 1 % 2.2%	7 15.6%	3 6.7%	11 24.4%	2.054	2	0.398
	Unemployed	N 10 % 22.2%	15 33.3%	9 20.0%	34 75.6%			
Independent mobility	Walking independently	N 6 % 13.3%	17 37.8%	11 24.4%	34 75.6%	4.351	2	0.115
	Not walking independently	N 5 % 11.1%	5 11.1%	1 2.2%	11 24.4%			

Legend: *p<0.05

Even though there were no statistically significant differences in the overall level of participants' physical activities, based on the data shown in Table 1 we can see that differences in terms of the intensity of the physical activities can be determined in relation to the degree of visual impairment ($\chi^2=6,252$, $df=1$, $p=0,042$). Most of the participants with low vision took part in moderate physical activities, while most of the blind participants took part in low-level physical activities. Compared to the remaining variables (gender, work status, independence in mobility), the differences determined in relation to the intensity of the physical activities were not statistically significant.

Discussion

In this study it was determined that the physical activities of visually impaired persons aged 18 to 39 yr. are at a high level. Almost one half of the participants (48,88%) were involved in moderate physical activities. High-level physical activities were noted for 26,68% of the participants, while one quarter (24,44%) of the participants lead a sedentary lifestyle. The average value of the MET score of the entire sample was 3808,10 (SD 4095,04). Sadowska & Krzepota (2013) used the same instrument, only its shorter form, and obtained the same results. They cited that 52% of persons with visual impairment were involved in moderate-level physical activities.

Such a high score for a population with visual impairment was not expected, but is supported by the results obtained by Kamelska & Mazurek (2015). In their research, persons with visual impairment scored 3930 MET minutes, while the athletes (tandem cyclists) scored 3835 MET minutes per week. Wrzesińska et al. (2018) cited a high level of physical activities for their participants, where the young adults with visual impairment showed a higher level of the aforementioned activities compared to the adolescents.

Actually, the results of this study, as well as the results of other studies carried out abroad (Kamelska & Mazurek, 2015; Wrzesińska et al., 2018) must not be taken at face value since they do not agree with the results of some other studies (Bláha et al., 2013; Haegele et al., 2016; Starkoff et al., 2016) which indicate a

passive attitude to leisure time activities among persons with visual impairment, and who tend to lead a sedentary lifestyle. Middle-aged visually impaired persons spend most of their time, almost ten hours a day, in sedentary activities (Starkoff et al., 2016), mostly reading or socializing, watching television, or on the computer (Haegele et al., 2017). Bearing this in mind, it is necessary to ask the question of whether there could be certain difficulties regarding this kind of evaluation of the physical activities of persons with visual impairment. A further reason to doubt the validity of the obtained data could also lie in the fact that, contrary to our and previous studies, the use of the same instruments by various authors has provided data on significantly lower levels of physical activities among persons with visual impairment: ranging from 2967 METmin./week (Bláha et al., 2013), to 2845 METmin./week (Haegele et al., 2016), 2278 METmin./week (Marmeleira et al., 2013), up to 1221 MET min./week (Sadowska & Krzepota, 2015). Considering the fact that the World Health Organization recommends a minimum of 600 MET minutes of physical activities for adults per week, it would appear that the level of physical activities of persons with visual impairment, even with these results, is more than satisfactory. However, when analyzing the structure of their weekly MET score, Haegele et al. (2016) determined that adults with visual impairment on average have only 413,79 MET minutes of moderate and energetic physical activities and 2058 minutes of sedentary activities a week. If they do participate in physical activities, persons with visual impairment usually walk (2222 METmin/week). Walking belongs to the group of low-intensity physical activities, while they rarely take part in intense and moderate physical activities (Bláha et al., 2013). Even though adults with visual impairment spend a lot of time walking, their level of physical activities realized in this way is significantly lower compared to that of sighted persons (Holbrook et al., 2009).

By evaluating the relation between the defined variables and the physical activities, no statistically significant differences were determined which supports the findings from similar studies. Of the analyzed socio-demographic variables (age, gender, ethnicity, level of education, degree of vision impairment, use of mobility aids, the time when the visual impairment occurred), Haegele et al. (2016) determined that only gender represents a significant predictor of physical activity among adults with visual impairment. In the case of relation of degree of visual impairment and the physical activities, the research results are contradictory. Some studies indicate that greater level of vision impairment leads to decreased physical activity (Hopkins et al., 1987; Barbosa Porcellis da Silva et al., 2018), while others (Holbrook et al., 2009) point out that the level of impaired vision is not related to overall level of physical activities, as was the case in this study. The degree of visual impairment (blindness or low vision) determines intensity of physical activities. However, the absence of statistically significant differences in the overall MET score among persons walking independently, and those who do not (which in our sample made up almost 25%) indicates that some other factors (not socio-demographic, or factors related to sight in general) which were not controlled in this study could have affected the obtained results.

All of the above raises the question of whether this manner of evaluating physical activities is suited to persons with visual impairment? Support for this type of evaluation can be found in the research of authors (Marmeleira et al., 2013) who studied the similarity of the data on physical activities of persons with visual impairment obtained through objective and subjective evaluations. It was determined that the time spent in moderate or intense physical activities (obtained on the IPAQ-S scale) did not match the data obtained through accelerometry. The authors believe that the shorter form of the IPAQ questionnaire is more useful for detecting persons with visual impairment who do not take part in the prescribed weekly amount of physical activities, than it is for classifying the levels and intensity of physical activities. This opinion is contrary to the conclusions reached by Sadowska & Krzepota (2015) who point out that the IPAQ (long form) is effective for monitoring physical activities of persons with visual impairment. Perhaps a solution to these kinds of dilemmas could be found in the fact that the IPAQ was designed for a general population, and so it is

possible that some concepts which are used in the questionnaire do not relate to people with limited practical experience, as is the case with persons with visual impairment (Hagstromer et al., 2008). Also, another explanation could be that, irrespective of the fact that children and the young with visual impairment are characterized by a low level of general physical fitness and an unhealthy body composition (Lieberman & McHugh, 2001; Grbović, Stojković, Dimoski, & Eminović, 2013), these features, if they persist, could result in excessive fatigue during exercises of moderate and low intensity in adulthood, which could lead to a non-objective self-evaluation.

Regarding the aforementioned, we consider the results of this study to be primarily influenced by the difficulties related to self-evaluation. That problem frequently occurs in all scientific disciplines, since self-evaluation can lead to the participants providing socially desirable responses (Marmeleira et al., 2013). Besides that, self-evaluation is far easier to perform when participating in a structured activity (such as a particular form of exercise or sport) than when participating in spontaneous activities (Hagstromer et al., 2008), as it was the case in this research (daily physical activities at work, transport, home or in leisure time). Another possibility could be that persons with visual impairment overestimate the difficulty of the activities they are taking part in and the time they spend doing them. The arguments in favor for such an attitude could be found in the fact that a similar situation regarding overestimation was also noted in the field of studying the self-concept of persons with visual impairment. The research of Stanimirov (2016) indicated that visually impaired persons have a statistically significant higher level of self-concept than sighted persons, which was contrary to expectations. The explanations for these results could be found in the studies carried out by Obiakor & Stile, (1990) who indicate that persons with visual impairment have a tendency of overrating their personal attributes. For example, Gal (2011) claims that persons with impairment analyze themselves and create an image of them in a specific manner. They are prone to rejecting negative features in order to develop and maintain a positive self-image. However, the instruments for self-evaluation certainly represent useful, effective and reliable research instruments. Even though this technique has inevitable advantages, the question is whether the self-evaluations provided by participants with visual impairment on this particular issue can be considered reliable. As far as the results are concerned, the dilemma remains: were the participants unable to properly evaluate their participation in physical activities or had they overrated them to a significant extent?

Conclusion

The results obtained using the long form of the IPAQ on a population of young adults with visual impairment must not be taken at face value. Future research should provide answers regarding the psychometric characteristics of this instrument when it is being used on a population of persons with various types of impairment. When it comes to persons with visual impairment, the recommendation is that the IPAQ should be combined with some of the objective or direct methods of evaluating physical activity. The following step should be an analysis of individual domains of the IPAQ questionnaire, and not just the overall MET score, in order to provide better insight into the structure of the physical activities of the visually impaired persons on a weekly basis.

Limitations of the study

Limitation of this study is the fact that the sample was selected and relatively small. Most studies focusing on persons with visual impairment, carried out not only in our country but also abroad, include relatively small samples. A larger sample would certainly have provided more credible data; however, motivating participants with visual impairment to participate in various studies represents a special problem, especially if limiting factors are set, as age was in this study.

In addition, the study included only persons who had computer and internet access, and who voluntarily agreed to participate. This leads us to the conclusion that participation in this study (again, generally viewed, and not only in this case), is provided by active adults with visual impairment, due to which obtained results cannot be generalized on the entire population, which is something that Haegele et al. (2017) agree with.

As another limitation we would like to point out that the data were collected by means of an online survey. In such a situation the interviewer could not respond to any possible dilemmas on the part of the participant, as is the case of an interview. On the other hand, an online survey as a means of evaluation enables the compilation of a larger sample of persons with visual impairment in a quick, economic and simple manner (Haegele et al., 2016).

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SAMOPROCENA NIVOVA I INTENZITETA FIZIČKIH AKTIVNOSTI OSOBA SA OŠTEĆENJEM VIDA DOBIJENA PRIMENOM MEĐUNARODNOG UPITNIKA O FIZIČKOJ AKTIVNOSTI

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Uvod

Fizička aktivnost predstavlja esencijalni deo zdravog načina života, a lična dobrobit se ogleda kroz mnoge domene fizičkog i psihičkog blagostanja. Međutim, osobe sa ometenošću nisu dovoljno fizički aktivne, najčešće ispoljavaju pasivne obrasce ponašanja, a slobodno vreme provode kod kuće (Majnemer et al., 2008). Ispitivanjem navika mladih sa ometenošću utvrđeno je da 30% njih upražnjava sedentaran stil života, a ovaj procenat se sa uzrastom povećava (Longmuir & Bar-Or, 1994, prema Longmuir & Bar-Or, 2000). To vodi riziku od socijalne izolacije, nižem nivou zadovoljstva kvalitetom života (Rae-Grant et al., 1989) i povećanom riziku za razvijanje zdravstvenih teškoća povezanih sa sedentarnim ponašanjem (kardiovaskularna oboljenja, hipertenzija, dijabetes melitus tip 2 i dr.) (Marmeleira, Laranjo, Marques, & Pereira, 2014). Osim što ugrožava zdravstveno stanje i psihičku dobrobit, nedovoljna fizička aktivnost ometa i ostvarivanje osnovnih životnih i radnih aktivnosti. Naime, briga o sebi, briga o kući i radno angažovanje u odrasloj dobi zahtevaju odgovarajuću mobilnost i fizičku spremnost. Ove dve komponente često predstavljaju značajan izazov za osobe sa oštećenjem vida.

Bez obzira na uzrast, osobe sa oštećenjem vida više su nego osobe sa drugim oblicima invaliditeta sklone sedentarnom stilu života (Longmuir & Bar-Or, 2000; Holbrook, Caputo, Perry, Fuller, & Morgan 2009; Starkoff, Lenz, Lieberman, & Foley, 2016; Haegele, Hodge, & Kozub, 2017). Razlog tome može biti to što ovaj tip oštećenja može ograničiti učestvovanje osoba u aktivnostima koje se odvijaju van kuće (Starkoff et al., 2016). Istraživački podaci govore da 67% slepih i slabovodih osoba izbegava izlaske iz kuće (Marston & Gollidge, 2003). Međutim, malo je empirijskih studija koje su proučavale način provođenja vremena osoba sa oštećenjem vida, naročito kada su u pitanju odrasle osobe. Starkoff i saradnici (Starkoff et al., 2016) su korišćenjem posebno dizajniranog instrumenta (PACE+SBQ) utvrdili da osobe sa oštećenjem vida mlađe od 40 godina, bez obzira na pol, u proseku 10h dnevno radnim danima i 8,5h dnevno vikendom upražnjavaju aktivnosti koje pripadaju sedentarnom stilu života (rad za kompjuterom; slušanje muzike; gledanje televizije; čitanje; telefoniranje; ručni rad i hobi, sviranje nekog instrumenta), za razliku osoba tipičnog razvoja koje aktivnosti ovakvog tipa upražnjavaju 7,7h dnevno. Uopšteno uzevši, empirijska istraživanja (Longmuir & Bar-Or, 2000; Houwen, Hartman, & Visscher, 2008; Starkoff et al., 2016) ističu da, ukoliko je oštećenje vida prisutno, možemo očekivati veću učestalost sedentarnih aktivnosti, bez obzira na uzrast ispitanika.

Osim što fizičke aktivnosti ređe upražnjavaju, osobe sa oštećenjem vida u proseku vrše fizičke aktivnosti umerenog do snažnog intenziteta 48% minuta dnevno kraće od osoba tipičnog razvoja (Willis, Jefferys, Vitale, & Ramulu, 2012). Pritom, samo 30% njih upražnjava ovakve aktivnosti najmanje 30 min. dnevno, što predstavlja nivo koji omogućava optimalno održanje zdravlja (Marmeleira et al., 2014). Nedovoljan nivo fizičkih aktivnosti može biti rezultat prekomerne zaštite porodice, manjeg stepena pokretljivosti, problema sa vidom ili neodgovarajućeg motoričkog razvoja u detinjstvu (Barbosa Porcellis da Silva, Marques, & Reichert, 2018). Bez obzira na uzrok, sedentarno ponašanje i nizak nivo fizičkih aktivnosti

rezultira povećanim rizikom od razvoja gojaznosti (Holbrook et al., 2009), udruženih smetnji, depresije i funkcionalnih ograničenja (Campbell & Crews, 2001).

Od faktora koji su u vezi s fizičkim aktivnostima, oštrina vida je najčešće proučavana. Studije ističu da je stepen vizuelne ometenosti povezan s nivoom i intenzitetom fizičkih aktivnosti, tako što niža oštrina vida vodi ređem upražnjavanju umerenih fizičkih aktivnosti (Holbrook et al., 2009) i dužem vremenu koje se provodi u sedentarnim aktivnostima, kada su u pitanju deca sa oštećenjem vida (Houwen et al., 2008).

Zbog snažne veze sa kvalitetom života, poslednjih godina raste interesovanje istraživača za proučavanje odlika fizičkih aktivnosti osoba sa oštećenjem vida (Houwen et al., 2009; Marmeleira, Laranjo, Marques, & Batalha, 2013; Sadowska & Krzepota, 2015) ili barijera koje ometaju upražnjavanje istih (Jaarsma, Dekker, Koopmans, Dijkstra, & Geertzen, 2014; Marmeleira et al., 2014; Haegele, Zhu, Lee, & Lieberman, 2016). Posebno interesovanje usmereno je ka proučavanju fizičkih aktivnosti koje osobe sa oštećenjem vida upražnjavaju u okviru uobičajenih, svakodnevnih aktivnosti na poslu, kod kuće i u slobodno vreme.

Metode ispitivanja fizičkih aktivnosti osoba sa oštećenjem vida

Za procenu nivoa fizičkih aktivnosti koriste se različite metode, uključujući objektivne mere (otkucaji srca, akcelerometrija i pedometrija), indirektno mere (kalorimetrija), direktne opservacije i subjektivne procene pomoću upitnika ili dnevnika fizičkih aktivnosti. Ipak, najčešće se za procenu fizičkih aktivnosti u okviru svakodnevnog života koriste upitnici jer njihova niska cena i jednostavnost primene daju mogućnost šire upotebe (Lee et al., 2011; Marmeleira et al., 2013).

Za ispitivanje fizičkih aktivnosti odraslih osoba sa oštećenjem vida u literaturi se navodi korišćenje akcelerometrije (Kozub, 2006; Marmeleira et al., 2013; Sadowska & Krzepota, 2015), pedometrije (Holbrook et al., 2009; Holbrook, Stevens, Kang, & Morgan, 2011; Holbrook, Kang, & Morgan, 2013) i različitih upitnika, među kojima se najčešće pominje Međunarodni upitnik za ispitivanje fizičkih aktivnosti – IPAQ, kratka forma (Marmeleira et al., 2013; Bláha, Frömel, & Válková, 2013) i dugačka forma (Sadowska & Krzepota, 2015; Wrzesińska, Lipert, Urzędowicz, & Pawlicki, 2018). Svetska zdravstvena organizacija preporučuje upotrebu ovog upitnika kada je u pitanju procena fizičkih aktivnosti u vezi sa zdravljem. Međutim, pregledom 23 empirijske studije utvrđeno je da su korelacije između fizičkih aktivnosti (ukupnog nedeljnog nivoa i intenziteta) merene IPAQ-om (kratkom formom) i objektivnim standardima pokazuju veliku varijabilnost (Lee, Macfarlane, Lam, & Stewart, 2011).

Kada su u pitanju osobe sa oštećenjem vida, autori ističu da se primenom IPAQ-a dobijaju precenjeni podaci u poređenju sa objektivnim merama (Marmeleira et al., 2013). Od šest studija koje su se bavile komparacijom nivoa fizičkih aktivnosti osoba sa oštećenjem vida dobijenih IPAQ-om i akcelerometrijom, njih pet (Lee et al., 2011) ističe da IPAQ znatno precenjuje nivo fizičkih aktivnosti (od 36 do 173%), dok je jedna studija (Ekelund et al., 2006 prema Lee et al., 2011) je utvrdila potcenjivanje, i to za 28%. S druge strane, akcelerometrija, iako objektivna metoda procene fizičkih aktivnosti, nije pogodna za korišćenje tokom aktivnosti u vodi i možda ne daje precizne informacije u vezi sa intenzitetom aktivnosti kao što su nošenje teških tereta, hodanje uz stepenice, vožnje sobnog bicikla ili vežbe sa opterećenjem (Hagstromer et al., 2008).

U radu je prikazan deo šireg istraživanja koje je imalo za cilj proveravanje veze fizičkih aktivnosti mlađih odraslih osoba sa oštećenjem vida i faktora koji ih određuju. Cilj ovog rada je određivanje nivoa i intenziteta fizičkih aktivnosti koje osobe sa oštećenjem vida izvode u okviru svakodnevnih aktivnosti, uključujući posao, prevoz, kuću i slobodno vreme.

Uzorak

Ispitanici su bili osobe sa oštećenjem vida (N=45), uzrasta 18 do 39 godina (AS=28), oba pola. Gornja granica od 40 godina je postavljena kako bi se ispitali samo mlađi odrasli i da bi se umanjio uticaj faktora koji mogu biti povezani sa starenjem, odnosno pojavom hroničnih bolesti koje dodatno ugrožavaju fizičke aktivnosti. Većina ispitanika (88,9%) pored problema sa vidom nema drugih problema koji bi negativno uticali na kretanje. Međutim, 11% ispitanika smatra da prisustvo različitih oboljenja i stanja (neurološke i srčane smetnje, češća hospitalizacija ili kontraindikacije za zamaranje većeg intenziteta) može ograničavati njihovu sposobnost kretanja.

Uzorak je bio relativno ujednačen prema polu (53% žena i 47% muškaraca) i stepenu oštećenja vida (53% slepih ispitanika i 47% slabovidih). Ispitivanjem stepena samostalnosti u kretanju samoprocenom ispitanika dobijeno je da skoro 40% njih efikasno koristi beli štap (slepi ispitanici). Isti procenat smatra da njihovo oštećenje vida ne predstavlja prepreku za kretanje (slabovidi ispitanici). Međutim, četvrtina (24,44%) ispitanika navodi da njihovo kretanje zavisi od pomoći drugih, odnosno retko izlaze jer nemaju adekvatnu pomoć u kretanju. U daljoj analizi su ispitanici kategorisani u dve grupe: osobe koje su samostalne u kretanju (N=34, 75,6%) i osobe koje nisu samostalne u kretanju (N=11, 24,4%).

Metod

Ispitanici su direktno kontaktirani preko Saveza slepih Srbije i pozivani su da učestvuju u istraživanju. Upitnici su adaptirani za internet anketiranje preko „Google forms“ platforme. Prikupljanje podataka je realizovano tokom aprila i maja 2018. godine.

Instrument

Opštim upitnikom konstruisanim za potrebe ovog istraživanja prikupljeni su sledeći podaci: uzrast, pol, stepen oštećenja vida, samostalnost u kretanju, radni status, obrazovni nivo.

U istraživanju je korišćena duga forma Međunarodnog upitnika o fizičkoj aktivnosti (*International Physical Activity Questionnaire – IPAQ-LF*), namenjena osobama starim od 15 do 69 godina. Ovaj upitnik se sastoji od 27 pitanja otvorenog tipa za samoprocenu intenziteta i trajanja fizičkih aktivnosti koje se realizuju na nedeljnom nivou u okviru četiri domena uključujući radno mesto, prevoz, poslove u kući i oko kuće i u toku slobodnog vremena. Procena fizičkog angažovanja na nedeljnom nivou izražava se u MET jedinicama (metabolički ekvivalent energetske potrošnje), što predstavlja odnos između energije potrebne za realizovanje aktivnosti i energije koje telo utroši tokom odmora. Nedeljni nivo (MET-minuti) se dobija bilo kojom kombinacijom aktivnosti koje rezultiraju povećanom razmenom materija u organizmu (što se ogleda kao ubrzano disanje i puls i sl.), ukoliko traju duže od 10 minuta dnevno, dok se aktivnost kraća od 10 minuta ne računa. Dobijeni rezultati se prikazuju u tri kategorije: visok, umeren i nizak nivo fizičke aktivnosti.

Nivo fizičke aktivnosti se vodi kao visok ukoliko osoba najmanje sat vremena dnevno upražnjava fizičke aktivnosti, ili ukoliko ispunjava bilo koji od sledećih kriterijuma:

- ostvaruje tri ili više dana energičnih aktivnosti, sa ukupno minimalno 1500 MET minuta,
- ostvaruje minimalno 3000 MET minuta nedeljno, bilo kojom kombinacijom fizičkih aktivnosti različitog intenziteta ili šetnje.

O umerenom nivou fizičkih aktivnosti se radi ukoliko osoba većinu dana u nedelji vrši fizičke aktivnosti u trajanju od pola sata ili ukoliko ispunjava bilo koji od sledeća tri kriterijuma:

- tri ili više dana nedeljno realizuje energične aktivnosti i/ili šetnja, u trajanju od minimalno 20 minuta dnevno,
- pet ili više dana u nedelji realizuje aktivnosti umerenog intenziteta i/ili šetnja u trajanju od najmanje 30 minuta dnevno,

- pet ili više dana u nedelji u kojima se ostvaruje bilo koja kombinacija gore pomenutih aktivnosti koja u ukupnom skoruu daje minimalno 600 MET minuta

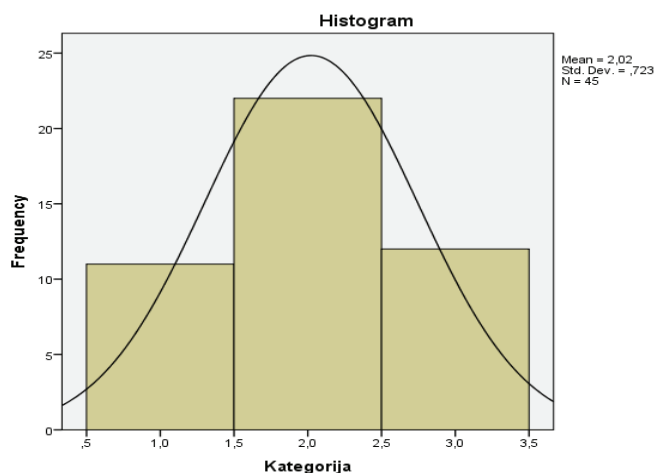
Ukoliko osoba ne ispunjava nijedan od pomenutih kriterijuma, može se svrstati u kategoriju osoba sa niskim nivoom fizičkih aktivnosti.

Rezultati

Rezultati pokazuju da je ukupan nedeljni nivo fizičkih aktivnosti mlađih odraslih osoba sa oštećenjem vida izražen preko MET skora veoma visok (AS=3808,10; SD=4095,04). Maksimalna vrednost iznosi čak 18534 MET min/nedeljno, što je skoro pet puta veće od prosečne vrednosti.

Interesovalo nas je postoje li statistički značajne razlike u nivou fizičkih aktivnosti na nedeljnom nivou u odnosu na neke opšte karakteristike ispitanika (stepen oštećenja vida, pol, radni status, samostalnost u kretanju). Analize su pokazale da slabovidni imaju više ukupne skorove od slepih, muškarci od žena, zaposleni od nezaposlenih i osobe koje su samostalne u kretanju u odnosu na ispitanike koji se ne kreću samostalno. Međutim, detektovane razlike nisu bile statistički značajne (stepen oštećenja vida: $\chi^2=0,690$, $df=1$, $p=0,406$; pol: $\chi^2=0,047$, $df=1$, $p=0,829$; radni status: $\chi^2=0,419$, $df=1$, $p=0,518$; samostalnost u kretanju: $\chi^2=1,476$, $df=1$, $p=0,224$).

Usledilo je kategorisanje ispitanika prema intenzitetu realizovanih fizičkih aktivnosti na nedeljnom nivou, što je prikazano u Grafikonu 1.



Grafikon 1. Intenzitet fizičkih aktivnosti osoba sa oštećenjem vida

Distribucija ispitanika u odnosu na nivo fizičkih aktivnosti (praćenih preko ukupnog MET skora) je ravnomerna i slična normalnoj. Najveći broj ispitanika (njih skoro 50%) ispoljava umeren nivo fizičkih aktivnosti (MET>600), dok su ispitanici čiji je nivo fizičkih aktivnosti nizak ili visok ravnomerno raspoređeni (24,44%; 26,68%). Generalno posmatrano, osobe sa oštećenjem vida imaju zadovoljavajući nivo fizičkih aktivnosti, pri čemu kod jedne četvrtine ima prostora za unapređenje.

Tabela 1. Postignuća i razlike između grupa ispitanika u odnosu na ispoljeni intenzitet fizičkih aktivnosti

		Kategorija			UKUPNO	χ^2	df	p	
		Niska FA	Umerena FA	Visoka FA					
Stepen oštećenja vida	Slep	N	9	8	7	24	6,252	2	0,042*
		%	20,0%	17,8%	15,6%	53,3%			
	Slabovid	N	2	14	5	21			
		%	4,4%	31,1%	11,1%	46,7%			
Pol	Muški	N	4	11	6	21	0,621	2	0,796
		%	8,9%	24,4%	13,3%	46,7%			
	Ženski	N	7	11	6	24			
		%	15,6%	24,4%	13,3%	53,3%			
Radni status	Zaposleni	N	1	7	3	11	2,054	2	0,398
		%	2,2%	15,6%	6,7%	24,4%			
	Nezaposleni	N	10	15	9	34			
		%	22,2%	33,3%	20,0%	75,6%			
Samostalno kretanje	Samostalno	N	6	17	11	34	4,351	2	0,115
		%	13,3%	37,8%	24,4%	75,6%			
	Nesamostalno	N	5	5	1	11			
		%	11,1%	11,1%	2,2%	24,4%			

Legenda: *p<0,05

Iako nije utvrđeno prisustvo statistički značajnih razlika u ukupnom nivou fizičkih aktivnosti ispitanika, iz Tabele 1 se vidi da razlike u pogledu intenziteta fizičkih aktivnosti postoje u odnosu na stepen oštećenja vida ($\chi^2=6,252$, $df=1$, $p=0,042$). Najveći broj slabovidnih ispitanika ima umeren nivo fizičkih aktivnosti, dok najveći broj slepih realizuje fizičke aktivnosti niskog nivoa. U odnosu na preostale tri posmatrane varijable (pol, radni status, sposobnost samostalnog kretanja) detektovane razlike u odnosu na intenzitet fizičkih aktivnosti nisu se pokazale statistički značajnim.

Diskusija

Ovim istraživanjem utvrđeno je da je fizička aktivnost osoba sa oštećenjem vida uzrasta 18 do 39 godina doba na visokom nivou. Skoro polovina ispitanika (48,88%) je umereno fizički aktivna, visok nivo fizičkih aktivnosti je utvrđen kod 26,68% ispitanika, dok četvrtina (24,44%) upražnjava sedentaran stil života. Prosečna vrednost MET skora celog uzorka iznosio je 3808,10 (SD 4095,04). Sadowska i Krzepota (Sadowska & Krzepota, 2013) su istim instrumentom, ali kratkom formom dobile jednake rezultate. One navode da 52% osoba sa oštećenjem vida ima umeren nivo fizičkih aktivnosti.

Ovako visok skor za populaciju osoba sa oštećenjem vida nije bio očekivan, ali je u skladu sa rezultatima koje su dobili Kamelska i Mazurek (Kamelska & Mazurek, 2015). U njihovom istraživanju osobe sa oštećenjem vida imale su 3930, a sportisti (tandem biciklisti) 3835 MET minuta nedeljno. Wrzesińska i saradnici u svom istraživanju (Wrzesińska et al., 2018) navode visok nivo fizičkih aktivnosti ispitanika, pri čemu mlađi odrasli sa oštećenjem vida imaju viši nivo pomenutih aktivnosti u odnosu na adolescente.

Zapravo, rezultati našeg istraživanja, kao i nekih istraživanja realizovanih u inostranstvu (Kamelska & Mazurek, 2015; Wrzesińska et al., 2018) se moraju uzeti sa rezervom jer nisu u skladu studijama (Bláha et al., 2013; Haegele et al., 2016; Starkoff et al., 2016) koje govore o pasivnom provođenju slobodnog vremena osoba sa oštećenjem vida i upražnjavaju sedentarnog stila života. Osobe sa oštećenjem vida srednjih godina najviše vremena, skoro deset sati dnevno, provode u sedentarnim aktivnostima (Starkoff et al., 2016), a slobodno vreme najradije provode u čitanju ili druženju, ili uz televizor, odnosno kompjuter (Haegele et al., 2017). Imajući to u vidu, potrebno je zapitati se da li možda postoje određene teškoće u vezi sa ovakvim načinom ispitivanja fizičkih aktivnosti osoba sa oštećenjem vida. Prilog sumnji u verodostojnost dobijenih podataka može biti i to što su, za razliku od naše i prethodno realizovanih studija, primenom istog

instrumenta različiti autori utvrdili znatno niži nivo fizičkih aktivnosti osoba sa oštećenjem vida: od 2967 METmin./ned. (Bláha et al., 2013), preko 2845 METmin./ned. (Haegele et al., 2016) i 2278 METmin./ned. (Marmeleira et al., 2013), sve do 1221 MET min./nedeljno (Sadowska & Krzepota, 2015). S obzirom na to da Svetska zdravstvena organizacija odraslim osobama preporučuje minimum 600 MET minuta fizičkih aktivnosti na nedeljnom nivou, proizilazi da je nivo fizičkih aktivnosti osoba sa oštećenjem vida, čak i sa ovim rezultatima, više nego zadovoljavajući. Međutim, posmatranjem strukture nedeljnog MET skora, Hegele i saradnici (Haegele et al., 2016) su utvrdili da odrasle osobe sa oštećenjem vida u proseku upražnjavaju samo 413,79 MET minuta umerenih i energičnih fizičkih aktivnosti i 2058 minuta sedentarnih aktivnosti nedeljno. Ukoliko upražnjavaju fizičke aktivnosti, osobe sa oštećenjem vida najčešće šetaju (2222 MET-min/nedeljno), što spada u fizičke aktivnosti niskog intenziteta, dok intenzivne i umerene fizičke aktivnosti retko upražnjavaju (Bláha et al., 2013). Iako dosta vremena hodaju, nivo fizičkih aktivnosti odraslih osoba sa oštećenjem vida ostvaren na ovaj način je značajno niži u poređenju sa osobama tipičnog razvoja (Holbrook et al., 2009).

Proverom povezanosti definisanih varijabli i fizičkih aktivnosti nisu utvrđene statistički značajne razlike, što se slaže sa nalazima sličnih studija. Hegele i saradnici (Haegele et al., 2016) su, od praćenih socio-demografskih varijabli (uzrast, pol, etnička pripadnost, nivo obrazovanja, nivo oštećenja vida, upotreba pomagala za kretanje, vreme nastanka oštećenja vida), utvrdili da samo pol predstavlja značajan prediktor fizičke aktivnosti kod odraslih osoba sa oštećenjem vida. Kada je u pitanju povezanost stepena oštećenja vida i fizičke aktivnosti, rezultati istraživanja su protivrečni. Neki radovi navode da je oštećenje vida višeg nivoa povezano sa umanjenom fizičkom aktivnošću (Hopkins et al., 1987; Barbosa Porcellis da Silva et al., 2018), dok drugi (Holbrook et al., 2009) ističu da stepen oštećenja vida nije povezan sa sveukupnim nivoom fizičkih aktivnosti, kao što je utvrđeno i u ovom istraživanju. Međutim, stepen vizuelne ometenosti (slepoća ili slabovidost) u vezi je sa intenzitetom fizičkih aktivnosti. Odsustvo statistički značajnih razlika u ukupnom MET skoruu između osoba koje su samostalne i onih koje nisu samostalne u kretanju (kojih je u našem uzorku bilo skoro 25%) navodi na pretpostavku da su možda neki drugi faktori (a ne sociodemografski, niti faktori u vezi sa stanjem vida) koji nisu bili kontrolisani u ovom istraživanju mogli uticati na dobijene rezultate.

Nakon svega, postavlja se pitanje koliko je ovakav način procene fizičkih aktivnosti pogodan za osobe sa oštećenjem vida. Tome u prilog govori i istraživanje inostranih autora (Marmeleira et al., 2013) kojim je proučavana podudarnost podataka o fizičkim aktivnostima osoba sa oštećenjem vida dobijenim objektivnim i subjektivnim procenama. Utvrđeno je da se vreme provedeno u umerenim ili intenzivnim fizičkim aktivnostima (dobijeno IPAQ-S skalom) nije podudaralo s podacima dobijenim akcelerometrijom. Autori smatraju da je upitnik IPAQ (kratka verzija) korisniji za otkrivanje osoba sa oštećenjem vida koje ne upražnjavaju preporučenu nedeljnu količinu fizičkih aktivnosti, nego za klasifikaciju nivoa i intenziteta fizičkih aktivnosti. Ovakvo mišljenje je u suprotnosti sa navodima Sadowske i Krzepote (Sadowska & Krzepota, 2015) koje ističu da je IPAQ (duga verzija) efikasan za praćenje fizičkih aktivnosti osoba sa oštećenjem vida. Možda se odgovor na ovakve dileme može naći u tome što je IPAQ razvijen za opštu populaciju, pa je moguće da neki pojmovi kojima se operiše u upitniku nisu razumljivi ljudima sa ograničenim praktičnim iskustvom, kao što je to slučaj sa osobama sa oštećenjem vida (Hagstromer et al., 2008). Takođe, objašnjenje može biti i to što, s obzirom na to da decu i mlade sa oštećenjem vida karakteriše nizak nivo opšte fizičke spremnosti i nezdrava telesna kompozicija (Lieberman & McHugh, 2001; Grbović, Stojković, Dimoski, & Eminović, 2013), ovakve odlike, ukoliko perzistiraju, u odrasloj dobi mogu rezultirati prekomernim umaranjem pri fizičkim aktivnostima umerenog i nižeg intenziteta, što može voditi neobjektivnoj samoproceni.

U vezi sa gore navednim, smatramo da su na rezultate ovog istraživanja najpre uticale teškoće u vezi sa samoprocenom. Problem samoprocene se konstantno javlja u svim naučnim disciplinama, jer ovakav vid ispitivanja može dovesti do toga da ispitanici daju društveno poželjne odgovore (Marmeleira et al., 2013).

Osim toga, samoprocenu je daleko lakše izvršiti kada je u pitanju učešće u nekoj strukuiranoj aktivnosti (kao što je to neki oblik vežbanja ili sporta) nego kada je u pitanju angažovanje u spontanim aktivnostima (Hagstromer et al., 2008), kao što je to slučaj u ovom istraživanju (svakodnevne fizičke aktivnosti u okviru posla, prevoza, kuće i slobodnog vremena. Takođe, postoji i mogućnost da osobe sa oštećenjem vida precenjaju težinu aktivnosti koje upražnjavaju i vreme koje provode u tome. Argumentacija za ovakav stav može biti u tome što je slična situacija sa precenjivanjem detektovana i u oblasti ispitivanja samopoimanja osoba sa oštećenjem vida. Istraživanje Stanimirov (2016) je pokazalo da odrasle slabovide osobe imaju statistički značajno viši stepen samopoimanja od osoba tipičnog razvoja, što je bilo suprotno od očekivanog. Objašnjenje za ovakve rezultate može se naći u studijama inostranih autora (Obiakor & Stile, 1990) koji kažu da osobe sa oštećenjem vida imaju tendenciju da precenjaju lične atribute. U vezi s tim, Gal (Gal, 2011) tvrdi da osobe sa invaliditetom sebe analiziraju, vide se i kreiraju sliku o sebi na specifičan način. One su sklone tome da odbacuju negativne karakteristike kako bi kreirale, razvile i održale pozitivnu sliku o sebi. Instrumenti za samoprocenu svakako predstavljaju korisne, efikasne i pouzdane instrumente istraživanja. Iako ova tehnika ima nesumnjive prednosti, pitanje je da li se samoprocena ispitanika sa oštećenjem vida po ovom pitanju može smatrati pouzdanom. Što se tiče rezultata, ostaje dilema: da li ispitanici nisu umeli na pravi način da procene svoje učešće u fizičkim aktivnostima ili su to u znatnoj meri precenjivali?

Zaključak

Rezultati dobijeni samoprocenom (primena IPAQ-a) u populaciji mlađih odraslih osoba sa oštećenjem vida moraju se uzeti s rezervom. Naredna istraživanja treba da daju odgovore o psihometrijskim karakteristikama ovog instrumenta kada se koristi u populaciji osoba sa različitim vrstama invaliditeta. Kada su u pitanju osobe sa oštećenjem vida, preporuka je da se IPAQ kombinuje sa nekom od objektivnih ili direktnih metoda procene fizičkih aktivnosti. Naredni korak biće analiza pojedinačnih domena IPAQ upitnika, a ne samo ukupnog MET skora, kako bi se stekao bolji uvid u strukturu ostvarenih fizičkih aktivnosti slepih i slabovidih osoba na nedeljnom nivou.

Ograničenja studije

Kao ograničenje studije može se smatrati to što je uzorak selekcioniran i relativno mali. Najveći broj istraživanja koja se bave osobama sa oštećenjem vida, ne samo kod nas već i u drugim zemljama, obuhvata relativno male uzorke. Svakako bi veći uzorak obezbedio verodostojnije podatke, međutim, motivisanje ispitanika sa oštećenjem vida na učestvovanje u raznovrsnim studijama predstavlja poseban problem, naročito ukoliko se postave limitirajući faktori kao što je to u ovoj studiji bio uzrast.

Osim toga, istraživanjem su obuhvaćeni samo pojedinci koji su imali pristup računaru i internet konekciju i dobrovoljno su pristali da učestvuju u istraživanju. To navodi na pomisao da učešće u istraživanju (opet, generalno gledano, ne samo u ovom slučaju) uzimaju aktivne odrasle osobe sa oštećenjem vida, zbog čega se dobijeni rezultati ne mogu generalizovati na celu populaciju, sa čim se slažu i Hegel i saradnici (Haegle et al., 2017).

Kao dodatno ograničenje treba istaći prikupljanje podataka putem online ankete. U takvoj situaciji ispitivač nije u mogućnosti da odgovori na eventualne nedoumice ispitanika, kao što bi to bio slučaj prilikom korišćenja intervjua. S druge strane, online anketa kao način ispitivanja omogućava prikupljanje većeg uzorka osoba sa oštećenjem vida na brz, ekonomičan i jednostavan način (Haegle et al., 2016).

Napomena: Rad je proistekao iz projekata „Efekti primenjene fizičke aktivnosti na lokomotorni, metabolički, psiho-socijalni i vaspitni status populacije R. Srbije“ ev. br. III 47015, a kao deo podprojekta “Efekti primenjene fizičke aktivnosti na lokomotorni, metabolički, psiho-socijalni i vaspitni status populacije osoba sa posebnim potrebama R. Srbije” i „Socijalna participacija osoba sa intelektualnom ometenošću“ ev. br. 179017 (2011-2018), čiju realizaciju finansira Ministarstvo prosvete, nauke i tehnološkog razvoja Republike Srbije.

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KINEMATIC ANALYSIS OF THE LONG JUMP (-A CASE STUDY-)

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Introduction

In modern sports, the long jump is a track and field event in which a leap is made from a run-up from one leg with the goal of achieving the longest possible jump (Stefanovic, Juhas, Jankovic 2008). One way of tracking and quantifying the jump technique is by using kinematics, which defines the characteristics of the space and time of the studied motion. It examines the relations between spatial, temporal and spatial-temporal characteristics of the movement (Vasiljev & Ilic 2004). The take-off quality can be estimated based on generated angles in the observed joints during take-off, take-off velocity, angular velocity and other variables. The jump distance can be viewed as the projectile motion (with the difference in level), where the jump length depends mostly on initial take-off velocity, elevation angle and the level difference. According to Hay (1986), the long jump is composed of four phases: run-up, take-off, flight and landing. The achieved result depends on the mutual compatibility and quality of all the above phases. From the biomechanical point of view, the two most important factors for achieving the jump length are horizontal velocity (Hv) before take-off and high quality performance of take-off technique (Tan & Zumerchik 2000). The most influential factors for the length of the jump are speed of run-up, actual angles of the take-off leg during the take-off and optimal leg stiffness (Seyfarth et al. 1999). The optimum leg stiffness is required for a good performance of the take-off, where for each leg stiffness value there is an optimal angle of attack. In addition to the above factors, the frequency of the steps, the length of the steps, and the take-off and flight phases are also relevant. (Omura et al. 2004). The jump length to a great extent depends on the horizontal velocity (Hv) achieved during the run-up. Karl Luis and Jesse Owens were extremely good sprinters. The length of their jumps depended largely on the so-called "raw" speed. Other famous jumpers, such as Ralf Boston and current world record holder Mike Powell, did not have that much speed, but compensated for this deficiency with a very good take-off technique.

The jump length can be calculated according to Tan and Zumerich (2000) based on the following formula:

$$\text{Length of the jump} = H_v [V_v + \sqrt{(V_v)^2 + 2gh}]$$

Hv = horizontal velocity at the end of the take-off

Vv = vertical velocity at the end of the take-off

g = 9.81m / s²

h = vertical difference of the centre of mass level between the point of the take-off and landing

Since h is relatively constant, the achieved length of the jump depends mostly on the Hv to Vv ratio at the end of the take-off. The value of these two variables determines the vector of the resulting take-off velocity (Young and Marino 2000). If Hv or Vv increases, the length of the jump will also increase. How does a jumper generate those speeds during the take-off phase?

In the analysed literature, two approaches were noted:

- 1) Speed approach - the run-up is performed at the maximum speed with a slight change in the length of the last step in relation to the other steps of the run-up and with a very short duration of the take-off. In this case, the horizontal velocity during the take-off is dominant.
- 2) Height approach - during the run-up, the jumper runs with high-hooked hips. In this case, the speed decreases before the take-off, the last step is shorter and a slightly higher jump height is achieved. This run-up affects the longer duration of the take-off. In this case, alongside the horizontal, goal is to increase the vertical component of the take-off velocity (Young & Marino 2000).

Young and Marino (2000) found that an increase in H_v by 10% affected the reduction of V_v by 10% and contributed to an increase in the length of jump by 3%. An increase in V_v by 10% causes a decrease in H_v by 10% and causes a 5% decrease in the jump length, indicating that H_v is a more influential variable for the length of the jump. If H_v is reduced by 10%, the V_v must be increased by 18% in order to maintain the same jump length.

In a number of studies, it was found that better jumpers have a shorter take-off time and a smaller angle of take-off. This suggests that better jumpers may differ from others by the H_v value rather than by the V_v value. Also, the shorter the time of amortisation and the earlier start of leg extension, the greater speed of movement can be transferred to the jumper, redirecting his movement. From the moment of setting the foot on the board until the end of the take-off passes about 0.10 to 0.13 s. During the take-off the stepping leg acts as a supported pendulum (Stefanovic 1992, Seyfarth et al. 1999, Jankovic 2009).

As H_v has a great influence on the achieved jump length, a jumper should perform every jump with the lowest possible loss of H_v . As a general recommendation, it can be said that the jumper should have dominant H_v in order to increase the V_v of the take-off through strength training. Such an approach requires that jumpers have the "power" to generate a high vertical force in a short time. According to Myers (1989), the primary goal of take-off in the long jump is to maintain H_v (with a slowdown of not more than 10%) while developing a sufficient V_v of the take-off.

Active landing affects the reduction of braking impulses and reduces the loss of horizontal velocity of the body centre of mass (CM) during running. The exact mechanism of generating the vertical and horizontal velocities of the take-off using different take-off techniques has not been completely clarified. In the last step of the run-up in all athletic jumping events, the active landing has a great influence on the quality of the take-off, and thus on the result (intensity, length or height of the jump). The active landing plays an important role in transforming the horizontal velocity into the resulting speed of take-off, and it is directed backwards and downwards (Matic 2009).

Flynn (1973) defines the active landing as the ratio of the horizontal velocities of the foot and the body CM immediately prior to contact with the surface. During the take-off in the long jump, as well as in other athletic jumps, the occurring phenomenon is the conversion of the predominantly horizontal velocity generated by the run-up to the resulting speed of take-off (Yu 1999), while the active landing affects the lower loss of horizontal velocity. The loss of horizontal velocity occurs during the entire phase of the take-off, and especially during the first half of the take-off (amortization phase).

Based on the researched issue and previous research, the subject matter of this paper is defined as the effect of different run-up lengths on the kinematic variables of the take-off and the length of the jump distance. Accordingly, the purpose of the research was set to determine the effect of different run-up lengths on the kinematic variables of the take-off and the length of the long jump and to determine the correlation between the tested variables.

Methods

Measurement equipment

The measurement of kinematic variables was made using three infrared cameras and 3D Qualisys Track Manager software (3D QTM), a sampling frequency of 240 Hz.

Measurement method

To prevent external influences, the measurements were made in an indoor track and field facility. The cameras were positioned so as to constantly and continuously follow all the markers on the jumper during the take-off. Retroreflective markers with a diameter of 19 mm were placed on the fingers (ball of the foot), the ankle joint (*malleolus lateralis*), the knee (*caput fibulae*), the *trochanter major* and the shoulder.

The angles, movements and velocities were analysed at least 10 frames prior to the instant of the TDT (touchdown of the take-off) until the ETO (end of the take-off).

Experiment protocol

After the warm-up, including sprinting and jumping exercises, active stretching of the lower extremities muscle groups and several introductory jumps from short run-up, the proceeded to perform jumps with a gradual increase in the run-up length (4, 6, 8, 10 and 12 steps). The run-up distance was measured from the beginning of the run-up to the take-off position. Retroreflective markers were set during the warm-up period. Breaks between the jumps were in the intervals of 3 to 5 minutes.

Participant

Kinematic variables were measured on a senior male long jumper with the personal best of 7.59 m.

Sample variables

Independent variable

- Run-up length (number of steps or in meters)

Dependent variables

- Maximal run-up velocity (m/s)
- Take-off duration (s)
- Active landing (m/s)
- Changing the angle in the ankle joint during the take-off (°)
- Changing the angle in the knee joint during the take-off (°)
- Changing the angle in the hip joint during the take-off (°)
- Velocity in the ankle joint at the end of the take-off (°/s)
- Velocity in the knee joint at the end of the take-off (°/s)
- Velocity in the hip joint at the end of the take-off (°/s)
- Effective jump distance (m)

The CM speed was approximated based on the average hip joint speed in the last ten frames before the beginning of the take-off. The effective jump length was measured, bouncing out of the “zone” so that the jumper was optimally and without limitation focused on performing the proper take-off.

The active landing is calculated as the difference between velocities of markers placed on the ankle and hip joints, one frame before the take-off.

Data processing

The obtained results were processed using the descriptive and comparative statistics. The SPSS 20 statistical data processing software was used.

Results

Table 1 shows the descriptive statistics of the selected dependent and independent variables. Table 2 shows the correlation matrix of certain dependent variables with an independent variable.

Table 1. Descriptive statistics of the selected dependent and independent variables

Variables	4 step 1	4 step 2	6 step 1	6 step 2	8 step 1	10 step 1	12 step 1	12 step 2	12 step 3
Run-up length (m)	6.55	6.55	11.6	11.6	15.5	19	21.7	21.7	21.7
Maximum run-up velocity (m/s)	6.14	5.53	8.09	6.53	7.80	8.09	7.68	7.99	7.98
Take-off duration (s)	0.18	0.15	0.16	0.14	0.15	0.13	0.14	0.15	0.15
Active landing (m/s)	2.102	2.63	2.08	2.46	2.74	3.28	2.87	2.33	2.18
Length of jump (m)	5.2	5.14	6.39	5.72	6.5	6.81	6.67	6.47	6.62

Key: 4 step 1 - first try with four step run-up; 4 step 2 - second try with four step run-up; 6 step 1 - first try with six step run-up; 6 step 2 - second try with six step run-up; 8 step 1 - first try with eight step run-up; 10 step 1 - first try with ten step run-up; 12 step 1 - first try with twelve step run-up; 12 step 2 - second try with twelve step run-up; 12 step 3 - third try with twelve step run-up.

Table 2. Results of linear and polynomial correlation of certain dependent and independent variables

	Run-up length - linear	Run-up length - polynomial
Maximum run-up velocity	0.81*	0.90*
Take-off duration	-0.56	-0.65*
Active landing	0.31	0.37
Length of jump	0.89*	0.96*

Key: *significance level $p < 0.05$; Run-up length - linear: results of linear correlation; Run-up length - polynomial: results of polynomial correlation.

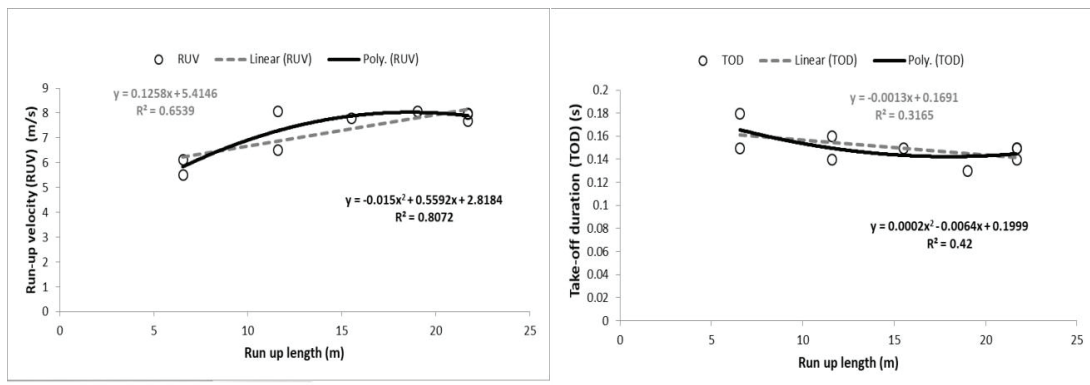


Chart 1. Linear and polynomial regression of dependent variables (maximum run velocity and take-off duration) and independent variables (run-up length).

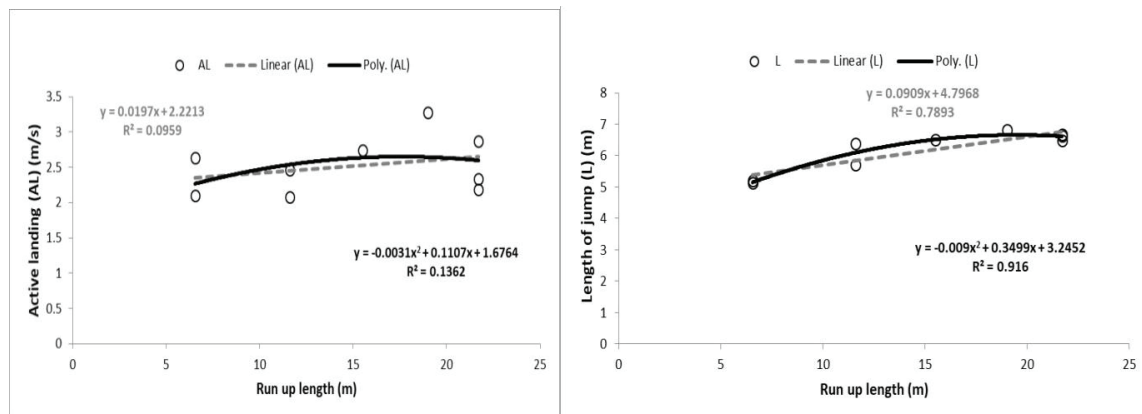


Chart 2. Linear and polynomial regression of dependent variables (active landing and result of length of jump) and independent (run-up length).

The highest linear correlation was obtained between the Run-up Length and Length of Jump variables (0.89), and the highest obtained polynomial correlation was also between these two variables (0.96). Dependent variables with higher correlation coefficients are presented in Charts 1 and 2 and better relationship (higher determination coefficient) was obtained with a polynomial than with a linear regression equation.

From 4- and 6-step run-ups, the participant achieved longer jumps with greater amortization and extensional amplitude in the ankle, knee and hip joints, and a longer take-off duration compared to shorter jumps from the same run-up lengths. The take-off duration in a longer jump from a 4-step run was 0.18 s, and 0.15 s in shorter jump; and from a 6-step run-up, the take-off duration in a longer jump was 0.16 s, and 0.14 s in a shorter jump.

In jumps from 4- and 6-step run-ups, higher angular velocities in ankle and hip joints velocities were achieved 0.1 s before the Touch Down of Take-off (TDT), as well as mean velocity values 10 frames before the take-off of the ankle and hip joints. In the case of longer jumps, higher values of Hv and Vv were achieved before the jump as compared to shorter jump lengths.

Active landing in long jumps from the 4-step run-up was 2.1 m/s, and 2.08 m/s, from the 6-step run-up. Active landing in shorter jumps from 4- and 6-step run-ups was 2.63 m/s and 2.46 m/s, respectively.

From the 12-step run-up, the participant achieved similar angles of the first jump (the longest jump from the 12-step run-up) and the third jump. Take-off duration was 0.14 s and 0.15 s in the longest jump and shorter jumps, respectively. Active landing of the longest jump was 2.87 m/s, and 2.18 m/s of the shortest jump. Values of amortization and extensional amplitude, angular velocity, speed of ankle and hip joints 0.1 s before the TDT, mean velocity values 10 frames before the take-off and the TDT were higher in the shorter jump.

In the second jump from the 12-step run-up, the participant achieved a smaller amortization amplitude of the ankle and hip joints, and smaller hip joint extension than in the longer jump from the 12-step run-up. The extensional amplitudes (during the concentric phase of the take-off) of the ankle and knee joints, and the amortisation amplitude of the knee joint were higher in this jump than in the longer jump from the 12-step run-up. Angle speeds were lower compared to those in the longer jump. Active landing of a shorter jump was 2.33 m/s, and 2.87 m/s of the longer jump. The ankle and hip joints speed is 0.1 s before the TDT, mean values velocity 10 frames before the take-off ankle and hip joint, the speed of the ankle and the hip joints on the TDT are higher in the shortest jump.

The jumper achieved the maximum length of the jump with the 10-step run-up. The mean velocity value of the ankle joint 10 frames before the TDT was lower than in the longer jump from the 6 step run-up and all jumps from the 12-step run-up; velocity of the ankle joint 0.1 s before the TDT was lower than the velocity of the longer jump from the 6-step run-up and was greater than the velocity of the ankle joint in all other jumps. The velocity of the ankle joint at the TDT was lower than the velocity of the longer jumps from the 6- and 8-step run-ups, and all jumps from the 12-step run-up. During the experiment, the ankle joint and hip joint velocities were the highest velocities achieved by the participant after the TDT.

The mean velocity of the ankle and hip joints during the last 10 frames before TDT, the ankle joint and hip joint velocities on the TDT, the speed of the ankle joint 0.1 s before the TDT had the highest values in the longer jump from the 6-step run-up.

The highest mean value of the horizontal velocity of the body CM 10 frames before the take-off was achieved in the longer jump from the 6- and 10-step run-ups. In both jumps, the body CM velocity was 8.09 m/s.

Discussion

The achieved greater amortization and extensional amplitude in the ankle, knee and hip joints, and a longer duration of take-off in longer jumps from the 4- and 6-step run-ups in relation to shorter leaps can be explained by a more pronounced muscle component during the take-off in longer jumps. In the reviewed literature (Young and Marino 2000, Jankovic 2009), the extension in the course of take-off should occur during the concentric phase of the take-off when the vertical component of the velocity is generated by extension, and not during the amortisation phase. In the conducted research, the prolongation of the take-off in the longer jumps occurred during the concentric phase of the take-off.

Higher angle velocities, speeds of ankle and hip joints 0.1 s before the TDT and the H_v and V_v before the take-off were achieved in longer jumps from the 4- and 6-step run-ups compared to shorter jumps from the same run-ups, which is in accordance with the analysed studies (Myers 1989, Omura et al. 2004) and the values of the tested variables can be considered to have significantly influenced the length of the jump.

A reason for the lower active landing values in longer jumps from the 4- and 6-step run-ups could be an increase in the ankle velocity compared to the hip joint velocity. Furthermore, the reason for the lower active landing values in longer jumps may be the fact that the participant achieved the jump lengths utilising muscular component rather than the elastic one, in the stretch-shortening cycle.

From the 12-step run-up, the take-off technique was badly performed in the shortest jump (third jump), which resulted in the shorter length of the jump. All other measured kinematic variables were significantly better in the shortest jump compared to the longest jump achieved from the 12-step run-up. In the second jump from the 12-step run-up, the jumper had a good running speed, but did not technically perform a good take-off and took advantage of the achieved speed, which can be concluded by comparing the dependent variables. The shorter lengths achieved from higher running speeds compared to the longest lengths are indicative of inadequate physical preparedness of the jumper for faster 12-step run-up.

The take-off duration is shortest in the jump from the 10-step run-up and it is 0.13 s. This take-off was performed with H_v more pronounced than V_v . Many researchers have confirmed the interdependent relationship between kinematic variables and the fact that the horizontal component of the velocity has a dominant influence on the achieved jump length (Kahikana and Suzuki 2001; Bridget and Linthorne 2006).

The highest active landing value was achieved in the jump from the 10-step run-up and it was 3.28 m/s. The high value of active landing most likely influenced the lower loss of horizontal velocity during the take-off, with minimal reduction of the vertical speed and the reduction of the take-off braking forces, which

resulted in the shorter duration of the take-off. According to Leblanc (1997), the highest active landing value in the longest jump probably affected the duration of contact with the surface.

The longest jump in this research was achieved with the 10-step run-up and it was a result of the achieved run-up velocity and high-quality take-off technique. The maximum speed before the take-off which was achieved from the 6- and 10-step run-ups may have been the consequence of the fact that the measurement was made during the preparation period of the jumper. The participant can be advised to work to improve the take-off technique and increase the maximum speed of running (Matic 2008). Charts 1 and 2 show that the prediction of certain dependent variables by an independent variable (run-up length) is more readily obtained when a polynomial regression equation is applied rather than the linear one. Also Graphs 1 and 2 show that the values of certain dependent variables decrease (apart from the take-off duration variable) for the first and last applied run-up length. It can be said that the optimal run-up length for the jumper at the time of the case study was between 6 and 10 steps.

Conclusion

The main goal of the present experimental research was to determine the influence of different run-up lengths on the kinematic variables of the take-off and the distance of the jumps, and to determine the correlation between the tested variables.

It can be concluded that jump lengths and run-up velocities mainly increased in longer jumps and run-ups from 4 to 10 steps. The length of the jump from the longest 12-step run-up attempt was shorter than that from the 10-step run-up. The measured run-up speed at the longest jump from the 12-step run-up is lower than those achieved from the 6-, 8- and 10-step run-ups, while the active landing is lower than that from the 10-step run-up. The question may be raised whether the intensity of active landing in the function of achieving the optimal length of the jump or providing conditions for a higher intensity take-off? Somewhat lower values of the observed variables from the 12-step run-up compared to shorter run-ups may be the consequence of the fact that the measurement was made in the preparation period. It can be concluded that the optimal run-up length for the jumper was 10 steps.

Future research dealing with the effect of the length of the run-up on certain kinematic variables of the take-off should examine how the increase in the strength and power of muscles affects the mechanics of the take-off. How certain training tools and methods used in a relatively long period of time (micro-, meso- or macro-cycle) affect the outcome of the jump distance and the take-off technique should also be examined.

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KINEMATIČKA ANALIZA SKOKA UDALJ (-STUDIJA SLUČAJA-)

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Uvod

U savremenom sportu atletska disciplina skok udalj podrazumeva skok izveden iz zaleta odskokom sa jedne noge sa ciljem ostvarivanja što dužeg skoka (Stefanović, Juhas, Janković 2008). Jedan od načina praćenja i kvantifikovanja tehnike skoka udalj je pomoću kinematike, koja definiše karakteristike prostora i vremena proučavanog kretanja. U njoj se ispituju odnosi između prostornih, vremenskih i prostorno-vremenskih karakteristika kretanja (Vasiljev i Ilić 2004). Kvalitet odskoka se može proceniti na osnovu: generisanih uglova u aktuelnim zglobovima za vreme odskoka, brzine izvođenja odskoka, ugaone brzine zamajne noge i drugih varijabli. Skok udalj se u osnovi može posmatrati kao kretanje projektila (kosi hitac sa razlikom nivoa), gde će dužina skoka najviše zavisiti od početne brzine odskoka, elevacionog ugla i razlike nivoa. Prema Hayu (1986) skok udalj se sastoji iz četiri faze: zaleta, odskoka, leta i doskoka. Postignut rezultat zavisi od međusobne usklađenosti i kvaliteta svih navedenih faza skoka udalj.

Sa aspekta biomehanike dva najvažnija faktora za ostvarenu dužinu skoka udalj su: horizontalna brzina (Hv) pred odskok i kvalitetan odskok (Tan & Zumerchik 2000). Najuticajniji faktori za dužinu skoka udalj su: brzina trčanja, aktuelni uglovi odskočne noge tokom trajanja odskoka i optimalna čvrstina (krutost) noge (Seyfarth i sar. 1999). Potrebna je optimalna čvrstina odskočne noge za kvalitetno izvođenje odskoka, gde za svaku čvrstinu noge postoji optimalan ugao napada odskočne noge. Pored navedenih faktora, izuzetno su važni frekvencija koraka, dužine koraka, faze odskoka i leta (Omura i sar. 2004). Dužina skoka veoma zavisi od horizontalne brzine (Hv) postignute tokom zaleta, činjenica je da su Karl Luis i Džesi Ovens bili izuzetno dobri sprinteri. Dužina njihovih skokova je najviše zavisila od tzv. „sirove“ brzine. Drugi slavni skakači: Ralf Boston, i aktuelni rekorder Majk Pael nisu imali toliku brzinu ali su taj nedostatak kompenzovali izuzetno dobrim odskokom.

Dužina skoka se može izračunati prema Tan i Zumerich (2000) na osnovu sledeće formule:

$$\text{Dužina skoka} = Hv [Vv + \sqrt{(Vv)^2 + 2gh}]$$

Hv = horizontalna brzina na kraju odskoka; Vv = vertikalna brzina na kraju odskoka; $g = 9,81\text{m/s}^2$
 h = vertikalna razlika nivoa između mesta odskoka i doskoka

Kako je h relativno konstantna, postignuta dužina skoka zavisi najviše od Hv i Vv na kraju odskoka. Veličina te dve varijable određuje veličinu rezultantne brzine odskoka (Young i Marino 2000). Ako se povećava Hv ili Vv povećavaće se i dužina skoka. Kako skakač utiče tim brzinama na odskok?

U analiziranoj literaturi su uočena dva pristupa: 1) akcenat na generisanje najbržeg zaleta i odskoka - *speed approach* - zalet se trči maksimalnom brzinom sa malom promenom dužine poslednjeg koraka u odnosu na ostale korake zaleta i sa izuzetno kratkim vremenom trajanja odskoka. U ovom slučaju je dominantna horizontalna brzina tokom odskoka.

2) Pristup u kome je najveća pažnja posvećena pripremi za odskok - *height approach* – tokom zaleta skakač trči sa visoko podignutim kukovima. U ovom slučaju se brzina smanjuje pred odskok, poslednji korak se više skraćuje i postiže se nešto viša visina skoka. Ovakav zalet utiče na duže trajanje odskoka. U ovom

slučaju se pored horizontalne povećava vrednost i vertikalne komponenta brzine odskoka (Young i Marino 2000).

Young i Marino (2000) su utvrdili da povećanje Hv za 10% utiče na smanjenje Vv za 10% i doprinosi povećanju dužine skoka za 3%. Povećanje Vv za 10% prouzrokuje smanjenje Hv za 10% i prouzrokuje smanjenje dužine skoka za 5%, što pokazuje da je Hv više uticajna varijabla. Ako je Hv smanjena za 10%, Vv mora biti povećana za 18% da bi se sačuvala ista dužina skoka.

U određenom broju istraživanja je utvrđeno da bolji skakači u odnosu na lošije imaju kraće vreme trajanja odskoka i manji ugao odskoka. To nagoveštava da se bolji skakači mogu razlikovati od lošijih prema veličini Hv pre nego prema veličini Vv. Što je kraće vreme amortizacije i raniji početak opružanja noge, to je veća brzina kretanja koja može da se saopšti telu u novom pravcu. Od trenutka postavljanja stopala odskočne noge na dasku do završetka odskoka prolazi oko 0,10 do 0,13 s. Tokom odskoka odskočna noga se ponaša kao poduprto klatno (Stefanović 1992, Seyfarth i sar. 1999, Janković 2009).

Pošto Hv ima veliki uticaj na realizovanu dužinu skoka skakač bi trebalo da izvodi svaki skok sa što manjim gubitkom Hv. Kao generalna preporuka može se reći da kod skakača treba da bude dominantna Hv sa ciljem da se povećava Vv odskoka kroz trening snage. Takav pristup zahteva da skakači imaju „moć“ da ispolje veliku vertikalnu silu za kratko vreme. Prema Myersu (1989) primarni cilj odskoka u skoku u dalj je sačuvati Hv (sa usporenjem ne većim od 10%) dok se razvija dovoljna Vv odskoka.

Kod skoka u dalj zagrebanje utiče na smanjenje kočećih impulsa i smanjenje gubitka horizontalne brzine težišta tela tokom trčanja. Tačna mehanika generisanja vertikalne i horizontalne brzine odskoka korišćenjem različitih tehnika odskoka nije u potpunosti razjašnjena. U poslednjem koraku zaleta kod svih atletskih skakačkih disciplina zagrebajući pokret ima velikog uticaja na kvalitet odskoka, a time i na postignut rezultat (intenzitet, dužinu ili visinu skoka). Zagrebajući pokret ima bitnu ulogu u transformisanju horizontalne u rezultatnu brzinu odskoka, i usmeren je unazad i nadole (Matić 2009).

Flynn (1973) zagrebajući pokret definiše kao odnos između horizontalne brzine stopala odskočne noge i težišta tela neposredno pre kontakta sa podlogom. Tokom odskoka kod skoka udalj, kao i drugih atletskih skokova dešava se fenomen konverzije pretežno horizontalne brzine generisane zaletom u rezultatnu brzinu odskoka (Yu 1999), dok zagrebajući pokret utiče na manji gubitak horizontalne brzine. Gubitak horizontalne brzine dešava se tokom čitave faze odskoka, a naročito za vreme prve polovine odskoka (amortizacione faze).

Na osnovu problema istraživanja, kao i dosadašnjih istraživanja definisan je predmet rada koji se odnosi na efekte uticaja različitih dužina zaleta na kinematičke varijable odskoka i dužinu skoka udalj. U saglasnosti sa tim postavljen je cilj istraživanja – da se odredi uticaj različitih dužina zaleta na kinematičke varijable odskoka i dužinu skoka udalj i da se utvrdi povezanost ispitivanih varijabli.

Metode

Merenje kinematičkih varijabli skakača udalj je realizovano pomoću tri infracrvene kamere i softvera 3D Qualisys track manager (3D QTM), frekvencijom uzorkovanja od 240 Hz.

Sva merenja su izvedena u atletskoj dvorani kako bi se sprečili svi spoljašnji uticaji. Kamere su postavljene tako da sve vreme – kontinualno prate sve markere na skakaču tokom izvođenja odskoka. Retrofektivni markeri dijametra 19mm su postavljeni na: peti, prstima (ball of the foot), skočnom zglobu (malleolus lateralis), kolenu (caput fibulae), kuku (trochanter major) i ramenu. Analizirani su uglovi, pomeraji i brzine u trenutku POD-a (početka odskoka), KOD-a (kraja odskoka) i tokom odskoka.

Protokol eksperimenta

Nakon perioda zagrevanja koji se sastojao od sprinterskih i skakačkih vežbi, aktivnog istežanja mišićnih grupa donjih ekstremiteta i nekoliko uvodnih skokova iz kratkih zaleta, pristupalo se izvođenju skokova udalj sa postepenim povećanjem dužine zaleta (4, 6, 8, 10 i 12 koraka). Dužina zaleta je izmerena

metarskom pantljikom od početka trčanja zaleta do mesta odskoka. Markeri su postavljeni tokom perioda zagrevanja. Pauza između skokova bila je u intervalu od 3 do 5 min.

Kinematičke varijable su merene kod jednog ispitanika - seniora sa najboljim ličnim rezultatom 7.59 m.

Uzorak varijabli

Za dobijanje rezultata istraživanja korišćene su nezavisne i zavisne varijable. Kao nezavisna varijabla u ovom istraživanju korišćena je

- Dužina zaleta (broj koraka i dužina zaleta u metrima)

Za analizu efekata koji utiču na dužinu skoka uzete su sledeće zavisne varijable

- Maksimalna brzina zaleta (m/s)
- Trajanje odskoka (s)
- Zagrebanje (m/s)
- Promene ugla u skočnom zglobu, zglobu kolena i zglobu kuka tokom odskoka ($^{\circ}$), podrazumevaju početne, minimalne i uglove na kraju odskoka, kao i iz njih izvedenih fleksionih i ekstenzionih amplituda.
- Ugaone brzine u skočnom zglobu, zglobu kolena i kuka na kraju odskoka ($^{\circ}/s$) predstavljaju maksimalne ugaone brzine u koncentričnoj fazi mišićnih kontrakcija ekstenzora u posmatranim zglobovima.
- Efektivna dužina skoka udalj (m)

Kao brzina težišta tela (Maksimalna brzina zaleta) računata je prosečna brzina zgloba kuka u poslednjih deset frejmova pre početka odskoka. Prikazana je efektivna dužina skoka, odskakalo se iz „zone“ kako bi skakač optimalno i bez ograničenja bio fokusiran na izvođenje tehnike odskoka. Razlikom brzine kuka i skočnog zgloba jedan frejm pre početka odskoka za svaki pojedinačni skok dobijene su brzine „zagrebanja“.

Dobijeni rezultati su obrađeni deskriptivnom i komparativnom statistikom. Korišćen je statistički softver za obradu podataka SPSS 20.

Rezultati

U Tabeli 1. je prikazana deskriptivna statistika odabranih zavisnih i nezavisne varijable. U Tabeli 2 prikazana je korelaciona matrica određenih zavisnih varijabli sa nezavisnom varijablom.

Tabela 1. Deskriptivna statistika određenih zavisnih i nezavisne varijable.

Varijable	4 kor	4 kor	6 kor	6 kor	8 kor	10 kor	12 kor	12 kor	12 kor
	1	2	1	2	1	1	1	2	3
Dužina zaleta (m)	6,55	6,55	11,6	11,6	15,5	19	21,7	21,7	21,7
Brzina zaleta (m/s)	6,14	5,53	8,09	6,53	7,80	8,09	7,68	7,99	7,98
Trajanje odskoka (s)	0,18	0,15	0,16	0,14	0,15	0,13	0,14	0,15	0,15
Zagrebanje (m/s)	2,102	2,63	2,08	2,46	2,74	3,28	2,87	2,33	2,18
Dužina skoka udalj (m)	5,2	5,14	6,39	5,72	6,5	6,81	6,67	6,47	6,62

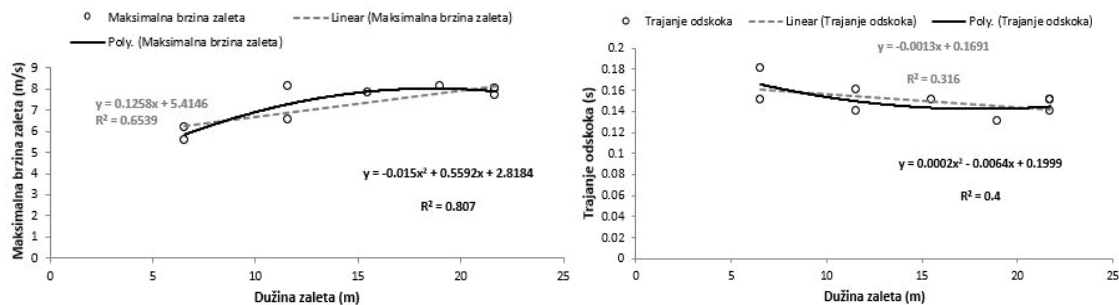
Legenda: 4 kor 1 - prvi pokušaj sa dužinom zaleta od 4 koraka; 4 kor 2 - drugi pokušaj sa dužinom zaleta od 4 koraka; 6 kor 1 - prvi pokušaj sa dužinom zaleta od 6 koraka; 6 kor 2 - drugi pokušaj sa dužinom zaleta od 6 koraka; 8 kor 1 - prvi pokušaj sa dužinom zaleta od 8 koraka; 10 kor 1 - prvi pokušaj sa dužinom zaleta od 10 koraka; 12 kor 1 - prvi pokušaj sa dužinom zaleta od 12 koraka; 12 kor 2 - drugi pokušaj sa dužinom zaleta od 12 koraka; 12 kor 3 - treći pokušaj sa dužinom zaleta od 12 koraka.

Tabela 2. Rezultati linearne i polinomijalne korelacije određenih zavisnih i nezavisne varijable.

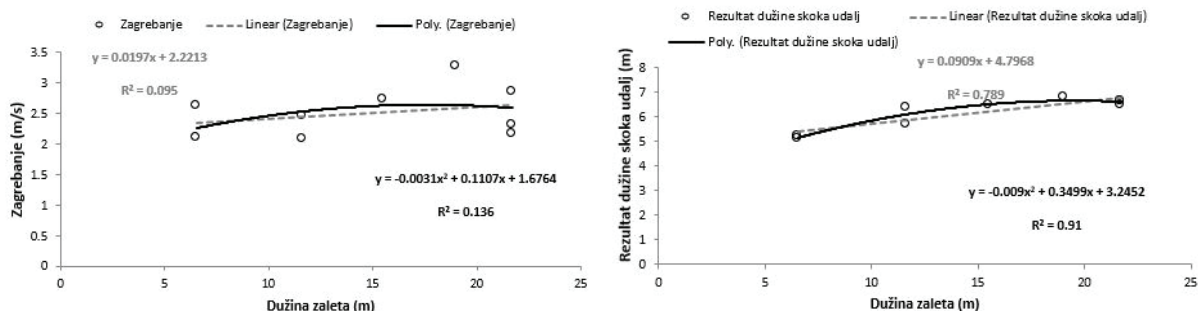
	Dužina zaleta-lin.	Dužina zaleta-pol.
Maksimalna brzina zaleta	0,81*	0,90*
Trajanje odskoka	-0,56	-0,65*
Zagrebanje	0,31	0,37
Rezultat dužine skoka udalj	0,89*	0,96*

Legenda: *nivo značajnosti $p < 0.05$; Dužina zaleta-lin. - rezultati linearne korelacije, Dužina zaleta-pol.-rezultati polinomijalne korelacije.

Najveća linearna korelacija je dobijena između varijable Dužina zaleta i Rezultat dužine skoka udalj (0,89), takođe i polinomijalna najveća korelacija je dobijena između te dve varijable (0,96). Zavisne varijable sa višim koeficijentom korelacije su predstavljene na Grafikonima 1 i 2 i bolje veze (veći je koeficijent determinacije) su dobijene sa polinomijalnom nego linearnom regresionom jednačinom.



Grafikon 1. Linearna i polinomijalna regresija zavisnih varijabli (maksimalna brzina zaleta i trajanje odskoka) i nezavisne (dužina zaleta).



Grafikon 2. Linearna i polinomijalna regresija zavisnih varijabli (zagrebanje i rezultat dužine skoka udalj) i nezavisne (dužina zaleta).

Sa zaletom od 4 i 6 koraka ispitanik je postigao kod dužih skokova veće amortizacije i ekstenzione amplitude u skočnom zglobu, zglobu kolena i zglobu kuka, i duže trajanje odskoka u odnosu na kraće skokove. Trajanje odskoka kod dužeg skoka sa zaletom od 4 koraka je 0.18 s kod kraćeg skoka 0.15 s, sa zaletom od 6 koraka trajanje odskoka kod dužeg skoka je 0.16 s, kraćeg skoka 0.14 s.

U dužim skokovima sa 4 i 6 koraka zaleta postignute su veće ugaone brzine, brzine skočnog zgloba i zgloba kuka 0.1 s pre POD-a, i srednje vrednosti brzina 10 frejmova pre odskoka kod skočnog zgloba i zgloba kuka. Kod dužih skokova postignute su veće vrednosti Hv i Vv brzine pred odskok u odnosu na kraće dužine skokova.

Zagrebanje kod dužih skokova iz zaleta od 4 koraka je 2.1 m/s, a iz zaleta od 6 koraka 2.08 m/s. Zagrebanje kod kraćih skokova sa zaletom od 4 koraka je 2.63 m/s, sa zaletom od 6 koraka 2.46 m/s.

Sa dužinom zaleta od 12 koraka ispitanik je kod prvog skoka (najduži sa zaletom od 12 koraka) i trećeg skoka postigao slične uglove. Trajanje odskoka kod dužeg skoka je 0.14 s, kod kraćeg 0.15 s. Zagrebanje kod dužeg skoka je 2.87 m/s, kod kraćeg 2.18 m/s. Vrednosti amortizacije i ekstenzione amplitude, ugaone brzine, brzine skočnog zgloba i zgloba kuka 0.1 s pre POD-a, srednje vrednosti brzina po magnitudi 10 frejmova pre odskoka i na POD-a su veće kod kraćeg skoka.

U drugom skoku sa zaletom od 12 koraka ispitanik je postigao manju amortizacionu amplitudu skočnog zgloba, zgloba kuka i ekstenzionu zgloba kuka nego kod najdužeg skoka sa zaletom od 12 koraka. Ekstenziona (tokom koncentrične faze odskoka) amplituda skočnog zgloba, zgloba kolena i amortizaciona zgloba kolena su veće kod ovog skoka u odnosu na najduži skok sa zaletom od 12 koraka. Ugaone brzine su manje u odnosu na duži skok. Vrednost zagrebanja kraćeg skoka je 2.33 m/s, dužeg 2.87 m/s. Brzine skočnog zgloba i zgloba kuka 0.1 s pre POD-a, srednje vrednosti brzina po magnitudi 10 frejmova pre odskoka skočnog zgloba i zgloba kuka, brzine skočnog zgloba i zgloba kuka na POD-a su veće kod kraćeg postignutog skoka.

Ispitanik je najveću dužinu skoka postigao sa zaletom od 10 koraka. Srednja vrednost brzine 10 frejmova pre odskoka skočnog zgloba je manja od istih kod boljeg skoka sa zaletom od 6 i svih skokova sa zaletom od 12 koraka, brzina skočnog zgloba 0.1 s pre POD-a je manja od brzine dužeg skoka sa zaletom od 6 koraka, a veća je od brzina skočnog zgloba kod svih ostalih skokova. Brzina skočnog zgloba na POD-a je manja od brzine kod boljeg skoka sa zaletom od 6 koraka, 8 koraka i svih skokova sa zaletom od 12 koraka. Postignute brzine skočnog zgloba i zgloba kuka su najveće brzine koje je ispitanik postigao posle POD-a tokom eksperimenta.

Srednje vrednosti brzina 10 frejmova pre odskoka skočnog zgloba i zgloba kuka, brzina skočnog zgloba i zgloba kuka na POD-a, brzina skočnog zgloba 0.1 s pre POD-a imaju najveće vrednosti kod dužeg skoka sa zaletom od 6 koraka.

Najveća srednja vrednost horizontalne brzine težišta tela 10 frejmova pred odskok je dobijena kod dužeg skoka sa zaletom od 6 koraka i skoka sa zaletom od 10 koraka. Kod oba skoka postignuta brzina težišta tela je 8.09 m/s.

Diskusija

Postizanje veće amortizacione i ekstenzione amplitude u skočnom zglobu, zglobu kolena i zglobu kuka, i duže trajanje odskoka kod dužih skokova sa zaletom od 4 i 6 koraka u odnosu na kraće skokove se može objasniti izraženijom mišićnom komponentom tokom odskoka kod dužih skokova. U analiziranoj literaturi (Young i Marino 2000, Janković 2009), produžavanje odskoka treba da se događa za vreme koncentrične faze odskoka (odgurivanje) kada se vertikalna komponenta brzine generiše opružanjem, a ne za vreme amortizacione faze. U realizovanom istraživanju produženje trajanja faze odskoka kod dužih postignutih skokova se desilo tokom koncentrične faze odskoka.

Veće ugaone brzine, brzine skočnog zgloba i zgloba kuka 0.1 s pre POD-a i H_v i V_v brzine pred odskok kod dužih u odnosu na kraće skokove sa zaletom od 4 i 6 koraka su u skladu sa analiziranim istraživanjima (Myers 1989, Omura i sar. 2004) i može se smatrati da su vrednosti ispitivanih varijabli značajno uticale na dužinu skoka.

Razlog manjih vrednosti zagrebanja kod dužih skokova sa zaletom od 4 i 6 koraka može biti povećanje brzine skočnog zgloba u odnosu na zglob kuka. Takođe razlog manjih vrednosti zagrebanja kod boljih skokova je možda i to što je takmičar dužinu skoka postizao više na račun mišićne, a manje na račun elastične komponente u ciklusu izduženje-skraćenje.

Sa zaletom od 12 koraka ispitanik je verovatno u kraćem skoku (treći skok) tehniku odskoka loše izveo čija je posledica kraća postignuta dužina skoka. Sve ostale merene kinematičke varijable su znatno bolje kod kraćeg skoka u odnosu na najduži skok postignut sa 12 koraka zaleta.

U drugom skoku sa 12 koraka ispitanik je imao dobar zalet ali nije tehnički dobro izveo odskok i iskoristio postignutu brzinu zaleta što se može zaključiti upoređivanjem zavisnih varijabli. Manje dužine postignutih skokova kojima je prethodila veća brzina zaleta u odnosu na duži skok pokazuje nedovoljnu pripremljenost skakača za izvođenje skoka iz zaleta od 12 koraka dužine.

Vremenski period odskoka je najkraći u skoku sa dužinom zaleta od 10 koraka, iznosi 0.13 s. Ovaj odskok je izveden sa više izraženom H_v nego vertikalnom komponentom brzine. Međuzavisni odnosi između kinematičkih varijabli potvrđuju konstatacije mnogih naučnika, da horizontalna komponenta brzine ima dominantan uticaj na postignutu dužinu skoka udalj (Kahikana i Suzuki 2001; Bridget i Linthorne 2006).

Najveća vrednost zagrebanja je postignuta kod skoka sa zaletom od 10 koraka i iznosi 3.28 m/s. Verovatno je velika vrednost zagrebanja uticala na manji gubitak horizontalne brzine tokom odskoka uz minimalno smanjenje vertikalne brzine i smanjenje kočećih sila tokom odskoka, što za posledicu ima kraće trajanje odskoka. U skladu sa istraživanjem Leblanca (1997) veća vrednost zagrebanja u ovom skoku je verovatno uticala i na smanjenje trajanja kontakta sa podlogom.

Najduži skok u ovom istraživanju je postignut sa dužinom zaleta od 10 koraka i posledica je postignute brzine zaleta i kvalitetne tehnike odskoka. Postizanje maksimalne brzine pred odskok sa zaletom od 6 i 10 koraka je verovatno posledica pripremnog perioda kada je realizovano merenje. Ispitaniku koji je učestvovao u ovoj studiji se može savetovati da radi na poboljšanju tehnike odskoka i povećanju maksimalne brzine trčanja (Matić 2008). Sa grafikona 1. i 2. se vidi da se predikcija određenih zavisnih varijabli pomoću nezavisne varijable (dužina zaleta) u većoj meri dobija kada se primenjuje polinomijalna regresiona jednačina nego linearna. Takođe na osnovu dobijenih grafikona 1. i 2. vidi se da se vrednosti određenih zavisnih varijabli smanjuju (osim varijable trajanje odskoka koja se produžava) kod prve i poslednje primenjene dužina zaleta. Sa tim u vezi može se reći da je optimalna dužina zaleta kada je sprovedeno istraživanje kod analiziranog ispitanika bila između 6 i 10 koraka.

Zaključak

U realizovanom eksperimentalnom istraživanju osnovni cilj je bio da se odredi uticaj različitih dužina zaleta na kinematičke varijable odskoka i dužinu skoka udalj, kao i da se utvrdi njihova povezanost.

Može se zaključiti da su se dužine skokova i brzine zaleta uglavnom povećavale kod dužih skokova i i dužina zaleta od 4 do 10 koraka. Dužina skoka kod najboljeg pokušaja iz 12 koraka zaleta je manja nego iz 10 koraka. Izmerena brzina zaleta kod najdužeg skoka iz zaleta od 12 koraka je manja nego ona postignuta iz 6, 8 i 10 koraka zaleta, a zagrebanje je manje od zagrebanja postignutog iz 10 koraka zaleta. Može se postaviti pitanje da li je intenzitet zagrebanja u funkciji realizovanja optimalne dužine skoka ili stvaranja uslova za kvalitetan odskok? Nešto niže vrednosti navedenih varijabli kod dužine zaleta od 12 koraka u odnosu na kraće zaletе verovatno su posledica trenažnog perioda u kome je sprovedeno merenje. Može se zaključiti da je za analiziranog ispitanika u periodu realizovanja eksperimenta optimalna dužina zaleta bila 10 koraka.

U budućim istraživanjima koja će se baviti problematikom ispitivanja uticaja dužine zaleta na određene kinematičke varijable odskoka treba ispitati kako će povećanje jačine i snage mišića uticati na mehaniku odskoka. Takođe treba ispitati kako će primena određenih trenažnih sredstava u relativno dužem vremenskom periodu (mikro-, mezo- ili makro-ciklus) uticati na rezultat i tehniku odskoka kod skoka udalj.

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FUNCTIONAL - MECHANICAL CHARACTERISTICS OF RECTUS AND BICEPS FEMORIS IN THE TOP FOOTBALL PLAYERS MEASURED BY TENSIOMYOGRAPHY METHOD (TMG)

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Introduction

The emergence of an increasing number of new competitions, as well as the characteristics of modern football, require extraordinary physical preparation, which depends to a large extent on anthropometric and physiological attributes, as well as the fitness of the football players (Di Salvo et al., 2007). Also, the football game has been intensified (Wallace & Norton, 2014), which is a clear indication that modern players must possess extraordinary physical attributes to respond to the needs of the game. Accordingly, the mechanical characteristic of the muscles greatly influences the ability of the player to function during matches.

One of the methods for estimating neuromuscular characteristics is the use of a tensiomyography device. Tensiomyography is a non-invasive device that serves to transmit an electrical impulse to the belly of a particular muscle using a digital converter (Valencic, 1997). This method provides information on muscle stiffness, contraction time, type of pre-dominant muscle fiber, muscle fatigue (Dahman et al., 2001, 2005; Simunić et al., 2011). The TMG device is also used to evaluate the neuromuscular properties of skeletal muscle in different populations and diseases, so in young athletes (García-Manso et al., 2012), in people with peripheral arterial disease (Gasparini, M. et al., 2012), in people suffering from multiple sclerosis (Neamtu MC et al., 2011). In previous studies in which the results were obtained using TMG devices, were also examined the effects on the rate of muscular contraction (Loturco et al., 2016), the effects of recovery, such as, the influence of immersion in cold water and their effect on the contractile ability of skeletal muscle in the players (García-Manso et al., 2011) and the risk factor for injuries to the anterior cruciate ligament (Alentorn-Geli et al., 2014).

Muscular stiffness is directly related to strength and power (Watsford et al., 2010), thus in previous studies the observed and mechanical characteristics of the dominant and non-dominant leg, respectively, the bilaterally of the leg a football player (Alvarez-Diaz et al., 2014; et al., 2012).

The subject of this study is the comparison of the neuromuscular characteristics between the dominant and the non-dominant leg in biceps femoris (BF) and rectus femoris (RF) in elite players who perform in different positions. Due to the increased physiological demands in football, and a small number of studies in this area in Republic of Serbia, it was necessary to do this type of research which would aim to determine the characteristics of contractility abilities and their importance in practice with players who perform in different positions.

Method

The research is of non-experimental and transversal character, with data collected retrospectively for dominant and non-dominant legs.

The sample of the respondents consisted of 37 top-level players, aged 25.6 ± 5.7 years, of which 12 defensive, 14 midfielder players and 11 attack players, of an average height of 183 ± 6.4 cm and a weight of 78.8 ± 6.1 kg. In addition to the division of the players into positions in the team, the division was divided by

the dominance of the player's leg, so the 9 players had the dominant left leg, and the other 28 players had the right as the dominant leg.

The measurements were made in the “Advance Fitness” diagnostic center, FK “Partizan”, FC “MOL Vidi” (Hungary) from 2016 to 2018 on top players, in the strongest league competitions in countries like England, Spain, Germany, Portugal, Austria, Croatia, Belgium, Norway, Hungary, Serbia and the Czech Republic. Participants did not have any muscular problems. Testing was conducted at standstill, before any physical activity during the winter or summer break for the players. BF and RF were tested, the muscles that were most tight before the season and during the season (Woods et al., 2002, 2004). BF was measured while the subjects were lying on the stomach, while RF was measured while the subjects were lying on the back. TMG results are based on maximum displacement (Dm) which represents a radial movement of the muscular belly after electrical stimulation. Other TMG variables observed in this study depend on Dm, such as the time of contraction (Tc), the time between 10 - 90% of Dm, the delay time (Td) representing 10% of the total contraction time. The last studied variable in this study is the velocity contraction (Vc) representing the derived variable from the basic variables, $Vc = Dm / Tc + Td$ (Fig. 1). Measurement methods and protocols are established according to (Rey et al., 2012).

The TMG System (TMG-BMC Ltd., Ljubljana, Slovenia), the Trans-TekwGK40 sensor, the 5x5cm muscle reaction electrode, the adhesive electrodes (Compex, Medical AS, Ecublens, Switzerland) were used in the study, at an angle of 120° for RF measurement, and at an angle of 165° while BF was measured (Rey et al., 2012). The sensor was set in relation to the direction of delivery fiber and their positioning. The starting signal began at 30mA, for each subsequent contraction it was increased by 10mA, until the maximum Dm is reached. In order to avoid the fatigue or the effect of potentiation, between each stimulus a pause of 10s was made (Krizaj et al., 2008).

Upon completion of the testing, the data were entered into the data matrix and statistically processed. Descriptive statistics (AVG, MIN, MAX, STDEV) were calculated for all data. The difference between the dominant and the non-dominant leg was determined by applying Student t-test with a level of statistical significance $p < 0.05$, while comparing the player to the position analyzed using one - way analysis of variance (ANOVA). Microsoft Office Excel 2016 was used for data processing.

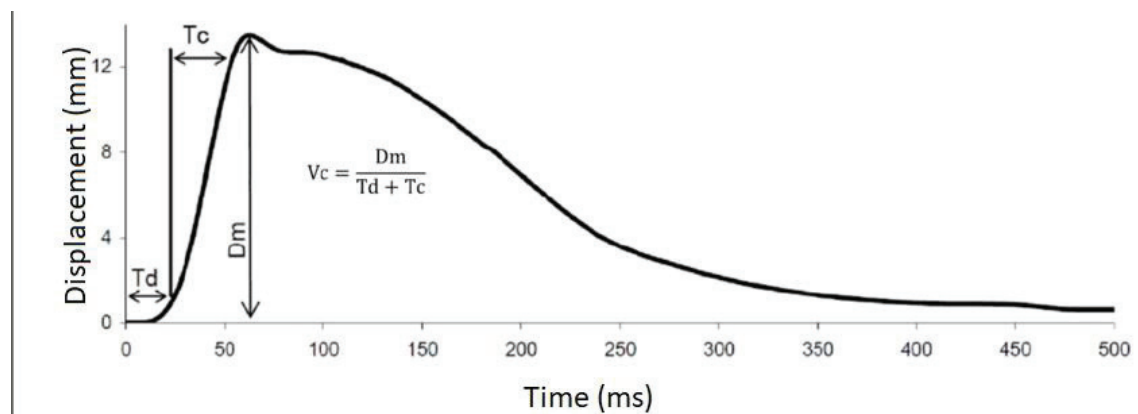


Figure 1. TMG variables, Dm - maximum displacement; Tc - contraction time; Td - delay time; Vc - Velocity contraction

Results

It is interesting that in all tested variables for BF, the average values were higher in the dominant leg compared to the non-dominant leg, so the BF contraction is insignificant slower in the dominant leg. In the RF on the dominant leg, lower values in the Tc and Td variables were observed, which means that the RF contraction of the dominant leg is slightly shorter.

Table 1. Descriptive statistics of observed variables (N = 37 participants)

TMG variables	The observed leg	min	max	avg	stdev
Tc (ms)	BF dominant	15.1	63.4	32.0	9.1
	BF non-dominant	19.7	45.0	30.6	6.8
	RF dominant	20.7	44.0	29.8	5.6
	RF non-dominant	18.1	45.1	30.3	5.0
Td (ms)	BF dominant	21.0	57.2	27.7	7.4
	BF non-dominant	21.4	36.3	26.2	3.4
	RF dominant	20.0	28.8	24.3	2.2
	RF non-dominant	21.0	28.9	24.7	1.9
Dm (mm)	BF dominant	1.8	13.0	6.2	2.4
	BF non-dominant	1.6	12.3	5.8	2.6
	RF dominant	3.3	15.1	9.0	3.1
	RF non-dominant	3.7	17.1	8.9	3.1
Vc (mm/ms)	BF dominant	0.027	0.162	0.105	0.035
	BF non-dominant	0.023	0.209	0.103	0.041
	RF dominant	0.071	0.268	0.166	0.052
	RF non-dominant	0.071	0.300	0.161	0.055

The results of the study showed that there are no statistically significant differences between players playing at the same positions in the tested BF and RF muscles (Table 2) for the observed variables (Tc, Td, Dm, Vc).

Table 2. Statistically processed muscular data of the BF and RF dominant and non-dominant legs in players on the same position in the team

TMG	Muscle	Leg	Defence	p value	Middle	p value	Attack	p value
Tc (ms)	BF	D	32.9 ± 10.7	p=0.24	30.2 ± 6.0	p=0.41	33.1 ± 10.8	p=0.37
		N	30.4 ± 6.4		29.7 ± 7.6		31.8 ± 6.9	
	RF	D	29.2 ± 5.4	p=0.35	29.7 ± 6.2	p=0.23	30.6 ± 5.4	p=0.20
		N	30.0 ± 5.1		31.5 ± 6.2		29.1 ± 2.7	
Td (ms)	BF	D	26.3 ± 3.1	p=0.46	27.3 ± 7.8	p=0.28	29.8 ± 10.1	p=0.15
		N	26.2 ± 2.4		26.0 ± 3.9		26.5 ± 4.1	
	RF	D	24.1 ± 2.1	p=0.34	24.0 ± 2.8	p=0.26	25.0 ± 1.4	p=0.47
		N	24.4 ± 1.8		24.6 ± 2.4		24.9 ± 1.4	
Dm (mm)	BF	D	7.5 ± 2.7	p=0.33	5.4 ± 1.5	p=0.42	5.9 ± 2.6	p=0.30
		N	7.0 ± 2.6		5.2 ± 2.1		5.3 ± 2.8	
	RF	D	9.4 ± 3.2	p=0.38	8.2 ± 3.2	p=0.46	9.7 ± 2.9	p=0.40
		N	9.1 ± 3.0		8.3 ± 3.0		9.3 ± 3.3	
Vc (mm/ms)	BF	D	0.125 ± 0.03	p=0.42	0.096 ± 0.029	p=0.48	0.095 ± 0.038	p=0.38
		N	0.122 ± 0.04		0.097 ± 0.039		0.090 ± 0.042	
	RF	D	0.177 ± 0.06	p=0.30	0.151 ± 0.050	p=0.43	0.174 ± 0.047	p=0.49
		N	0.166 ± 0.05		0.148 ± 0.053		0.174 ± 0.065	

Legend: Dominant – D; No-dominant – N.

However, by comparing the players with different positions, it is found that there are statistically significant differences in the dominant leg between the defender players and midfielders in Dm ($p = 0.03$) and Vc ($p = 0.02$) as well as between defenders and players in the attack in Vc ($p = 0.03$). There is no difference in the contractile characteristics of the dominant leg between the midfielders and the attackers, while in the non-dominant leg there are no statistical differences in any comparison (Table 3).

Table 3. Results of contractile abilities of defender players, center midfielders and attack players and their dominant and non-dominant leg measured on the RF and BF muscles

TMG	Muscle	Leg	Defence ^a	Middle ^a	Attack ^a	p value defense vs middle	p value middle vs offense	p value defense vs offense
Tc (ms)	BF	D	32.9 ± 10.7	30.2 ± 6.0	33.1 ± 10.8	p=0.21	p=0.20	p=0.48
		N	30.4 ± 6.4	29.7 ± 7.6	31.8 ± 6.9	p=0.39	p=0.22	p=0.30
	RF	D	29.2 ± 5.4	29.7 ± 6.2	30.6 ± 5.4	p=0.40	p=0.35	p=0.26
		N	30.0 ± 5.1	31.5 ± 6.2	29.1 ± 2.7	p=0.24	p=0.10	p=0.30
Td (ms)	BF	D	26.3 ± 3.1	27.3 ± 7.8	29.8 ± 10.1	p=0.32	p=0.24	p=0.12
		N	26.2 ± 2.4	26.0 ± 3.9	26.5 ± 4.1	p=0.45	p=0.39	p=0.40
	RF	D	24.1 ± 2.1	24.0 ± 2.8	25.0 ± 1.4	p=0.47	p=0.14	p=0.11
		N	24.4 ± 1.8	24.6 ± 2.4	24.9 ± 1.4	p=0.38	p=0.35	p=0.22
Dm (mm)	BF	D	7.5 ± 2.7	5.4 ± 1.5	5.9 ± 2.6	p=0.03*	p=0.27	p=0.08
		N	7.0 ± 2.6	5.2 ± 2.1	5.3 ± 2.8	p=0.09	p=0.49	p=0.07
	RF	D	9.4 ± 3.2	8.2 ± 3.2	9.7 ± 2.9	p=0.16	p=0.11	p=0.41
		N	9.1 ± 3.0	8.3 ± 3.0	9.3 ± 3.3	p=0.25	p=0.20	p=0.41
Vc (mm/ms)	BF	D	0.125 ± 0.03	0.096 ± 0.029	0.095 ± 0.038	p=0.02*	p=0.33	p=0.03*
		N	0.122 ± 0.04	0.097 ± 0.039	0.090 ± 0.042	p=0.13	p=0.45	p=0.06
	RF	D	0.177 ± 0.06	0.151 ± 0.050	0.174 ± 0.047	p=0.12	p=0.12	p=0.45
		N	0.166 ± 0.05	0.148 ± 0.053	0.174 ± 0.065	p=0.18	p=0.14	p=0.36

Legend: Dominant – D; No-dominant – N; Results shown at the level of statistical significance $p < 0.05$; ^a Results expressed by average values and standard deviation

Discussion

To date, there are several studies dealing with the study of neuromuscular characteristics of the lower extremities in football using TMG (Alentorn-Geli et al., 2014; García-Manso et al., 2011; Alvarez-Diaz et al., 2014; Gil et al., 2015). However, there are not many, and in our area have not been found, research in which the mechanical characteristics of the muscles of dominant and non-dominant legs are compared with the footballers at different positions in the team. Due to the growing physiological demands of football, there was a need to do this type of research which would aim to determine the characteristics of contractual abilities and their importance in practice. The results show statistically significant differences in the BF dominant leg in the variables Dm and Vc between the defensive and midfielders, and significant differences in the Vc variable were found between the defending players and the striker. Due to the specificity of the movements and demands of the football game in relation to the different positions in the team, it is concluded that players who perform in defensive positions have less ability in the contraction rate of the BF muscle than other players, and accordingly have less ability to change direction in specific football situations.

Football players make changes in the direction of movement for every 2-4 seconds (Bangsbo, 1992). This data was also confirmed by Verheijen et al. (2010) when it was investigated that players made 1200 to 1400 changes in direction during the game. According to the above, it is necessary for players to be trained for quick reactions in the new situations that occur during the game. In previous studies, it was noted that central midfielders performed the most acceleration and stops over other players during the game, and the biggest differences were seen in relation to central defenders (Barron et al., 2014). The results of our study

show that players who play in the attack and midfield have shorter Vc and Dm. therefore a higher degree of muscle stiffness (Kokkonen et al., 1998; Valencic and Knez, 1997) compared to defenders, resulting in greater force production for that muscle length, and therefore a higher speed and a faster change of direction during running (Joyce and Lewindon, 2014).

With higher values of Dm and Tc, there is reduced muscle stiffness in the musculoskeletal joint, which results in decreased muscular strength (Kokkonen et al., 1998). By analyzing the results of previous studies, it is concluded that lower values of Dm affect the increase in muscle tone (Pishot et al., 2008), to improve the ability of the jump (Zubac & Šimunić, 2017), and that there is an increase in muscle fatigue (de Paula et al., 2015). In the research by Rey et al. (2012) it was noticed that there is no difference in BF for the variables Tc, Td and Dm in different positions in the team, and statistically significant differences were observed by observing RF in players who were divided by positions in the team for variables Tc, between central backs and side defensive players. Also, it is evident that the values of the variable Dm are significantly higher in the respondents in this study than the respondents who participated in our research, which can be due to the training effect, the fatigue of the player, the level of preparation of the player, etc. Observing the studies carried out by García-García et al. (2017) a significant difference was observed between the side defender and central midfielder in the Td variable for the BF while comparing the dominant and non-dominant leg with the soccer players at the same positions in the team did not find statistically significant differences, which coincides with the results of our research. Also, when the results of our research are compared with the results of Alvarez-Diaz et al. (2014) in the variables Tc, Td and Dm for BF and Td, Tc for RF dominant and non-dominant legs were observed less value in all positions, while higher values in the Dm for RF dominant and non-dominant legs were observed compared to our research. The results thus obtained can be interpreted as the result of different periods in the season when the testing, the age of the respondents and the different levels of the competition in which the players are performed are conducted.

Based on previous research and due to insufficient research on a similar topic in the future, several variables related to the mechanical characteristics of the muscles, such as the sustain time (Ts) and relaxation time (Tr), should be observed. Also, a more detailed division of players by positions, age, sporting experience, ranking of competitions can contribute to obtaining significant results.

The limitations on the conducted research, the conditions in which the results were collected can be considered. All results are collected in laboratory conditions, on resting muscles, which largely deviates from the real or competing conditions for the game. Also, the sample of this study was not divided into subgroups in detail, which would more precisely determine the neuromuscular muscle characteristics and the difference between the players in certain positions, but a larger number of respondents are required for such a procedure.

Tracking mechanical characteristics during the season in a competitive microcycle can help improve the performance of elite football players. The importance of the results obtained using TMG can indirectly improve the quality of training and reduce the level of injuries, especially knee ligaments, during the season. Also, the TMG device can be useful as a means for assessing neuromuscular status during the season (assessment of the progress of ability), to evaluate the contractual ability of players in preseason and during the season, thereby reducing the risk of injury by implementing individual programs, monitoring recovery speed, etc.

Conclusion

The results of this study did not show significant results on the BF and RF muscles of the dominant and non-dominant legs of the observed players on the same team position. The reason for these results can

be directed to the specificity of the movement of footballers in the same positions as a small number of respondents.

By comparing the players to different positions in the team against the dominance of the leg, no statistically significant was seen in players in the middle of the field and in the attack, but significant differences were observed with defender and midfielders, as well as defensive players and attack players in the variables Vc and Dm for the BF muscle. RF has no significant differences.

The slow velocity contraction of the muscle (Vc) and the longer muscle displacement (Dm) suggest that there is less muscle stiffness in the defense players as well as less ability to accelerate and decelerate, players in the defense are generally slower compared to players in the middle of the field and in the attack. The reason can be found in the specificity of the movement that certain positions require in the game. Further studies with a larger number of participants and a defined pattern, in accordance with the same methodological principles, are necessary to examine in more detail the functionality of the dominant and non-dominant leg in footballers at different positions in the team.

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FUNKCIONALNO – MEHANIČKE KARAKTERISTIKE RECTUS I BICEPS FEMORIS-A KOD VRHUNSKIH FUDBALERA MERENE METODOM TENZIOMIOGRAFIJE (TMG)

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Uvod

Pojava sve većeg broja novih takmičenja, kao i karakteristike savremenog fudbala od igrača zahtevaju izuzetnu fizičku pripremljenost, što u najvećoj meri zavisi od antropometrijskih i fizioloških predispozicija, kao i utreniranosti fudbalera (Di Salvo et al., 2007). Takođe, fudbalska igra se u ogromnoj meri intezivirala (Wallace & Norton, 2014), što je jasna indikacija da savremeni igrači moraju da poseduju izuzetne fizičke predispozicije kako bi odgovorili potrebama u igri. Prema tome, mehaničke karakteristike mišića u velikoj meri utiču na ispoljavanje sposobnosti igrača u takmičarskim nastupima.

Jedan od metoda procenljivnja neuromišićnih karakteristika je upotreba TMG uređaja. Tenziomiografija je neinvazivan prenosni uređaj koji služi za prenos električnog impulsa na trbuh određenog mišića pomoću digitalnog pretvarača (Valencic, 1997). Ovaj metod daje informacije o mišićnoj krutosti, brzini kontrakcije, tipu predominantnog mišićnog vlakna, mišićnom umoru (Dahmane et al., 2001, 2005; Simunić et al., 2011). TMG uređaj se takođe koristi i za procenu neuromišićnih svojstva skeletnih mišića kod različitih populacija i bolesti, pa tako kod mladih sportista (García-Manso et al., 2012), kod ljudi sa perifernim arterijskim bolestima (Gasparini, M. et al., 2012), kod ljudi obolelih od multiple skleroze (Neamtu MC et al., 2011). U prethodnim istraživanjima u kojima su rezultati dobijeni korišćenjem TMG uređaja ispitivani su i trenažni efekti na brzini mišićne kontrakcije (Loturco et al., 2016), efekti oporavka kao što je npr. uticaj potapanja u hladnu vodu i njihov efekat na kontraktilne sposobnosti skeletnih mišića kod fudbalera (García-Manso et al., 2011) i faktor rizika od povreda prednjih ukrštenih ligamenata (Alentorn-Geli et al., 2014).

Mišićna krutost je direktno povezana sa silom i snagom (Watsford et al., 2010), pa su u prethodnim istraživanjima posmatrane i mehaničke karakteristike dominantne i nedominantne noge, odnosno bilateralnost i funkcionalana simetričnost kod fudbalera (Alvarez-Diaz et al., 2014; Rey et al., 2012).

Predmet ovog istraživanja je poređenje neuromišićnih karakteristika između dominantne i nedominantne noge kod biceps femoris-a (BF) i rectus femoris-a (RF) kod vrhunskih igrača koji nastupaju na različitim pozicijama. Zbog sve većih fizioloških zahteva u fudbalu, a malog broja istraživanja na ovu temu u Republici Srbiji, ukazala se potreba da se uradi ovakva vrsta istraživanja koja bi imala za cilj da utvrdi karakteristike kontraktilnih sposobnosti i njihov značaj u praksi kod igrača koji nastupaju na različitim pozicijama.

Metod

Istraživanje je neeksperimentalnog i transverzalnog karaktera, pri čemu su podaci prikupljeni retrospektivno za dominantnu i nedominantnu nogu.

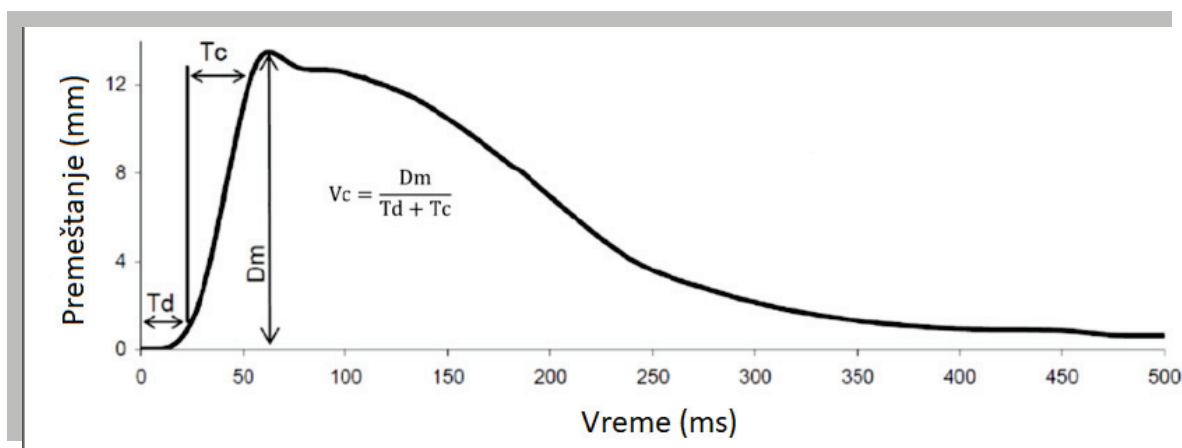
Uzorak ispitanika sačinjavalo je 37 vrhunskih fudbalera, starosti 25.6 ± 5.7 godina, od toga 12 odbrambenih, 14 veznih igrača i 11 napadača prosečne visine 183 ± 6.49 cm i težine 78.8 ± 6.1 kg. Pored podele igrača po pozicijama u timu, izvršena je podela i po dominantnosti noge kod fudbalera, pa je tako 9 fudbalera imalo dominantnu levu nogu, a ostalih 28 igrača imalo je desnu kao dominantnu nogu.

Merenje je sprovedeno u dijagnostičkom centru „Advance Fitness“, FK „Partizan“, FC „MOL Vidi“ (Mađarska) u periodu od 2016 godine do 2018 godine na fudbalerima koji igraju na vrhunskom nivou, u najjačim ligaškim takmičenjima država poput Engleske, Španije, Nemačke, Portugala, Austrije, Hrvatske, Belgije, Norveške, Mađarske, Srbije i Češke. Ispitanici nisu imali nikakvih mišićnih problema. Testiranje je sprovedeno u mirovanju, pre bilo kakve fizičke aktivnosti u periodu kada je bila zimska ili letnja pauza za fudbalere. Testirani su BF i RF, mišići koji su najviše napeti tokom presezone i sezone (Woods et al., 2002, 2004). Merenje je sprovedeno na stomaku za BF i leđima za RF.

TMG rezultati su zasnovani na maksimalnom premeštanju (D_m) što predstavlja radijalnu kretnju mišićnog trbuha nakon električne stimulacije. Ostale varijable TMG-a posmatrane u ovom istraživanju zavise od D_m -a, poput vremena kontrakcije (T_c), vreme između 10 – 90% od D_m -a, vremena kašnjenja (T_d) koje predstavlja 10% od ukupnog vremena kontrakcije. Poslednja ispitivana varijabla u ovom istraživanju je brzina kontrakcije (V_c) koja predstavlja izvedenu varijablu iz osnovnih varijabli, $V_c = D_m / T_c + T_d$ (slika 1). Metode merenja i protokoli su uspostavljeni prema (Rey et al., 2012).

U istraživanju je korišćen uređaj TMG System (TMG – BMC Ltd., Ljubljana, Slovenija), senzor Trans-TekwGK40, elektrode za mišićnu reakciju 5x5cm, lepljive elektorde (Compex, Medical AS, Ecublens, Switzerland), jastuk oblika trougla kojim se fiksiralo koleno pod uglom od 120° za merenje RF, a pod uglom od 165° dok je meren BF (Rey et al., 2012). Senzor se postavljao u odnosu na pravac pružanja vlakana i njihovo pozicioniranje. Početni signal je startovao na 30mA, za svaku sledeću kontrakciju podizano je za 10mA, sve dok se ne dostigne maksimalni D_m . Da bi se izbegao umor ili efekat potencijacije, između svakog stimulusa napravljena je pauza od 10s (Krizaj et al., 2008).

Po završetku testiranja, podaci su uneti u matricu podataka i statistički obrađeni. Za sve podatke odrađena je deskriptivna statistika (AVG, MIN, MAX, STDEV). Razlika između dominantne i nedominantne noge je utvrđena primenom Studentovog t-testa sa nivom statističke značajnosti $p < 0.05$, dok je poređene igrača u odnosu na poziciju analizirano primenom jednostruke analize varijanse (ANOVA). Za obradu podataka je korišćen program Microsoft Office Excel 2016.



Slika 1. TMG varijable, D_m – maksimalno premeštanje; T_c – vreme kontrakcije; T_d – vreme kašnjenja; V_c – brzina kontrakcije

Rezultati

Zanimljivo je da kod svih testiranih varijabli za BF prosečne vrednosti su bile veće kod dominantne noge u odnosu na nedominantnu nogu, dakle kontrakcija BF se zanemarljivo sporije izvodi kod dominantne noge. Kod RF na dominantnoj nozi, uočene su manje vrednosti u varijablama Tc i Td, što znači da kontrakcija RF kod dominantne noge neznatno kraće traje.

Tabela 1. Deskriptivna statistika posmatranih varijabli (N = 37 ispitanika)

TMG varijable	Posmatrana noga	min	max	avg	stdev
Tc (ms)	BF dominantna	15,1	63,4	32,0	9,1
	BF nedominantna	19,7	45,0	30,6	6,8
	RF dominantna	20,7	44,0	29,8	5,6
	RF nedominantna	18,1	45,1	30,3	5,0
Td (ms)	BF dominantna	21,0	57,2	27,7	7,4
	BF nedominantna	21,4	36,3	26,2	3,4
	RF dominantna	20,0	28,8	24,3	2,2
	RF nedominantna	21,0	28,9	24,7	1,9
Dm (mm)	BF dominantna	1,8	13,0	6,2	2,4
	BF nedominantna	1,6	12,3	5,8	2,6
	RF dominantna	3,3	15,1	9,0	3,1
	RF nedominantna	3,7	17,1	8,9	3,1
Vc (mm/ms)	BF dominantna	0,027	0,162	0,105	0,035
	BF nedominantna	0,023	0,209	0,103	0,041
	RF dominantna	0,071	0,268	0,166	0,052
	RF nedominantna	0,071	0,300	0,161	0,055

Rezultati istraživanja pokazali su da nema statistički značajnih razlika između fudbalera koji igraju na istim pozicijama u timu za testirane mišiće BF i RF (tabela 2) kod posmatranih varijabli (Tc, Td, Dm, Vc),

Tabela 2. Statistički obrađeni podaci mišića BF i RF dominantne i nedominantne noge kod igrača na istoj poziciji u timu

TMG	Mišić	Noga	Odbrana	p vrednost	Sredina	p vrednost	Napad	p vrednost
Tc (ms)	BF	D	32,9 ± 10,7	p=0,24	30,2 ± 6,0	p=0,41	33,1 ± 10,8	p=0,37
		N	30,4 ± 6,4		29,7 ± 7,6		31,8 ± 6,9	
	RF	D	29,2 ± 5,4	p=0,35	29,7 ± 6,2	p=0,23	30,6 ± 5,4	p=0,20
		N	30,0 ± 5,1		31,5 ± 6,2		29,1 ± 2,7	
Td (ms)	BF	D	26,3 ± 3,1	p=0,46	27,3 ± 7,8	p=0,28	29,8 ± 10,1	p=0,15
		N	26,2 ± 2,4		26,0 ± 3,9		26,5 ± 4,1	
	RF	D	24,1 ± 2,1	p=0,34	24,0 ± 2,8	p=0,26	25,0 ± 1,4	p=0,47
		N	24,4 ± 1,8		24,6 ± 2,4		24,9 ± 1,4	
Dm (mm)	BF	D	7,5 ± 2,7	p=0,33	5,4 ± 1,5	p=0,42	5,9 ± 2,6	p=0,30
		N	7,0 ± 2,6		5,2 ± 2,1		5,3 ± 2,8	
	RF	D	9,4 ± 3,2	p=0,38	8,2 ± 3,2	p=0,46	9,7 ± 2,9	p=0,40
		N	9,1 ± 3,0		8,3 ± 3,0		9,3 ± 3,3	
Vc (mm/ms)	BF	D	0,125 ± 0,03	p=0,42	0,096 ± 0,029	p=0,48	0,095 ± 0,038	p=0,38
		N	0,122 ± 0,04		0,097 ± 0,039		0,090 ± 0,042	
	RF	D	0,177 ± 0,06	p=0,30	0,151 ± 0,050	p=0,43	0,174 ± 0,047	p=0,49
		N	0,166 ± 0,05		0,148 ± 0,053		0,174 ± 0,065	

Legenda: Dominantna – D; Nedominantna – N.

Međutim, međusobnim upoređivanjem igrača koji nastupaju na različitim pozicijama utvrđeno je da postoje statistički značajne razlike kod dominantne noge između odbrambenih igrača i igrača sredine terena

u Dm ($p=0,03$) i Vc ($p=0,02$) kao i između odbrambenih igrača i igrača u napadu u Vc ($p=0,03$). Između igrača sredine terena i napadača ne postoji razlika u kontraktilnim karakteristikama dominantne noge, dok kod nedominantne noge nema statističkih razlika ni u jednom poređenju (tabela 3).

Tabela 3. Rezultati odbrambenih igrača, igrača sredine terena i napadača i njihove dominantne i nedominantne noge merene na mišiću RF i BF

TMG	Mišić	Noga	Odbrana ^a	Sredina ^a	Napad ^a	p vrednost - odbrana vs sredina	p vrednost - sredina vs napad	p vrednost - odbrana vs napad
Tc (ms)	BF	D	32,9 ± 10,7	30,2 ± 6,0	33,1 ± 10,8	p=0,21	p=0,20	p=0,48
		N	30,4 ± 6,4	29,7 ± 7,6	31,8 ± 6,9	p=0,39	p=0,22	p=0,30
	RF	D	29,2 ± 5,4	29,7 ± 6,2	30,6 ± 5,4	p=0,40	p=0,35	p=0,26
		N	30,0 ± 5,1	31,5 ± 6,2	29,1 ± 2,7	p=0,24	p=0,10	p=0,30
Td (ms)	BF	D	26,3 ± 3,1	27,3 ± 7,8	29,8 ± 10,1	p=0,32	p=0,24	p=0,12
		N	26,2 ± 2,4	26,0 ± 3,9	26,5 ± 4,1	p=0,45	p=0,39	p=0,40
	RF	D	24,1 ± 2,1	24,0 ± 2,8	25,0 ± 1,4	p=0,47	p=0,14	p=0,11
		N	24,4 ± 1,8	24,6 ± 2,4	24,9 ± 1,4	p=0,38	p=0,35	p=0,22
Dm (mm)	BF	D	7,5 ± 2,7	5,4 ± 1,5	5,9 ± 2,6	p=0,03*	p=0,27	p=0,08
		N	7,0 ± 2,6	5,2 ± 2,1	5,3 ± 2,8	p=0,09	p=0,49	p=0,07
	RF	D	9,4 ± 3,2	8,2 ± 3,2	9,7 ± 2,9	p=0,16	p=0,11	p=0,41
		N	9,1 ± 3,0	8,3 ± 3,0	9,3 ± 3,3	p=0,25	p=0,20	p=0,41
Vc (mm/ms)	BF	D	0,125 ± 0,03	0,096 ± 0,029	0,095 ± 0,038	p=0,02*	p=0,33	p=0,03*
		N	0,122 ± 0,04	0,097 ± 0,039	0,090 ± 0,042	p=0,13	p=0,45	p=0,06
	RF	D	0,177 ± 0,06	0,151 ± 0,050	0,174 ± 0,047	p=0,12	p=0,12	p=0,45
		N	0,166 ± 0,05	0,148 ± 0,053	0,174 ± 0,065	p=0,18	p=0,14	p=0,36

Legenda: Dominantna – D; Nedominantna – N; * rezultati prikazani na nivou statističke značajnosti $p<0,05$; ^aRezultati izraženi prosečnim vrednostima i standardnom devijacijom.

Diskusija

Do danas postoji nekoliko studija koje su se bavile istraživanjem neuromišićnih karakteristika donjih ekstremiteta u fudbalu koristeći TMG (Alentorn-Geli et al., 2014; García-Manso et al., 2011; Alvarez-Diaz et al., 2014; Gil et al., 2015). Međutim, nema puno, a na našim prostorima nisu pronađena, istraživanja u kojima su poređene mehaničke karakteristike mišića dominantne i nedominantne noge kod fudbalera na različitim pozicijama u timu. Zbog sve većih fizioloških zahteva u fudbalu, ukazala se potreba da se uradi ovakva vrsta istraživanja koja bi imala za cilj da utvrdi karakteristike kontraktilnih sposobnosti i njihov značaj u praksi. Rezultati pokazuju statistički značajne razlike kod BF dominantne noge u varijablama Dm i Vc između odbrambenih i veznih igrača, a između odbrambenih igrača i napadača pronađene su značajne razlike kod varijable Vc. Zbog specifičnosti kretanja i zahteva u fudbalskoj igri u odnosu na različite pozicije u timu, zaključuje se da igrači koji nastupaju na odbrambenim pozicijama imaju manju sposobnost u brzini kontrakcije mišića BF od ostalih igrača, pa prema tome imaju i manju sposobnost promene pravca u specifičnim fudbalskim situacijama.

Fudbaleri naprave promenu pravca kretanja na svake 2-4 sekunde (Bangsbo, 1992). Ovaj podatak je potvrđen i od strane Verhajna i saradnika (2010) kada je istraženo da igrači naprave 1200 do 1400 promena pravca tokom utakmice. Prema navedenim podacima, neophodno je da igrači budu osposobljeni za brze reakcije u novonastalim situacijama koje se javljaju tokom igre. U ranijim istraživanjima uočeno je da centralni vezni igrači u toku utakmice izvedu najviše ubrzanja i zaustavljanja u odnosu na ostale igrače, a najveće razlike su uočene u odnosu na centralne odbrambene igrače (Barron et al., 2014). Rezultati u našem istraživanju pokazuju da igrači koji igraju u napadu i sredini terena imaju kraće Vc i Dm, dakle veći stepen krutosti mišića (Kokkonen et al., 1998; Valencic and Knez, 1997) od igrača u odbrani, odnosno mogu

generisati veću silu kroz ispoljenu dužinu mišića, pa samim tim i veću brzinu i bolju promenu pravca tokom trčanja (Joyce and Lewindon, 2014).

Sa većim vrednostima Dm i Tc javlja se smanjena krutost mišića kod mišićno-tetivnog spoja čime se javlja smanjena snaga mišića (Kokkonen et al., 1998). Analizom rezultata prethodnih istraživanja, zaključuje se da manje vrednosti Dm utiču na povećanje mišićnog tonusa (Pišot et al., 2008), na poboljšanje sposobnosti skoka (Zubac & Šimunić, 2017) kao i da dolazi do povećanja mišićnog zamora (de Paula et al., 2015). U istraživanju Reya i saradnika (2012) primećeno je da kod BF ne postoji razlika za varijable Tc, Td i Dm kod fudbalera na različitim pozicijama u timu, a pronađene su statistički značajne razlike posmatranjem RF kod igrača koji su podeljeni po pozicijama u timu za varijablu Tc, i to između centralnih bekova i bočnih odbrambenih igrača. Takođe, evidentno je da su vrednosti varijable Dm znatno veće kod ispitanika u tom istraživanju od ispitanika koji su učestvovali u našem istraživanju, što može biti posledica trenaznog efekta, zamora igrača, nivoa pripremljenosti igrača itd. Posmatranjem istraživanja koje su sprovedeli García-García i sar. (2017) značajna razlika je uočena između bočnih odbrambenih i centralnih veznih igrača u varijabli Td za BF dok poređenjem dominantne i nedominantne noge kod fudbalera na istim pozicijama u timu nisu pronađene statistički značajne razlike, što se poklapa sa rezultatima našeg istraživanja. Takođe, kada se rezultati našeg istraživanja porede sa rezultatima Alvarez-Diaz i sar. (2014) u varijablama Tc, Td i Dm za BF i Td, Tc za RF dominantne i nedominantne noge uočene su manje vrednosti na svim pozicijama, dok su u varijabli Dm za RF dominantne i nedominantne noge uočene veće vrednosti u poređenju sa našim istraživanjem. Ovako dobijeni rezultati mogu da se tumače kao posledica različitih perioda u sezoni kada je sprovedeno testiranje, starosti ispitanika i različitog nivoa takmičenja u kojem igrači nastupaju.

Na osnovu prethodnih istraživanja, a usled nedovoljnog broja istraživanja na sličnu temu, u budućnosti bi trebalo posmatrati više varijabli koje se odnose na mehaničke karakteristike mišića, kao što su vreme održavanja kontrakcije (Ts) i vreme relaksacije (Tr). Takođe, detaljnija podela igrača po pozicijama, uzrastu, sportskom stažu, rangu takmičenja može doprineti dobijanju značajnih rezultata.

Kao ograničenja sprovedenog istraživanja, mogu se smatrati uslovi u kojima su prikupljeni rezultati. Svi rezultati su prikupljeni u laboratorijskim uslovima, na odmornim mišićima, što u velikoj meri odstupa od realnih, odnosno takmičarskih uslova za igru. Takođe, uzorak ovog istraživanja nije detaljno podeljen na subgrupe, što bi preciznije utvrdilo neuromišićne karakteristike mišića i razlike između igrača na određenim pozicijama, ali za takvu proceduru je neophodan i veći broj ispitanika.

Praćenje mehaničkih karakteristika tokom sezone u takmičarskom mikrociklusu može doprineti unapređivanju igračkih performansa elitnih fudbalera. Značaj dobijenih rezultata koristeći TMG može indirektno unaprediti kvalitet treninga i umanjiti nivo povreda, posebno ligamenata kolena, tokom sezone. Takođe, TMG uređaj može biti koristan kao sredstvo za procenu neuromišićnog statusa tokom sezone (procena napretka sposobnosti), za procenu kontraktilnih sposobnosti igrača u preseazoni i tokom sezone čime se može umanjiti rizik od povrede sprovođenjem individualnih programa, za nadgledanje brzine oporavka itd.

Zaključak

Rezultati ove studije nisu pokazali značajne rezultate na mišiću BF i RF kod dominantne i nedominantne noge posmatranih fudbalera na istoj poziciji u timu. Razlog ovako dobijenih rezultata može se usmeriti prema specifičnosti kretanja kod fudbalera na istim pozicijama kao i malog broja ispitanika.

Upoređivanjem igrača na različitim pozicijama u timu prema dominantnosti noge nije se uočila statistička značajnost kod igrača na sredini terena i u napadu, ali su značajne razlike uočene kod odbrambenih i veznih igrača, kao i odbrambenih igrača i napadača u varijablama Vc i Dm za mišić BF. Kod RF nema značajnih razlika.

Sporija brzina kontrakcije mišića (Vc) i duže premeštanje mišića (Dm) sugerišu da kod odbrambenih igrača postoji manja krutost mišića kao i manja sposobnost promene pravca, odnosno igrači u odbrani su generalno sporiji u promeni pravca u poređenju sa igračima na sredini terena i u napadu. Razlog se može pronaći u specifičnosti kretanja koju određene pozicije zahtevaju u igri. Dalje studije sa većim brojem ispitanika i definisanim uzorkom, u skladu sa istim metodološkim principima, su neophodne kako bi se detaljnije ispitala funkcionalnost dominantne i nedominantne noge kod fudbalera na različitim pozicijama u timu.

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KINEMATIC VARIABILITY OF SIDE-VOLLEY KICK IN RELATION TO APPROACHING BALL SPEED IN ELITE FOOTBALL PLAYERS

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Introduction

The side-volley kick in football presents one of the most efficient technical elements that is used for the advance in the game, in the attack and also in defence. The kicks in football are done by kinetic chains of human body with synchronized engagement of the adjacent segments of the whole body. Kinetic chain consists of large number of joints that participate in the movement and because of these reasons it is important to analyze the way of its coordination and what are the effects of that coordination on the speed of open end of kinetic chain. One of the primary positive effects of the use of large number of joints of one kinetic chain is the increase of speed of movements of its open distal end. Numerous-joint movements that are performed at proximal-to-distal sequencing of the inclusion of segments, like side-volley kick, accomplish the greatest speed of its open (distal) end only in the case of proper synchronisation of movements and adjustment of the speed of all segments that participate in the movement. The side-volley kick presents complex movement, and according to classification belongs to open motor skills with variable conditions of performance and that is performed at the principle of ballistic movements.

The previous research has been on the kinematics of the instep kick, and there were analysis of the different kinematic variability in relation to degree of the fatigue or of the advance of the dominant leg that is making a kick (Naito et al., 2010; Apriantono et al., 2006; Dorge et al., 2002; Lee & Nolan, 1998). In the area of kinematic analysis there are research that analyse kinematics of the performance of the kick by the inside part of the foot - side kick (Nunome et al., 2002), but in the previous literature there are no any researches that analyse the kinematics of the side-volley kick.

Generally, the aim of this research is the kinematic analysis of side-volley kick, while the specific aim of this research would be to determine if during the performance of side-volley kick there is a variability of kinematic variables at the moment of the contact of foot with the ball, in relation to the speed of incoming ball.

Methods

Subjects

In this research there participated 30 subjects from 21-22 years of age. All examinees were elite professional football players, members of the national Serbian team and the members of professional European clubs (*Chelsea, Benfica, Genk, München 1860, Leiria, Kosice and Luch-Energia*) and super league of Serbia (*Red Star, Partizan, OFK Belgrade*). The task of subjects was to perform side-volley kick kicking the ball in the goal, where the ball was at three different speeds (slow, moderate speed and fast ball). We followed few dependent variables: the speed of the foot during the contact of foot with the ball (*velFOOT*), the speed of the centre of the joint of the knee at the moment of contact of the foot with the ball (*velKNEE*), the speed of the centre of the joint of a hip at the moment of the contact of the foot with a ball (*velHIP*), the angle in the joint of the knee at the moment of the contact of the foot with the ball (*angKNEE*), the angle in the joint of the

hip at the moment of the contact of a foot with the ball (*angHIP*), the distance of figurative axis between the hip and heel at the moment of the contact of the foot with the ball (*distHipHeel*) and the angle that cover the axis Shoulder-Hip and Hip-Heel at the moment of the contact of the ball with the foot (*angSHH*).

Experimental setup

The experiment consisted of the performance of the side-volley kick during the variable speed of the ball that was coming towards the player. The protocol of the experiment was performed in a way that the ball was passed to the player in the range of three different speeds. In the procedure of the processing of the kinematic variables the speed of the ball was determined, in a way that were defined different ranges of the speed of the ball (slow at 3.9-6.5m/s, moderate speed from 7.0-7.6m/s, fast at 7.9-8.5m/s). For processing we used just successful trials of the performance of the kick. Goal was at the distance of the subject at 9 m.

The protocol

All the measurements presented in this work were performed in the Sports hall of the Faculty for Sport and Physical Education in Belgrade. The closed space of the hall was used in order to overcome outside atmospheric influence. All the players were in a similar training status i.e. in a phase of the end of competition mezzo cycles and the beginning to transition period.

Taking into account that all the subjects that participated in this research were professional footballers with high level of professional training, experiment was performed in one day. Before the testing subjects had standard warm-up that consisted of slow running of 10 minutes, and also basic exercise that also lasted 10 minutes. After that, there was the introduction with the task, where each examinee needed to perform side volley kick. After 20 kicks in the preparatory phase, there was placement of reflective markers. After that was the phase of the performance of experiment with collecting of data. The basic instruction to subjects was to successfully perform side-volley kick in a way to hit the upper half of the goal that was defined the area of 1 m squared. Randomly each examinee performed 5 kicks for each speed of the ball, with the goal to perform three successful kick for each of the model of the movement task (Figure 1).

Measurements

The kinematic variables of the side-volley kick were measured with 3D infra-red (IR) system brand Qualisys (Sweden), with the frequency of sample signal of 240Hz. System consisted of three IR cameras and personal computer where with the help of original software (QTM), all the data was collected that were later analysed. Positioning of cameras was successfully performed in a way to disable light interference for detecting of some markers. Before each performance there was calibration of the space characteristic of the system, that was repeated for each set of measurement during repositioning of cameras or if there were any changes in relation to original calibration (Figure 1).

Reflective markers (diameter 19mm) were positioned at the location of the centre of joints as referent points for anthropometric model. For that purpose, the following points were defined: shoulder - proximal head of humerus, heep - trochanter major, knee - caput fibulae, ankle joint - maleous lateralis, foot - fifth metatarsal bone, heel - calcaneus. All the markers were fixed firmly for referent points by sticky tape and sticky plaster. The ball was marked with two reflective markers in the shape of calotte that was sticked at oval hemisphere of the ball on both sides.



Figure1. The display of the experimental setup and the display of the position of the subject at the moment of the contact of foot and the ball during the test.

Statistics

The obtained results are presented by descriptive and comparative statistics. The used statistic procedure for the investigation of the speed of the ball on dependent kinematic variables was Analysis of variance with repeated measurements (ANOVA). If the obtained statistic important influence of the factors of the speed of incoming ball on variable of dependent variable, *post hoc LSD Fisher* analysis was performed between different modalities of that factor. SPSS program was used for statistical processing of data. Criteria for the level of statistical importance was $p \leq 0.05$.

Results

Descriptive indicator of the kinematic variables of side-volley kick in relation to different speed of incoming balls is shown in Table 1. The results of ANOVA test is presented in text.

Table 1. The results of descriptive statistics (average values and standard deviation) for monitoring of kinematic variable for three different speeds of incoming ball (slow, moderate and fast ball).

	velFOOT (m/s)	velKNEE (m/s)	velHIP (m/s)	angKNEE (°)	angHIP (°)	distHipHeel (m)	angSHH (°)
Slow	10.608 ±1.81	2.148 ±0.609	0.938 ±0.393	141 ±20,4	105.8 ±14.4	0.782 ±0.056	123.9 ±7.8
Moderate	11.902 ±1.008	2.126 ±0.668	0.875 ±0.393	147,2 ±19,7	115.2 ±9.9	0.776 ±0.049	129.1 ±6.1
Fast	12.339 ±0.961	2.358 ±0.663	0.924 ±0.332	145,7 ±19,6	120.4 ±19.2	0.828 ±0.059	137.5 ±6.8

Analysing of collected data it was noted statistic importance of the influence of speed of incoming ball on the variability *velFOOT* ($p=0.024$). The results of post hoc analysis show that in factors of the speed of the ball there is statistic important difference between slow and moderate ($p=0.001$) and slow and fast balls ($p=0.000$). It was not noticed statistical important difference between moderate and fast balls ($p=0.182$). As oppose to the speed of the foot, it was not noticed statistical important influence of the factors of the speed of incoming ball on the variability of *velKNEE* ($p=0.372$), and also on variability of *velHIP* ($p=0.455$).

When we analyse angles in the knee and hip at the moment of contact of foot with the ball, it was not noticed statistical influence of the factors of the approaching ball speed on the variability *angKNEE* ($p=0.488$), while it was noticed statistical influence of the approaching ball speed on the variability *angHIP* ($p=0.000$). The results of post hoc analysis show that at factor of the approaching ball speed there is

important difference between slow and moderate ($p=0.000$) and slow and fast ($p=0.008$) balls. It was not noticed statistical difference between moderate and slow balls ($p=0.292$).

It was noticed that *distHipHeel* is statistically important influence of the factor of the approaching ball speed ($p=0.034$). The results of post hoc analysis show that at factor of the approaching ball speed there is statistical important difference between slow and fast ($p=0.08$), and moderate and fast ($p=0.021$) balls. It was not noticed statistical difference between slow and moderate balls ($p=0.877$).

It was not noticed statistically important influence of the factors of the speed of incoming ball on variability *angSHH* ($p=0.000$). The results of post hoc analysis show that at factors of the speed of the ball there is statistical important difference between slow and moderate ($p=0.000$) and slow and fast balls ($p=0.000$). It was not noticed statistical difference between moderate and fast balls ($p=0.092$).

Discussion

It was noticed that the speed of the incoming ball has had the influence on the increased of the performance of the kick, considering that the speed of the foot is increased increasing the speed of the incoming ball. We could guess that characteristic of the impact of the foot and the ball makes the subjects to increase the speed of the foot with increasing of the speed of the incoming ball and all in order to insecure greater values of the coefficient of restitution at the moment of the impact of the foot and the ball (Shinkai et al., 2007).

Kinematic variables that describe the angles in joints show that the speed of incoming ball directly influence on the angle of the hip joint. The explanation for this could be that the angle of the joint of the hip is adjusting to the speed of the incoming ball in order for the upper part of the leg as the most massive segment of kinematic chain is kept longer in one position. On that way the dynamic balance is kept and it is prevented that the other segments of the system go over the centre of the joint of the hip. That would directly influence the positions of the speeds of the whole kinematic chain and also the efficiency of the kick.

The results also show that the speed of incoming ball influence the angle which is defined by vertical axes of the abdomen and the axes that connects the centre of the joint of the hip and ankle joint. This result show that the conditions on the beginning depend of the speed of the ball. This shows that the neighbouring parts of the body influence the balance and stability and they have to be in relation to the speed accurately positioned (Shan & Westerhoff, 2005, Kellis at al., 2004). It was noticed that the speed of the ball influences that the contact of the foot with the ball is in stretched position.

It was noticed that the players adjusted the distance between the centre of the joint with hip and foot in the moment of the contact of the foot with the ball. Those differences is noticed only during the comparisons of fast balls with moderate and slow, while between moderate and slow there is no difference. We assume that this does not happen because the additional adjustment the body, because of the preparation of the final phase where stretched leg in the final phase of the kick is in stable position and is in slow post phase because of the increase of the moment of the inertia of the whole system. For the balls that does not have great momentum (slow and moderate incoming ball), there is a need to improve their movement by additional speeding of the system.

Conclusion

The purpose of this work was to analyse kinematic variables of the side-volley kick at the moment of the contact foot with ball, and during the performance of the side volley kick with different speeds of the incoming ball. It was notices that there are changes in kinematic variables of the locomotors system on different mechanical conditions of side-volley kick which includes the change of the speed of incoming ball. Increasing the speed of the ball the speed of the movement is increased and it comes to the stretching the

joints or precisely removal of the extremities (distal) of the kinetic chain (foot) from the central. Based on these obtained results it was noticed that top footballers adapt their technique to the side-volley kick in relation to the speed of the incoming ball.

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VARIJABILITET KINEMATIKE BOČNOG VOLEJ UDARCA U ODNOSU NA BRZINU DOLAZEĆE LOPTE KOD VRHUNSKIH FUDBALERA

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Uvod

Volej udarac u fudbalu predstavlja jedan od najefikasnijih tehničkih elemenata kojim se ostvaruje prednost u igri, kako u napadačkim tako i u odbrambenim akcijama. Udarci u fudbalu realizuju se angažovanjem kinetičkih lanaca lokomotornog sistema kroz sinhronizovano angažovanje susednih segmenata tela u celini. Svaki kinetički lanac sastoji se iz većeg broja segmenata i zglobova koji učestvuju u pokretu i iz tih razloga je važno da se analizira na koji način oni međusobno koordinišu i koji su efekti te koordinacije na brzinu radne tačke otvorenog kraja kinetičkog lanca. Jedan od primarnih pozitivnih efekata korišćenja većeg broja zglobova jednog kinetičkog lanca je povećanje brzine pokreta njegovog otvorenog – distalnog kraja. Višezglobni pokreti koji se izvode po proksimalno-distalnom obrascu uključivanja segmenata, kakav je i bočni volej udarac, postižu najveće brzine svog otvorenog (distalnog) kraja samo u slučajevima pravovremene sinhronizacije pokreta i slaganja brzina svih segmenata koji u pokretu učestvuju. Bočni volej udarac predstavlja složeno kretanje, i po klasifikaciji pripada otvorenim motornim veštinama sa varijabilnim uslovima izvođenja i koji se izvodi po principu balističkog pokreta.

Prethodna istraživanja su dominantno obrađivala kinematiku izvođenja udarca prednjim delom hrptom stopala (*instep kick*), gde su analizirane različite kinematičke varijable u odnosu na stepen ispoljenog zamora ili dominantnost noge koja izvodi udarac (Naito et al., 2010; Apriantono et al., 2006; Dorge et al., 2002; Lees & Nolan, 1998). U okviru kinematičke analize postoje i istraživanja koja analiziraju i kinematiku izvođenja udarca unutrašnjim delom stopala - *side kick* (Nunome et al., 2002), ali u dosadašnjoj literaturi nema radova koji analiziraju kinematiku bočnog volej udarca (*side voley kick*).

Generalno, cilj ovog istraživanja je kinematička analiza bočnog volej udarca, dok bi uže određen cilj rada bio da se utvrdi da li pri izvođenju ove vrste udarca postoji variranje kinematičkih varijabli u trenutku kontakta stopala sa loptom, u odnosu na brzinu dolazeće lopte.

Metod

Uzorak ispitanika

U istraživanju je učestvovalo 30 ispitanika uzrasta 21 ± 2 godine. Svi ispitanici su nastupali kao elitni profesionalni fudbaleri, članovi nacionalne selekcije Srbije i članovi profesionalnih Evropskih klubova (Chelsea, Benfica, Genk, Munchen 1860, Leiria, Kosice, Luch-Energia) i super lige Srbije (Crvena Zvezda, Partizan, OFK Beograd). Zadatak ispitanika je bio da izvedu bočni volej udarac gađajući gol loptom koja je dolazila u tri različite brzine (spora, umereno brza i brza lopta). Praćeno je nekoliko zavisnih varijabli: Brzina stopala u trenutku kontakta stopala sa loptom (*VelSTOP*), brzina centra zgloba kolena u trenutku kontakta stopala sa loptom (*VelKOL*), brzina centra zgloba kuka u trenutku kontakta stopala sa loptom (*VelKUK*), ugao u zglobu kolena u trenutku kontakta stopala sa loptom (*AngKOL*), ugao u zglobu kuka u trenutku kontakta stopala sa loptom (*AngKUK*), dužina figurativne ose između kuka i pete u trenutku kontakta stopala sa loptom (*dkUKPETA*) i ugao koji čine ose rame-kuk i kuk-peta u trenutku kontakta stopala sa loptom (*AngRKP*).

Eksperimentalna postavka

Eksperiment je podrazumevao izvođenje bočnog volej udarca pri promeni brzine lopte koja dolazi ispitaniku. Protokol eksperimenta je realizovan tako što je lopta prosleđivana ispitaniku u opsegu od tri različite brzine. U proceduri obrade kinematičkih varijabli određena je brzina lopte, tako što su formirani različiti opsezi brzina lopte (spore od 3.9 do 6.5 m/s, umereno berze od 7.0 do 7.6 m/s, i brze od 7.9 do 8.5 m/s). Za obradu su uzimani isključivo uspešni pokušaji izvođenja udarca. Gol se nalazio na udaljenosti od 9 m od ispitanika koji izvodi udarac.

Protokol

Sva merenja predstavljena u ovom radu, sprovedena su u sportskoj hali Fakulteta za sport i fizičko vaspitanje u Beogradu. Zatvoren prostor hale je iskorišćen kako bi se izbegli spoljašnji atmosferski uticaji. Svi igrači su bili u sličnoj trenazno-takmičarskoj fazi pripremljenosti definisanoj kao kraj takmičarskog mezociklusa i početak prelaznog perioda.

Imajući u vidu da su ispitanici koji su učestvovali u ovom istraživanju profesionalni fudbaleri sa visokim nivoom tehničke obučenosti, eksperiment je realizovan u jednom danu. Uoči testiranja ispitanici su imali standardno zagrevanje koji se sastojalo od laganog trčanja u trajanju od 10 minuta, kao i osnovnih vežbi pokretljivosti koje je trajalo takođe 10 minuta. Nakon toga, usledilo je uvodno upoznavanje sa kretnim zadatkom, gde se od svakog ispitanika zahtevalo da izvede precizan bočni volej udarac. Nakon realizovanih 20ak udaraca u pripremnoj fazi, usledilo je postavljanje reflektivnih markera. Nakon toga je usledila faza izvođenja eksperimenta sa prikupljanjem podataka. Osnovna instrukcija ispitanicima je bila da uspešno izvedu bočni volej udarac time što će da pogodi gornju polovinu gola koja je bila definisana površinom približnom 1 m². Nasumičnim redosledom svaki ispitanik je izvodio u proseku po 5 udaraca za svaku svaku od brzine lopte, sa ciljem da se izvede 3 uspešna pokušaja za svaki od modaliteta kretnog zadatka (Slika 1).

Način merenja

Kinematičke varijable bočnog volej udarca izmerene su 3D infracrvenim (IR) sistemom marke *Qualisys (Sweden)* sa frekvencijom uzorkovanja signala od 240 Hz. Sistem se sastojao od tri IR kamere i personalnog računara na kome su uz pomoć originalnog (QTM) softvera memorisani podaci koji su kasnije analizirani. Pozicioniranje kamera je uspešno izvedeno tako da je onemogućeno svetlosno ometanje za detektovanje pojedinih markera. Pre svakog izvođenja vršena je kalibracija prostornih karakteristika sistema, koja je ponavljana za svaki set merenja prilikom repositioniranja kamera ili ako bi se uslovi promenili u odnosu na prvobitnu kalibraciju (Slika 1).

Reflektivni markeri (dijametar 19 mm) pozicionirani su na lokacije – centre zglobova kao referentne tačke za antropometrijski model. U tu svrhu određene su sledeće tačke: rame - proksimalna glava humerusa, kuk - *trochanter major*, koleno - *caput fibulae*, skočni zglob - *maleous lateralis*, stopalo - peta metatarzalna kost, peta - *calcaneus*. Svi markeri su čvrsto fiksirani za referentne tačke lepljivom čičak trakom i flasterima. Lopta je bila obeležena sa dva reflektivna markera u obliku kalote koji su nalepljeni na oble hemisfere lopte sa obe strane.



Slika 1. Prikaz eksperimentalne postavke i prikaz pozicije ispitanika u trenutku kontakta stopala i lopte pri izvođenju testa.

Statistička obrada podataka

Dobijeni rezultati predstavljeni su deskriptivnom i komparativnom statistikom. Korišćena statistička procedura za ispitivanje efekata brzine lopte na zavisne kinematičke varijable je bila Analiza varijanse sa ponovljenim merenjima (ANOVA). Ukoliko je dobijen statistički značajan uticaj faktora brzine dolazeće lopte na varijabilitet zavisne varijable, sprovedena je *post hoc* LSD Fisher analiza između različitih modaliteta tog faktora. Za statističku obradu podataka korišćen je programski paket SPSS.. Kriterijum za nivo statističke značajnosti bio je $p \leq 0.05$.

Rezultati

Deskriptivni pokazatelji kinematičkih varijabli bočnog volej udarca u odnosu na različite brzine dolazećih lopti prikazani su u tabeli 1. Rezultati ANOVA testa predstavljeni su u tekstu.

Tabela 1. Rezultati deskriptivne statistike (prosečne vrednosti i standardne devijacije) za praćene kinematičke varijable za tri različite brzine dolazeće lopte (spora, umerena i brza lopta).

	velSTOP (m/s)	velKOL (m/s)	velKUK (m/s)	angKOL (°)	angKUK (°)	dKUKPETA (m)	angRKP (°)
Spora	10.608 ±1.81	2.148 ±0.609	0.938 ±0.393	141 ±20,4	105.8 ±14.4	0.782 ±0.056	123.9 ±7.8
Umerena	11.902 ±1.008	2.126 ±0.668	0.875 ±0.393	147,2 ±19,7	115.2 ±9.9	0.776 ±0.049	129.1 ±6.1
Brza	12.339 ±0.961	2.358 ±0.663	0.924 ±0.332	145,7 ±19,6	120.4 ±19.2	0.828 ±0.059	137.5 ±6.8

Analiziranjem prikupljenih podataka primećen je statistički značajan uticaj faktora brzine dolazeće lopte na varijabilitet *velSTOP* ($p=0.024$). Rezultati *post hoc* analize ukazuju da, kod faktora brzine lopte, postoji statistički značajna razlika između sporih i umerenih ($p=0.001$), i sporih i brzih lopti ($p=0.000$). Nije primećena statistički značajna razlika između umerenih i brzih lopti ($p=0.182$). Za razliku od brzine stopala, nije primećen statistički značajan uticaj faktora brzine dolazeće lopte na varijabilitet *velKOL* ($p=0.372$), kao ni na varijabilitet *velKUK* ($p=0.455$).

Kada analiziramo uglovne pozicije u kolenu i kuku u trenutku kontakta stopala sa loptom, nije primećen statistički značajan uticaj faktora brzine lopte na varijabilitet *angKOL* ($p=0.488$), dok je primećen je statistički značajan uticaj faktora brzine lopte na varijabilitet *angKUK* ($p=0.000$). Rezultati *post hoc* analize ukazuju da, kod faktora brzine lopte, postoji značajna razlika između sporih i umerenih ($p=0.000$), i sporih i brzih ($p=0.008$) lopti. Nije primećena statistički značajna razlika između umerenih i brzih lopti ($p=0.292$).

Uočeno je da je *dkUKPETA* pod statistički značajnim uticajem faktora brzine dolazeće lopte ($p=0.034$). Rezultati *post hoc* analize ukazuju da, kod faktora brzine lopte postoji statistički značajna razlika između sporih i brzih ($p=0.008$), i umerenih i brzih ($p=0.021$) lopti. Nije primećena statistički značajna razlika između sporih i umerenih lopti ($p=0.877$).

Primećen je statistički značajan uticaj faktora brzine dolazeće lopte na varijabilitet *angRKP* ($p=0.000$). Rezultati *post hoc* analize ukazuju da, kod faktora brzine lopte, postoji statistički značajna razlika između sporih i umerenih ($p=0.000$), i sporih i brzih lopti ($p=0,000$). Nije primećena statistički značajna razlika između umerenih i brzih lopti ($p=0.092$).

Diskusija

Uočeno je da je brzina dolazeće lopte uticala na uvećanje brzine izvođenja udarca, uzimajući u obzir da je brzina stopala uvećana sa povećanjem brzine dolazeće lopte. Može se pretpostaviti da karakteritiska sudara stopala, koje vrši zamah, i lopte koja određenom brzinom dolazi ispitaniku, uslovljava ispitanike da uvećavaju brzinu stopala sa povećavanjem brzine lopte koja dolazi, a u cilju obezbeđivanja veće vrednosti koeficijenta restitucije u trenutku sudara stopala i lopte (Shinkai et al., 2007).

Kinematičke varijable koje opisuju uglove u zglobovima ukazuju na to da brzina dolazeće lopte direktno utiče na ugao u zglobu kuka. Objašnjenje za ovu pojavu može biti da se ugao u zglobu kuka prilagođava brzini dolazeće lopte u cilju da se natkolenica, kao najmasivniji segment kinetičkog lanca, zadržava nešto duže u jednom položaju. Na taj način se održava dinamička ravnoteža, i sprečavaju ostali segmenti sistema da prevremeno preteknu centar zgloba kuka, što bi direktno uticalo na slaganje brzina celog kinetičkog lanca, a time i efikasnost udarca.

Takođe, rezultati ukazuju da brzina dolazeće lopte utiče na ugao koji je definisan uzdužnom osom trupa i osom koja spaja centar zgloba kuka i skočnog zgloba. Ovi rezultati upućuju na to da početni uslovi otklona trupa veoma zavise od brzine lopte. To ukazuje da susedni delovi tela utiču na ravnotežu i stabilnost i da moraju biti, u odnosu na brzinu, precizno pozicionirani (Shan & Westerhoff, 2005; Kellis et al., 2004). Primećeno je da, sa povećanjem brzine, taj otklon postaje veći u suprotnom smeru, što dodatno ukazuje da brže lopte utiču na to da kontakt stopala sa loptom bude u što opruženijoj poziciji.

Uočeno je da su ispitanici prilagođavali rastojanje između centra zgloba kuka i stopala u trenutku kontakta stopala sa loptom, u smeru povećanja rastojanja kako se povećavača brzina dolazeće lopte. Ta razlika je uočena samo pri poređenju brzih sa umerenim i sporim, dok između umerenih i sporih nije bilo razlike. Pretpostavlja se da do ove pojave ne dolazi zbog dodatnog prilagođavanja tela egzekutivnoj fazi, već zbog pripreme za postegzekutivnu fazu u kojoj opruženija noga u završnoj fazi udarca za brže lopte, podrazumeva mirnu i sve sporiju post fazu, usled povećanog momenta inercije celog sistema zbog veće brzine izvođenja. Za lopte koje inače nemaju veliku količinu kretanja (spore i umerene dolazeće lopte), potrebno je unaprediti njihovo kretanje dodatnim ubrzavanjem sistema, sa uslovima nešto flektiranije noge, gde se dodatni efekat, u smislu povećanja brzine lopte, postiže smanjenim momentom inercije.

Zaključak

Cilja rada je bio da se analiziraju kinematičke varijable bočnog volej udarca u trenutku kontakta stopala sa loptom, a pri izvođenju bočnog volej udarca sa različitim brzinama dolazeće lopte. Uočeno je da postoje promene u kinematičkim varijablama lokomotornog sistema na različite mehaničke uslove izvođenja bočnog volej udarca koje podrazumevaju promenu brzine dolazeće lopte. Sa povećanjem brzine lopte povećava se brzina realizacije pokreta i dolazi do opružanja u zglobovima, tj. udaljavanja krajnjih (distalnih) delova kinetičkog lanca (stopala) od centralnih. Na osnovu dobijenih rezultata uočeno je da vrhunski fudbaleri adaptiraju tehniku bočnog volej udarca u odnosu na brzinu dolazeće lopte.

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ANALYSIS OF THE EFFECTS OF DIFFERENT POSTURAL STABILITY' TRAINING ON HEALTHY ADULTS AFTER A RETENTION PERIOD

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Introduction

Static positions of the body like standing or sitting do not contain any obvious movement of the body. Precisely: those are not based on changing position of the body in space. However, dynamic processes and motor control are unavoidable part of successful resisting to the change. The ability to keep a posture which does not allow uncontrolled falling is known as postural stability (Kolář, 2013). In other words, it's the ability of the body to independently return its balance. Balance however, is a motor ability that necessary contributes to bodily movements and is an obvious part of many motoric tasks. Some authors such as Gallahue, consider stability a basic motor knowledge (Krstulović, 2018).

It is being recognized that the stabilization of the body in recreational and professional sport activities relies on the core muscles, which are located in the centre of the human body. There is not enough clarity and anatomical accuracy about what the core exactly is (Kibler et al., 2006). Fitness trainers who instruct recreative population use different methods and teach different, often contradictory types of muscle contractions; eccentric and concentric, of exactly the same abdominal muscle, addressing the same topic: improvement of postural stability of their clients. The common question weather is better to hollow or to brace while exercising is motivating the researchers to experiment with intraabdominal pressure using transverse abdominis concentric activation (hollowing) or eccentric contractions the abdominal wall muscles (bracing), aiming to finally define the proper importance of abdominal muscles contraction in maintaining postural stability (Hodges et al., 2003).

Ground force method (GFM), a recreational exercise system created by Peter Lakatos from Hungary, relies basis of its movement at mobility flows, bodyweight exercises, and metabolic outcome imbued with game-oriented short drills. This program does not refer to breathing exercises, more than it is already accustomed in usual physical recreation ("Groundforce method GFM", 2018).

Dynamic neuromuscular stabilization (DNS) system originates from Prague. It relies its policy exactly on breathing. Exercises are based on conscious and volitional inhaling and relaxing or "bracing" while exhaling, which is followed by body-parts movements. With its every contraction, the diaphragm; the breathing muscle lowers its position in abdomen. (Kolář, 2013). That is followed with the intraabdominal pressure increase (Willson et al., 2005), IAP. That pressure is amplified with the concentric or isometric activity of the abdominal muscles in synchronisation with the activity of pelvic floor muscles. This is how the stabilisation phase begins (Kolář, 2013). Produced by proper diaphragmatic breathing, an increased IAP in the abdominal cavity contributes to the improvement of the spinal stability (Paušić et al., 2016). DNS is based on developmental kinesiology, a science of maturation of the human movement system during the time of early development from birth and the first breath, until the child starts walking.

But, function and importance of the diaphragm is not being mentioned in most of the studies that concern stabilization and core. That is why the experiment that has been taken on a sample of 16 people

tested on Posturomed machine has gathered the data which gave us an insight of how DNS breathing exercises as a part of ground force method training practiced three times a week affect postural stability of its practitioners in just 15 days. Intraabdominal pressure and eccentric abdominal muscles contraction conceived in diaphragm, positively influence postural stability (Miketa et al., 2017).

Confirmation that breathing exercises increase human postural stability instructs us to proceed with the investigation in the direction of what effect on balance will those have after a retention period of non-exercising, in this case two months. Our main interest now is how this exercise refer to a motor learning, defined as a qualitative and quantitative performance of some meaningful movement that can be observed, analyzed and evaluated (Edwards, 2010) and an improvement of the motor skill of balance. Motor learning is a process of adoption, completion and a use of motor information (Čoh, 2004). It is a process of forming a motor skill; the ability for efficient and fluent completion of some motoric task (Breslauer, 2014).

Retention is a method for objective determination of the successfulness of the motor learning process. It allows us the insight in an adoption of the motor learning process on the satisfactory level and if a persistence of progress is present. To ensure that certain exercises are adopted on a higher level than shown on scores taken on initial testing, a researcher needs an insight about how will the scores look like after a period of non-exercising.

The aim of this study is to analyze the residual training effects in different groups with different postural stability training protocol after a retention period.

H1 – the experimental group shows a statistical difference with other groups, to demonstrate that a specific breathing protocol added to the ground force method have more powerful effect during time on the postural stability.

Method

Participants

Samples of 24 subjects were male and female, with similar anthropometric characteristics (age 35 ± 5 ; height 165 ± 5 ; weight 65 ± 5), with no recent proof of not being healthy.

For minimal 6 months, all were included in the same recreational program (ground force method) of exercising three times a week prior to the testing. Exclusion criteria were: injuries, surgeries, middle ear diseases or deviations, respiratory problems, pregnancies and giving birth within 6 months.

During testing, the sample was divided in 3 groups of 8 members:

1. Ground force method group (GFM)
2. breathing exercises group (DNS)
3. Control group (CON).

Variables

Researches that have been addressing postural stability and core imbalances use different platforms or proprioceptive training equipment for collecting data (Stanton et al., 2004). For this experiment a „Posturomed“ machine by manufacturer „Haider“ was used, with a kindness of “Faculty of health studies” in Rijeka where this „Posturo cybernetics“ test have taken place. „Posturomed“ is a neuro-orthopedic device for diagnosis, rehabilitation and prevention of neuro-orthopedic conditions. Its balance board is dimensions 60x60 cm. „Posturocybernetics test“ is conducted in a way that the program randomly selects the foot with which the subject will step on the platform and measures the removal of the upright positions on one leg for 10 seconds (Mijić, 2018). Test measures static balance in two different conditions: 1) while subject maintaining balance on the left leg stance for 10 seconds; 2) while subject maintaining balance on the right leg stance for 10 seconds.

The level of sensitivity or level of oscillation through the axes is determined by lowering and raising the screws located in the platform angles. For this experiment, a medium level of sensitivity was used.

The device is connected with PC and using "Mycroswing" software it allows a researcher to track the results percentage during testing. It uses variables: bipodalic stability, right leg shift, left leg shift. The results are displayed in percentage for the right leg, for the left leg and for both legs, accurately, the average value of the result of both legs. These last are the variable analyzed in this work.

Procedure

All the tests were done individually. In the absence of errors were repeated once, randomly, for 10 times on both legs. Each test lasted about 15 minutes, and the participants were ready to approach after 5 minutes of certain warm-up exercises. Prior to the tests, all the DNS group participants were submitted to DNS diaphragm tests of intraabdominal pressure quality, to ensure that their intraabdominal pressure is properly activated. The validation parameters of the DNS Diaphragm Test (Dynamic Neuromuscular Stabilization) with use of the diaphragm pattern activation have been examined in students of Faculty of Kinesiology University of Split by Paušić, Kuzmanić, Ivančić & Krželj (2016). The ICC has been considered an acceptable level using it in assessing and rating reliability of the „Diaphragm Test“.

Entities included in this testing were instructed to step barefoot with one leg to the platform, hold other leg up (heel in the height of the opposite knee, legs not touching) and keep the exact position for 10 seconds without leaning with their hands on the platform fence (Figure 1). They were obligated to breathe normally, not to hold breath, not to chew a gum, not to clench their teeth or squeeze their fists. Eyes were directed straight forward to a spot drawn on a blackboard. If any of these criteria was not followed for more than 3 seconds, certain attempt was cancelled and a subject was encouraged to try again.

This experiment flew in three main steps taken on the Posturomed machine:

STEP 1: A sample of 24 subjects approached the posture-cybernetic test. Then, the results were calculated to get the initial results.

STEP 2: The 24 sample group was divided in three sub-samples of 8 people: ground force method group (GFM group), DNS breathing exercises group (DNS group) and control group (CON group). The GFM group practiced only ground force method exercises during the whole testing period. The DNS sample practiced ground force method exercises during the whole testing period. After the initial measurements, they took an 1 hour „Functional breathing“ workshop, in which they awakened their natural breathing pattern with Dynamic neuromuscular stabilization exercises (DNS). After, breathing exercises were given for a 10 minutes practice, during their regular ground force method classes three times a week (DNS group) for 21-25 days. CON group did not practice any recreational or professional sport activities during the whole period. After 21-25 days, the same „Posture cybernetics test“ took place. The results were calculated via Excel to get the transitive scores.

STEP 3: After a period of 60 days, all three groups repeated the exact same test.



Figure 1. One leg test

Statistical Analysis

The data will be preliminarily screened for missing values. Later, the normality assumption will be verified with a Kolmogorov-Smirnov test and the inspection of skewness and kurtosis indexes. An Anova with Bonferroni post-hoc test was carried out to underline the difference between the groups after the training period. To analyse the difference for each group after the retention period a paired t-Test was carried out. All the statistical analysis will carry out using SPSS 20.0 (SPSS Inc, Ver. 20, Chicago, IL, U.S.A.) with the significance level set to 0.05 (95% CI).

Results

The difference after the training period and after the retention period are show in the figure 2. As shown in this graph, the statistical difference is present, after the training period, only in the DNS breathing exercises group.

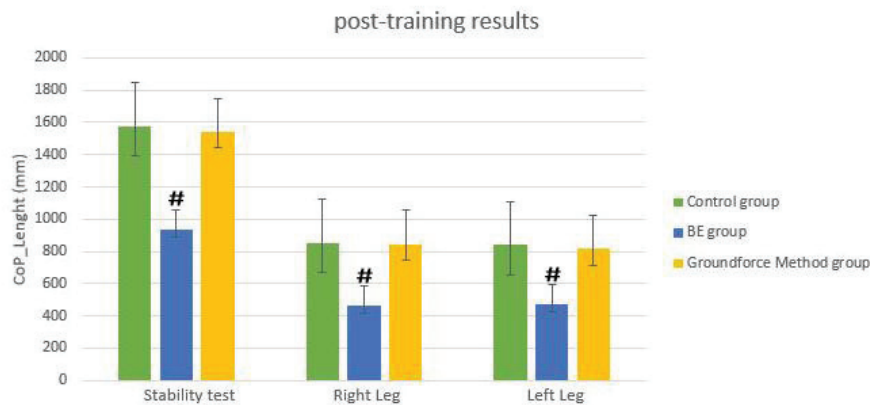


Figure 2. Results of postural stability test. The CoP_Length is the total length of centre of pressure sway. NOTE: # statistical significance difference ($p < 0.05$) (CI 95%).

In the table 1 there's the results of the one-way Anova, to analyse the difference after the treatment period between groups.

Table 1. Results of Anova test after the training period (post-treatment period).

Variable	F	df	p
Stability test	26.120	2.21	<0.00
Right Leg	17.395	2.21	<0.00
Left Leg	15.628	2.21	<0.00

The results of the second Anova show that there is a statistical difference between groups after the treatment. To understand which groups are statistically different from others a Bonferroni post-hoc test was carried out. The results of this test are reported in the table below.

Table 2. Results of Bonferroni post-hoc test after the training' period (post-treatment period).

Variable	(I) Group	(J) Group	Mean Difference (I-J)	p
Stability Test	Control	GFM	54.94	>0.05
	GFM	DNS	638.87	<0.05
	DNS	Control	-693.81	<0.05
Right Leg	Control	GFM	70.07	>0.05
	GFM	DNS	337.57	<0.05
	BE	Control	-407.64	<0.05
Left Leg	Control	GFM	-7.68	>0.05
	GFM	DNS	350.42	<0.05
	DNS	Control	-342.74	<0.05

The table 2 shows that the effects of the breathing exercise protocol are efficient compared to the other groups. To analyse if the effects of the training were still present, a paired t-Test was carried out for each group. The results are reported in the tables below.

Table 3. Results of t-Test for Control group.

Variable	T	df	p
Stability test	-0.831	1.7	>0.05
Right Leg	-1.156	1.7	>0.05
Left Leg	0.216	1.7	>0.05

Table 4. Results of t-Test for DNS Breathing Exercises group.

Variable	T	df	p
Stability test	0.737	1,7	>0.05
Right Leg	-0.056	1,7	>0.05
Left Leg	-0.971	1,7	>0.05

Table 5. Results of t-Test for GFM Groundforce Method group.

Variable	T	df	p
Stability test	-0.224	1.7	>0.05
Right Leg	1.773	1.7	>0.05
Left Leg	-0.080	1.7	>0.05

The abovementioned tables shows as, after a period of no-activity, the control group don't show any difference in the two period because the subjects didn't practice any activity before and any activity after, so they just did the test two times. The same results are present in the GFM group, because the effects of the training (Ground force method) are not efficient for the postural stability training. Otherwise the absence of statistical significance in the DNS group indicate that the positive effects of the training are still present after the retention period, because there's no difference between the post-treatment test (after the training period) and repost-treatment test (after two months of no activity).

Discussion

After being proven that DNS breathing exercises positively affect postural stability (Miketa et al., 2017), and that GFM exerciseis do not affect postural stability in a way of statistical significance (Mijić, 2017)., a need for further research revealed. We wanted to investigate whether the process of motor learning had taken place. There are three common methods used to prove the persistence of motor learning: (1) frequent measurement of performance; (2) retention; (3) knowledge transfer. (Miletić, 2013).

To sum up, we can conclude that a 15 days period of exerciseing breathing protocol is sufficient to awake an optimal motor pattern of breathing, which is present in the first diaphragm contraction in the moment of birth, but is often modified during life. That contraction contributes intraabdominal pressure creation, IAP (Kolar, 2003). In some literature it is called - brace. (Miketa et al., 2017). Bracing creates patterns that contribute to the stability better than hollowing. (Grenier & McGill, 2007). And, breathing exercises contribute better bracing. (Miketa et al., 2017). Precisely because it is a natural motor pattern; in a short period of time, breathing exercises achieve positive results, that last a long time.

Conclusion

This longitudinal study's hypothesis has been accepted, by proving that the DNS breathing protocol added to the Ground force method has powerful effect on the postural stability not only post treatment, but during time. Alongside that, a level of the basic motor knowledege of stability is increasing and basic motor tasks are a daily repertoire of human activities. We do not limit their importance to just some sport specific activity achievement. (Krstulović, S., 2018).

The performance of breathing exercises does not demand a special kind of equipment or space. It is a cheap and simple way to uplift a quality of life especially for the elderly population. By educating citizens about breathing, we can contribute to prevent the consequences of osteoporosis caused by falls. 14 elderly participants with a fear of falling syndrome took part in a 12-week yoga sessions composed of physical postures and breathing exercises. The results have indicated that this kind of practice may be a promising intervention to manage balance improvement. (Schmid et al., 2010).

Finaly, a diaphragmatic breathing is natural neuromotor pattern and in a case of a normal neuromotor communication between a brain and a body, success in improving an IAP and a postural stability is certain to be achieved in a short time. And finaly, how well a person performs a skill when first learning it, it is the best indication of his/hers potential for learning the skill. (Edwards, 2010).

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Poster presentations

Poster prezentacije

BULGARIAN 110 M HURDLERS SPORT RESULT DYNAMICS IN AGE ASPECT

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Introduction

Hurdle events are essential part of all athletic competition programs [И. Димова, 2018]. Sport results and their evolution in age aspect have both their individual and common characteristics [И. Лазаров, 2014]

The discipline 110 m hurdlers running is an interest for us due to the fact that it is most well-known discipline and it is the oldest in the hurdle running family. It is often call "king" discipline of all hurdle running.

From a philosophical point of view, hurdle running involves elements of almost all groups of athletic disciplines. This peculiarity, as well as the level of technical difficulty further increases our interest in exploring the discipline in its roots.

Method

The aim of the following study is to trace the sport result dynamics in age aspect of the best Bulgarian 110 m hurdlers. Respondents are the top 37 athletes in the discipline (retired at the date of finishing the following paper). We can note the names of Jivko Videnov (Personal Best/PB 13.33 sec. from 2000), Plamen Krustev (PB 13,46 sec. from 1984), Ventzislav Radev – World Championship 1983 finalist (PB 13,59 sec. from 1983), Vasko Nedyalkov (PB 13,70 sec. from 1981) Georgi Mlyakov (PB 13,97 sec. from 1973). PB was set between 1973 and 2012 – a period of 39 years revealing the development of Bulgarian 110 m hurdles discipline.

We trace best results in each year of competing during their sport career and the personal best (PB) result. For the purposes of the study we applied variance and correlation analysis and sigmal method for evaluation and development of assessment tables.

Results and Discussion

The year best result is good index for discipline mastering. It reveals indirectly both technical and physical improvement of hurdlers.

The best result (current Bulgarian national record) included in the following study is 13,33 sec. set by Jivko Videnov (in 2000). Average value of respondents' sport result is 14,09 sec. (ranging up to 14,50 sec.). Standard deviation ($S=0,30$ sec.) and variance coefficient ($V\%=2,14$) presents high level of homogeneity of respondent's groups. (see Table 1)

Table 1. Respondents sport result variance analysis.

count	min	max	average	m_{σ}	S	V%	As	Ex
37	13.33	14.50	14.09	0.05	0.30	2.14	-0.87	0.04
Critical values for As (skewness) and Ex (kurtosis) $\alpha=0.05$:							0.80	1.56

On table 1 we present variance analysis of best result for each year for all-time best 110 m hurdlers in Bulgarian athletics (retired to this date). The heat map of the table presents best results in green (light color) and weak results in red (dark color). Studied cases range from 1 (32 years), 3 (16 years), 4 (31 years) and raise over 12 cases between 18 and 28 years – a period of 10 years. Fastest and slowest best results for the

corresponding age of respondents are presented as min (fastest) and max (slowest). Standard deviation ranges between 0.21 to 0.74 sec. for the different age periods. Variance coefficient (V%) shows high level of homogeneity of respondents (with lower homogeneity levels after 29 years of age. All level of skewness (As) and kurtosis (Ex) are below the critical values ($\alpha=0.05$) excluding 28 and 30 years of age.

Table 2. Variance analysis of PB result for each year of all-time best 110 m hurdlers in Bulgarian athletics.

	age PB		age															
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
count	37	3	9	21	27	28	31	31	29	20	17	17	14	12	9	6	4	1
min	19	15.58	14.19	13.99	13.93	13.79	13.54	13.59	13.33	13.43	13.41	13.46	13.67	13.59	13.83	13.77	14.57	
max	29	15.99	15.73	15.45	15.53	15.20	14.97	15.05	15.35	14.64	14.98	14.77	14.86	14.88	15.37	15.87	16.08	
AVG	23.11	15.81	14.80	14.74	14.64	14.47	14.34	14.32	14.33	14.27	14.22	14.25	14.25	14.41	14.60	14.62	15.12	14.42
max	0.371	0.12	0.16	0.08	0.08	0.07	0.07	0.06	0.07	0.07	0.10	0.09	0.10	0.11	0.18	0.30	0.33	
S	2.26	0.21	0.47	0.38	0.43	0.39	0.37	0.36	0.40	0.31	0.39	0.38	0.39	0.39	0.54	0.74	0.67	
V%	9.77	1.33	3.18	2.58	2.96	2.72	2.55	2.51	2.81	2.14	2.77	2.64	2.72	2.67	3.73	5.07	4.41	
As	0.42		1.27	0.16	0.13	0.35	-0.22	-0.22	-0.16	-1.36	-0.13	-0.41	-0.01	-0.81	0.02	0.83	1.59	
Ex	0.11		1.65	-0.36	-0.78	-0.50	-0.64	-0.51	1.28	1.73	-0.03	-0.38	-1.15	0.10	-1.57	1.04	2.74	

Figure 1 graphically presents best, weakest and average PB result for each year of Bulgarian 110 m hurdlers (data from table 2). From the average result we clearly see the tendency of achieving best results in age aspect (between 21 and 27 years of age). This is confirmed by the best results line (min).

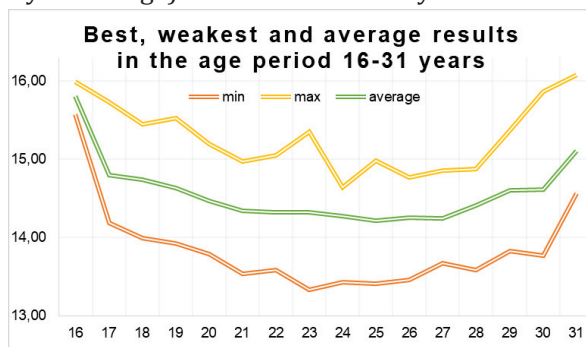


Figure 1.

For getting into details of hurdles discipline sport realization we applied correlation analysis of PB result and the bests results for each competitive year. All correlations (age period 18-28) are statistically significant (0.05 level).

Table 3. Correlation between PB and age (period 18-28 years).

age	18	19	20	21	22	23	24	25	26	27	28
PB	0.440	0.530	0.604	0.695	0.841	0.687	0.708	0.787	0.758	0.878	0.804
number of cases	21	27	28	31	31	29	20	17	17	14	12
Correlation	0.05 level	0.41	0.37	0.36	0.35	0.35	0.36	0.42	0.46	0.46	0.50
is significant	0.01 level	0.53	0.48	0.46	0.45	0.45	0.46	0.54	0.58	0.58	0.62

We graphically present the data from table 3 in figure 2 which reveals all tendencies – high correlation levels (over 0,700) between PB and the result from 22, 25-28 years of age. Lower correlation levels are found for age below 20. This might be due to several facts. First young athletes have hard transition into running the male hurdles. And the old rules set a hurdle height of 106,7 cm for the U20 athletes which has negative impact on their development. This was corrected by IAAF when they changed the height of U20 hurdles to 100 cm. Also, U20 hurdles often do not possess enough strength-speed abilities for realizing their maximal potential in this early age.

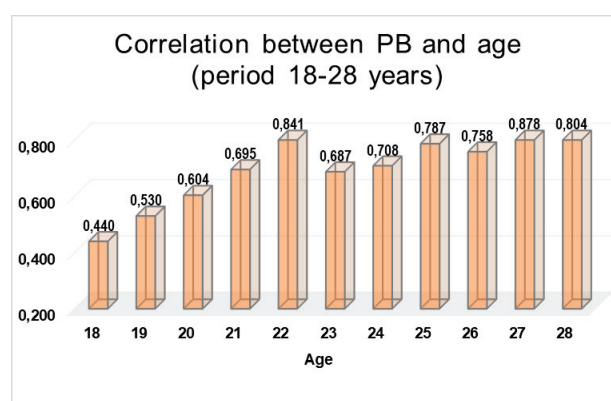


Figure 2.

Based on the research data and the statistically analyzed data we present an opportunity for assessment of Bulgarian hurdlers based on the experience of the best 37 hurdlers from all-time best rank list. Using this table, we can control the development of sport result. But we must note that sport qualification development has its own individual tendencies which must be taken in account. Table 4 present assessment table based on the signal method for evaluation possessing 7-scale evaluation (scores vary from very high, high, above average, below average, low, very low).

Table 4. Assessment table of Bulgarian 110 m hurdlers potential and sport realization in age aspect.

assessment	17	18	19	20	21	22	23
very high	under 13.86	under 13.98	under 13.78	under 13.69	under 13.60	under 13.60	under 13.53
high	13.86-14.32	13.98-14.35	13.78-14.20	13.69-14.07	13.60-13.96	13.60-13.95	13.53-13.92
above average	14.33-14.56	14.36-14.54	14.21-14.42	14.08-14.27	13.97-14.15	13.96-14.13	13.93-14.12
average	14.57-15.04	14.55-14.93	14.43-14.86	14.28-14.67	14.16-14.53	14.14-14.50	14.13-14.53
below average	15.05-15.27	14.94-15.12	14.87-15.07	14.68-14.86	14.54-14.71	14.51-14.68	14.54-14.73
low	15.28-15.74	15.13-15.50	15.08-15.50	14.87-15.25	14.72-15.08	14.69-15.04	14.74-15.13
very low	over 15.74	over 15.50	over 15.50	over 15.25	over 15.08	over 15.04	over 15.13
	24	25	26	27	29	31	
very high	under 13.65	under 13.44	under 13.49	under 13.47	under 13.52	under 13.78	
high	13.65-13.95	13.44-13.82	13.49-13.86	13.47-13.85	13.52-14.05	13.78-14.44	
above average	13.96-14.11	13.83-14.02	13.87-14.05	13.86-14.05	14.06-14.32	14.45-14.78	
average	14.12-14.43	14.03-14.42	14.06-14.44	14.06-14.45	14.33-14.87	14.79-15.46	
below average	14.44-14.58	14.43-14.61	14.45-14.63	14.46-14.64	14.88-15.14	15.47-15.79	
low	14.59-14.89	14.62-15.00	14.64-15.01	14.65-15.03	15.15-15.68	15.80-16.46	
very low	over 14.89	over 15.00	over 15.01	over 15.03	over 15.68	over 16.46	

Conclusions

Each geographical region or country has its own patterns in development of sport results in each discipline.

Based on the history of the 110 m hurdle running in Bulgaria we looked in the development pattern (for a period over 39 years) of the discipline and revealed sport result model, valid or Bulgarian hurdle school. Also, we present a method for control of future hurdlers based on the best Bulgarian athletes in the selected discipline.

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EXPERIMENTAL STUDY OF SPEED COORDINATION (AGILITY) ABILITIES OF AMATEUR FOOTBALL PLAYERS

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Introduction

Football happens to be a worldwide phenomenon. During its evolution the distance and number of runs at high speed have increased as the pace of the game has become more ballistic and powerful. (D. T. Kurkendall, 2011; M. Gadev, G. Gutev, 2011)

Football is constantly developing and evolving. It is changing both in tactical and physical aspects. In our opinion one of the most evolving areas in football is players movement speed and agility. This was one the reasons which made us to conduct the following study. Also, there are studies for professional football players movement during official games. But information regarding data about lower levels of football players and their speed abilities was very little or there was not any at all. (Dargatz, 1995)

That is why we focused in one not deeply analysed aspect of the football game – speed (agility) abilities of football players.

Method

The aim of the study is to analyze the level of speed coordination of amateur football players and to find the level of improvement when a special training program is applied. For the purpose of the study we analyze two amateur football clubs, one training with speed coordination methodology presented by us (FC "Vitosha" Bistritsa – presented also as experimental group or EG), and one without (FC "Yantra 1919" Gabrovo – presented as control group or CG). Tests included in the study are sprint running 5/10/20/30 m, Zig-zag test (Figure 1), T-test (Figure 2), Arrow left (Figure 3) and right (Figure 4) and Illinois test (Figure 5). All data is analyzed using variance analysis. Respondents were 40 (dividing by 20 per group) football players from the third level of Bulgarian football.

Experiment duration was 3 months (Spring of 2015) in which football clubs training process was similar regarding physical training. In the experimental group were added three times weekly exercises with speed coordination character in the first part of the training process. All data was registered using electronic time measurement system. During the first testing at the beginning of the experiment were measured only linear speed abilities. For the second testing we added 5 more tests revealing at higher level the speed coordination abilities. All study data was analyzed using variance analysis and Student's t-test for dependent and independent cases.

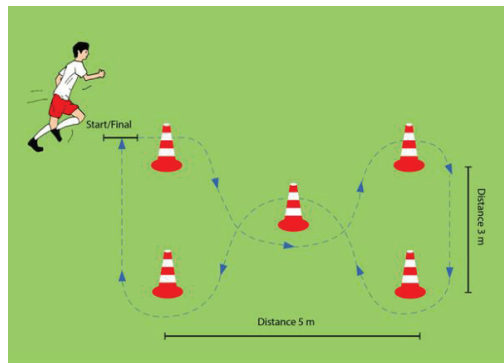


Figure 1. Zig-zag test.

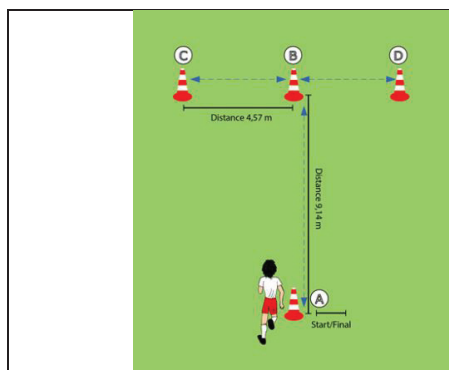


Figure 2. T-test.

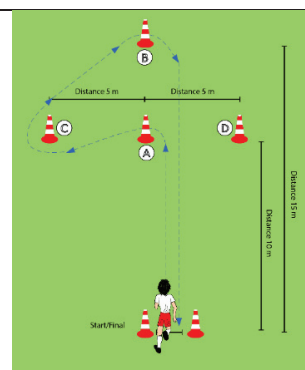


Figure 3. Arrow left.

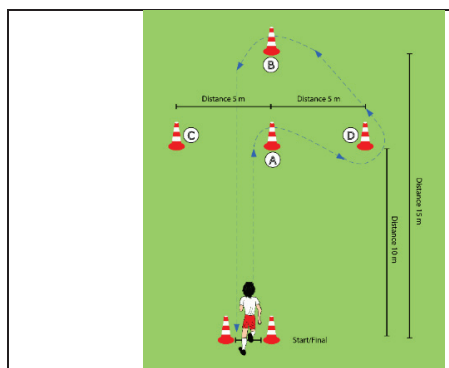


Figure 4. Arrow right.

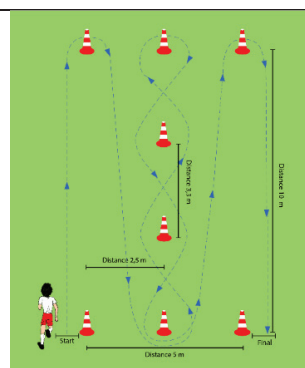


Figure 5. Illinois test.

Results and Discussion

On tables 1 and 2 we present the variance analysis from the first testing of experimental (FC “Vitoshka” Bistritsa) and control (FC “Yantra 1919” Gabrovo) groups.

The total number of respondents in the EG is 20. Average values of the test 5 m, 10 m, 20 m and 30 m are as follows: 1.10 sec., 1.82 sec., 3.16 sec., 4.38 sec. Range of different tests vary between 0.16 for the shortest distance (10 m) and 0,47 sec. (30 m). Variance coefficient (cV%) shows high homogeneity of all results from the first testing. Higher homogeneity levels we find in the 20 (cV%=3.27) and 30 m (cV%=3.74). Slightly higher variance coefficient level we find in the 10 m running test – cV%=4.11.

Table 1. Variance analysis of the experimental group from the first testing (FC "Vitoshka" Bistritsa).

test	n	R	Xmin	Xmax	\bar{x}	$m_{\bar{x}}$	S	V	As	Ex
5 m	20	0.16	1.03	1.19	1.10	0.010	0.04	3.92	0.34	-0.22
10 m	20	0.30	1.69	1.99	1.82	0.017	0.07	4.11	0.35	-0.11
20 m	20	0.36	2.96	3.32	3.16	0.023	0.10	3.27	-0.22	-0.75
30 m	20	0.47	4.14	4.61	4.38	0.037	0.16	3.74	-0.16	-1.45

On table 2 we present the data from the variance analysis of the control group. Respondents number is equal to the EG. Average value of the running test 5 m, 10 m, 20 m and 30 m are as follows: 1.11 sec, 1.87 sec, 3.02 sec and 4.21 sec. Range of result vary between 0.23 sec. (5 m) to 0.38 sec. (30 m). The tendency of higher range (R) with the increase of the running distance is valid also for EG. Here we note higher variance coefficient (cV%) for the first two test (5 m and 10 m) and decrease (higher homogeneity) for 20 m (cV%=2.20) and 30 m (cV%=2.09).

Table 2. Variance analysis of the control group from the first testing (FC "Yantra 1919" Gabrovo).

test	n	R	Xmin	Xmax	\bar{x}	$m_{\bar{x}}$	S	V	As	Ex
5 m	20	0.23	1.00	1.23	1.11	0.016	0.07	6.46	0.02	-1.06
10 m	20	0.30	1.71	2.01	1.87	0.021	0.09	5.00	-0.05	-0.96
20 m	20	0.29	2.88	3.17	3.02	0.015	0.07	2.20	0.10	0.59
30 m	20	0.38	4.03	4.41	4.21	0.020	0.09	2.09	0.07	1.06

Tables 3 and 4 present data from the variance analysis from the second testing (at the end of the experiment) for both EG and CG. Respondents number is the same for both groups. We add 5 more tests presenting coordination speed and we measure linear speed with the test from the first testing.

We found some interesting tendencies in the second testing valid for the EG. Range (R) for the test from 5 to 30 m range between 0.14 sec. (for the 5 m test) to 0.40 sec. (30 m test) and variance coefficient (cV%) vary between 2.05 (20 m) to 3.09 (5 m). On the other hand, we find lower homogeneity levels for the test presenting coordination speed (agility). Range (R) for these tests vary from 1.31 sec. (for Zig-zag test) to 2.77 sec. (for the Illinois test). Variance coefficient (cV%) levels range between 3.99 (Illinois test) to 5.75 (Zig-zag test). All coordination speed test takes a little more time to execute compared to the linear speed tests.

Table 3. Variance analysis of the experimental group from the second testing (FC "Vitoshka" Bistritsa).

test	n	R	Xmin	Xmax	\bar{x}	$m_{\bar{x}}$	S	V	As	Ex
5 m	20	0.14	0.95	1.09	1.01	0.007	0.03	3.09	0.83	1.67
10 m	20	0.17	1.60	1.77	1.69	0.010	0.04	2.56	-0.39	0.40
20 m	20	0.20	2.87	3.07	2.97	0.014	0.06	2.05	0.03	-0.74
30 m	20	0.40	3.88	4.28	4.12	0.027	0.12	2.92	-0.67	-0.26
Zig-zag	20	1.31	5.97	7.28	6.54	0.084	0.38	5.75	0.46	-0.95
T-test	20	1.61	9.34	10.95	9.86	0.091	0.41	4.13	1.02	1.22
Arrow left	20	1.55	7.92	9.47	8.59	0.097	0.44	5.07	0.27	-0.65
Arrow right	20	1.78	8.06	9.84	8.56	0.094	0.42	4.92	1.44	3.34
Illinois	20	2.77	16.00	18.77	17.20	0.154	0.69	3.99	0.88	1.07

The same tendencies noted above are valid for the results from the second testing of the CG – FC "Yantra 1919" Gabrovo. We see a little higher variance coefficient levels for both linear speed test and coordination speed tests.

Table 4. Variance analysis of the control group from the second testing (FC "Yantra 1919" Gabrovo).

test	n	R	Xmin	Xmax	\bar{x}	$m\bar{x}$	S	V	As	Ex
5 m	20	0.17	0.90	1.07	1.00	0.01	0.05	4.69	-0.58	0.19
10 m	20	0.17	1.60	1.77	1.71	0.01	0.05	3.03	-1.21	0.52
20 m	20	0.66	2.53	3.19	2.98	0.04	0.16	5.33	-1.41	2.46
30 m	20	0.76	3.65	4.41	4.10	0.04	0.20	4.87	-0.75	0.23
Zig-zag	20	1.70	6.12	7.82	6.83	0.11	0.50	7.32	0.55	-0.90
T-test	20	2.44	9.54	11.98	10.21	0.13	0.57	5.57	1.75	3.92
Arrow left	20	1.91	8.10	10.01	8.90	0.12	0.54	6.05	0.45	-0.58
Arrow right	20	2.15	8.23	10.38	8.89	0.12	0.53	5.99	1.18	1.77
Illinois	20	3.09	16.37	19.46	17.72	0.17	0.76	4.27	0.74	0.65

The statistical significance between the studied tests from the first and second testing presenting linear speed (test from 5 to 30 m) is presented on table 5. The difference between the 20 m results from the two tests for CG is not statistically significant $P(t)=61.87$. All other results improvement are statistically significant. All results show improvement based on Students t-criteria for dependent samples.

Table 5. Statistical significance between 1st and 2nd testing of linear speed – results improvement levels.

test	n	1 st testing		2 nd testing		Results improvement				
		\bar{x}_1	S_1	\bar{x}_2	S_2	d	d%	Cohen d	t	P (t)
5 m – EG	20	1.10	0.04	1.01	0.03	-0.09	-8.03	2.534	11.33	100.00
5 m – CG	20	1.11	0.07	1.00	0.05	-0.12	-10.43	1.143	5.11	99.99
10 m – EG	20	1.82	0.07	1.69	0.04	-0.13	-7.36	1.772	7.92	100.00
10 m – CG	20	1.87	0.09	1.71	0.05	-0.15	-8.31	1.410	6.31	100.00
20 m – EG	20	3.16	0.10	2.97	0.06	-0.20	-6.20	1.790	8.01	100.00
20 m – CG	20	3.02	0.07	2.98	0.16	-0.04	-1.23	0.200	0.90	61.87
30 m – EG	20	4.38	0.16	4.12	0.12	-0.25	-5.79	1.100	4.92	99.99
30 m – CG	20	4.21	0.09	4.10	0.20	-0.11	-2.56	0.497	2.22	96.15

We present graphically (Figure 6) the results improvement between the two tests of linear speed. We find higher level of result improvement for the EG compared to the CG in all test. With the increase of the running distance the improvement (t-criteria) of EG decreases from 11.33 (5 m) to 4.92 (30 m).

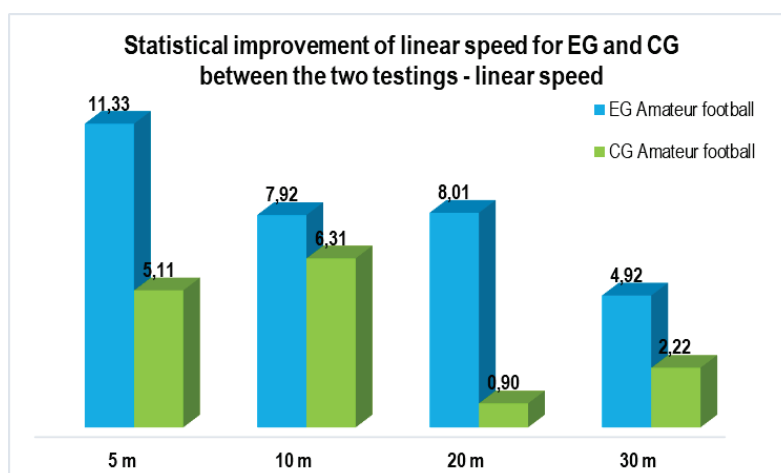


Figure 6.

The statistical significance between the studied tests from the second testing presenting speed coordination (agility) comparing results of EG and CG is presented on table 6 and figure 7. We find

statistically significant difference in all tests. It is clearly visible by the data presented on table 6 that the results from EG are better compared to the CG – temp vary between 2.03 to 2.27.

Table 5. Statistical significance between EG and CG – all studied test revealing speed coordination.

test	EG			CG			difference		statistical significance		r _{bs}
	n ₁	\bar{x}_1	S1	n ₂	\bar{x}_2	S2	d	Cohen d	t emp	P (t)	
Zig-zag	20	6.5	0.4	20	6.8	0.5	-0.285	0.62	2.03	95.11	0.313
T-test	20	9.9	0.4	20	10.2	0.6	-0.347	0.67	2.22	96.75	0.339
Arrow left	20	8.6	0.4	20	8.9	0.5	-0.316	0.62	2.04	95.18	0.314
Arrow right	20	8.6	0.4	20	8.9	0.5	-0.331	0.66	2.18	96.44	0.333
Illinois	20	17.2	0.7	20	17.7	0.8	-0.519	0.68	2.27	97.11	0.346

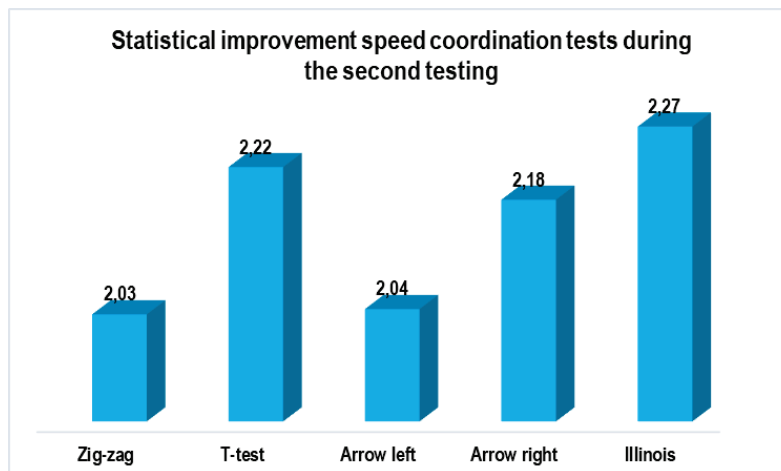


Figure 7.

Conclusion

Based on the results the including of speed coordination characterized exercises in the weekly training program of amateur football club improved linear speed and speed coordination (agility abilities) of football players.

Also, we present officially information regarding speed and coordination speed abilities of amateur football players (third level of football in Bulgaria) which is useful information for sport practice in the region.

Greater improvement we find in the 5 m, 10 m and 20 m. We found statistically significant difference in favor of the experimental group in the speed coordination test in the second testing – improvement levels are similar.

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STUDY OF EFFORT AT FEMALE 400 M RUNNERS ON THE IAAF WORLD ATHLETICS CHAMPIONSHIP 2017

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Introduction

Although once classified among middle distance events, the 400 metres is now regarded as a "prolonged sprint". Sometimes the 400m is also referred to as the "killer event" (Бъчваров & Антонов, 1991; Neuhoff, 1978) because, being just beyond the limit through which a well-trained runner can maintain his or her maximum speed, a huge stress is placed on the organism (Shephard, 1978; Gutev, 2015). Maximum sprint speed capability is a significant contributing factor to success in the event, but athletes also require substantial speed endurance and the ability to cope well with high amounts of lactic acid to sustain a fast speed over a whole lap. (Shephard, 1978; Neuhoff, 1978; Quecertani, 2005; Бъчваров, 2003). How they distribute their effort along the distance is very interesting and it is of great importance. There are studies which deal with average speed in the different parts of the distance (Norton, 1986, Pollitt et al., 2017; Бъчваров & Антонов, 1991; Славчев, 1996) but sometimes this indicator is not so accurate, because some athletes can run with the same average speed, but the effort that they put in the running is different. That is why to compare them we used a relative speed coefficient. We managed to make a comparison between the running of athletes at the same parts of the distance. With this method and the estimated evaluation table we suggest a way of comparison between athletes with different qualification. One of the latest athletic events with high performance is the IAAF World Championship in London 2017. Conducted biomechanical report allowed us to extract data for the suggested of us way of investigating the competition run of the athlete.

Method

The aim of the following study is to establish the preferred way of running and distribution of effort along the 400 m run, separated in 100 m parts. The main task corresponding to following study are:

1. Research available science information about the current investigation.
2. Gather data from the IAAF World Championship London 2017 for female 400 m semifinals and final.
3. Establish the relative speed coefficient in the different parts and making an assessment.

Based on previous studies which were conducted in high qualification female athletes, we used modified method to find how athletes run the different parts. The modified methods consists of mathematical equation according to which the relative speed coefficient is equal to the average speed of the separate 100 m (I_100m, II_100m, III_100m, IV_100m) divided to the average speed of the whole 400 m distance. We used a data from previous study (Quecertani, 2005; Бъчваров, 2003) according to Figure 1 to establish the type running.

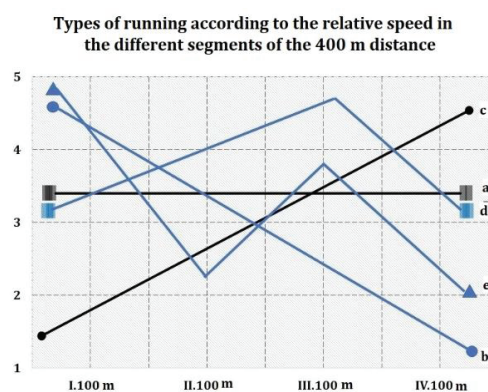


Figure 1. Visualization of types of running effort distribution during 400 m: a-middle zone run; b-descending type relative speed; c-ascending type relative speed; d-pyramid type run; e-descending followed by ascending relative speed.

Table 1. Evaluation of the coefficient on the separate 100 m parts of the distance.

	I_100m		II_100m		III_100m		IV_100m	
very fast	over	1,13	over	1,13	over	1,06	over	0,98
fast	1,09	1,13	1,09	1,13	1,03	1,06	0,94	0,98
average	1,03	1,09	1,02	1,09	0,97	1,03	0,87	0,94
slow	1,00	1,03	0,98	1,02	0,94	0,97	0,83	0,87
very slow	under	1,00	under	0,98	under	0,94	under	0,83

Time splits are officially measured by IAAF study and some of the relevant data is from their biomechanical report. In the study is used a special calibrated measuring system, and the collected data is accurate and suitable for the current investigation.

From this data we established the split times of the different parts. We discovered which type of effort distribution they use and what is the part from the whole group. We estimated the dominant type, which can be deem as common and preferred for high level female athletes.

Results and Discussion

In the presented tables is shown significant data from this study. The results are considered as world elite, given the reason that the competition, which they come from is the most important athletic forum of the year. Although the long competition season of elite runners, it is also highly probable that the athlete's annual planning is aimed to be peaking right in the time of the investigated competition.

Table 2. Sport result, split times of each 100 m and relative speed coefficient from Semi-final 1.

	ATHLETE	COUNTRY	RESULT/s	TIME/s				coefficient				type of run (fig.Ne)
				I_100_m	II_100_m	III_100_m	IV_100_m	I_100_m	II_100_m	III_100_m	IV_100_m	
1	Shaunae MILLER-UIBO	BAH	50,36	11,93	11,65	12,54	14,08	1,06	1,08	1,00	0,89	b
2	Stephenie Ann MCPHERSON	JAM	50,56	12,18	11,55	12,74	13,93	1,04	1,09	0,99	0,91	d
3	Quanera HAYES	USA	50,71	12,37	12,30	12,35	13,50	1,02	1,03	1,03	0,94	d
4	Gunta LATIŠEVA-ČUDARE	LAT	51,57	12,56	11,94	12,86	13,99	1,03	1,08	1,00	0,92	d
5	Roxana GÓMEZ	CUB	52,01	12,60	11,99	12,79	14,38	1,03	1,08	1,02	0,90	d
6	Bianca RAZOR	ROU	52,09	12,58	12,00	13,05	14,28	1,04	1,09	1,00	0,91	d
7	Patience Okon GEORGE	NGR	52,60	12,09	11,70	13,65	14,97	1,09	1,12	0,96	0,88	d
8	Ashley KELLY	IVB	54,50	11,89	11,94	13,92	16,57	1,15	1,14	0,98	0,82	d

Table 3. Sport result, split times of each 100 m and relative speed coefficient from Semi-final 2.








	ATHLETE	COUNTRY	RESULT/s	TIME/s				coefficient				type of run (fig.Ne)
				I_100_m	II_100_m	III_100_m	IV_100_m	I_100_m	II_100_m	III_100_m	IV_100_m	
1	Salwa Eid NASER	 BRN	50,08	11,70	12,27	12,40	13,51	1,07	1,02	1,01	0,93	b
2	Allyson FELIX	 USA	50,12	11,65	11,57	12,79	13,93	1,08	1,08	0,98	0,90	b
3	Novlene WILLIAMS-MILLS	 JAM	50,67	12,12	11,63	12,68	13,97	1,05	1,09	1,00	0,91	b
4	Shericka JACKSON	 JAM	50,7	12,09	11,50	12,81	14,11	1,05	1,10	0,99	0,90	d
5	Lydia JELE	 BOT	51,57	12,20	11,82	13,05	14,30	1,06	1,09	0,99	0,90	b
6	Yinka AJAYI	 NGR	52,1	12,56	12,18	12,97	14,14	1,04	1,07	1,00	0,92	d
7	NIRMLA	 IND	53,07	12,62	11,91	13,63	14,62	1,05	1,11	0,97	0,91	d
8	Irini Vasiliou		52,27	12,43	12,08	13,05	15,52	1,05	1,08	1,00	0,84	d

Table 4. Sport result, split times of each 100 m and relative speed coefficient from Semi-final 3.
















	ATHLETE	COUNTRY	RESULT/s	TIME/s				coefficient				type of run (fig.Ne)
				I_100_m	II_100_m	III_100_m	IV_100_m	I_100_m	II_100_m	III_100_m	IV_100_m	
1	Phyllis FRANCIS	 USA	50,37	11,91	11,28	12,77	14,22	1,06	1,12	0,99	0,89	d
2	Kabange MUPOPO	 ZAM	50,6	12,09	11,65	12,58	14,08	1,05	1,09	1,01	0,90	d
3	Chrisann GORDON	 JAM	50,87	12,24	11,59	12,61	14,26	1,04	1,10	1,01	0,89	d
4	Amantle MONTSHO	 BOT	51,28	12,09	11,61	12,88	14,50	1,06	1,10	1,00	0,88	d
5	Ruth Sophia SPELMEYER	 GER	51,77	12,74	12,02	12,83	14,02	1,02	1,08	1,01	0,92	d
6	Iga BAUMGART	 POL	51,81	12,71	12,08	12,83	13,97	1,02	1,07	1,01	0,93	d
7	Zoey CLARK	 GBR	51,81	12,41	11,97	13,00	14,23	1,04	1,08	1,00	0,91	d

Table 5. Sport result, split times of each 100 m, and relative speed coefficient from Final.

	ATHLETE	COUNTRY	RESULT/s	TIME/s				coefficient				type of run (fig.Ne)
				I_100_m	II_100_m	III_100_m	IV_100_m	I_100_m	II_100_m	III_100_m	IV_100_m	
1	Phyllis FRANCIS	 USA	49,92	11,70	11,41	12,55	14,06	1,07	1,09	0,99	0,89	d
2	Salwa Eid NASER	 BRN	50,06	12,01	11,49	12,43	13,93	1,04	1,09	1,01	0,90	d
3	Allyson FELIX	 USA	50,08	11,46	11,24	12,76	14,44	1,09	1,11	0,98	0,87	d
4	Shaunae MILLER-UIBO	 BAH	50,49	11,46	11,28	12,46	15,13	1,10	1,12	1,01	0,83	d
5	Shericka JACKSON	 JAM	50,76	11,91	11,52	12,85	14,29	1,07	1,10	0,99	0,89	d
6	Stephenie Ann MCPHERSON	 JAM	50,86	12,05	11,49	12,79	14,37	1,06	1,11	0,99	0,88	d
7	Kabange MUPOPO	 ZAM	51,15	11,66	11,74	12,86	14,71	1,10	1,09	0,99	0,87	b
8	Novlene WILLIAMS-MILLS	 JAM	51,48	12,16	11,59	12,79	14,67	1,06	1,11	1,01	0,88	d

Analyzing the data, we discovered that in the semi-finals and final athletes use two types of running. According to Figure 1 they are d-pyramid type and b-descending type of relative speed. The other types, does not apply to this group. The bigger share belongs to pyramid type of running which we can deem as most preferred way from highly qualified athletes (Figure 2). A few runners use the descending type which, according to us is due to inability to maintain the speed for longer distance. But this does not necessary comes from insufficient preparation for special endurance for the 400 m event, because speaking of athletes from the world elite we can suggest that this speed drop occurs, when the athletes use well their maximum speed in the first meters of the distance. This is supported from the data, shown.

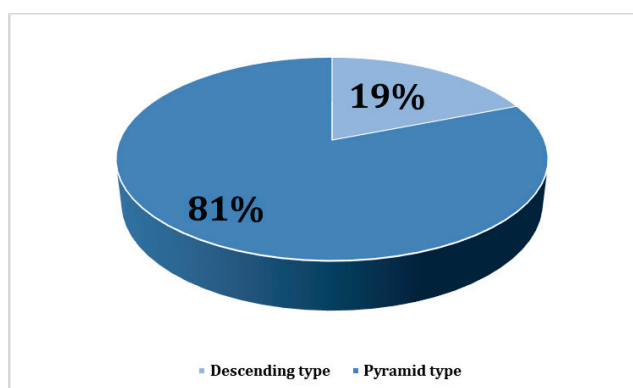


Figure 2. Relative share of preferred type of running.

Even more detailed information can be extracted when we compare if any of the athletes change their type of running on the final. From the final run 3 runners stay within the same type of running like semi-final run. This can be explained with the fact that in their long-term training process, they managed to discover the type of running which is more suitable for their individuality.

1	Phyllis FRANCIS	USA	50,37 49,92	PYRAMID TYPE
2	Salwa Eid NASER	BRN	50,08 50,06	DESCENDING → PYRAMID TYPE
3	Allyson FELIX	USA	50,12 50,08	DESCENDING → PYRAMID TYPE
4	Shaunae MILLER-UIBO	BAH	50,36 50,49	DESCENDING → PYRAMID TYPE
5	Shericka JACKSON	JAM	50,70 50,76	PYRAMID TYPE
6	Stephenie Ann MCPHERSON	JAM	50,56 50,86	PYRAMID TYPE
7	Kabange MUPOPO	ZAM	50,60 51,15	PYRAMID TYPE → DESCENDING
8	Novlene WILLIAMS-MILLS	JAM	50,67 51,48	DESCENDING → PYRAMID TYPE

Figure 3. Comparison between semifinal and final run, according to running type.

In the other hand five of eight runners changed the way they run in the final, compared to semi-finals. From these five, only one athlete changed her type from pyramid to descending type. The other four managed to lead their position by executing a run with pyramid type of distribution of effort. This can be evidence that pyramid type of running along the distance of 400 m can be deemed as one of the most used types, and also that type which leads to successful presentation of the abilities of the athletes.

Conclusions

1. Relative speed coefficient is appropriate to compare and assess the way of running in the different parts of the 400 m run.

2. It is estimated that most of elite female sprinters in the discipline, have chosen the pyramid type of run.
3. Evidence from the study show that a significant part of the 400 m finalist, conducted their run shifting to pyramid type, which can be deem as one of the most used and successful types.

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CONDITIONING TRAINING FOR 17-18 YEARS OLD BADMINTON PLAYERS

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Introduction

The development of modern badminton requires creating a science-based system for conditioning. Physical training should primarily be used to improve the effectiveness of the game. Often, in those with good technical training, the outcome of the match is determined by the level of physical development. The creating of specific athletic training for badminton players will contribute to the improvement of their sports preparing.

The speed of a badminton player on the court is a good indicator of the combination of his technical, tactical, physical and mental condition. During a badminton match, it is important for a competitor to take a right position on the court early to perform effective and accurate strikes. For a good efficiency fast runs, sudden stops and starts, jumps, and fast turnarounds are extremely important. The agility and the speed of direction change in the training process are planned in advance and developed with the technique. The ability to change direction is influenced by the position of the body. The agility is composed of two components: mental - the decision-making mechanism, and physical - the speed of change of direction.

Badminton requires highly developed muscle strength of the upper and lower limbs. Additionally, the competitor's rapid movement on the court required a very high level of speed-strength performance.

The high level of development of abdominal muscles and back muscles strength contributes to more effective movements in the court, which perform important strengthening and balancing functions in all stops and start-up movements.

Modern badminton has high demands on both general durability and specificity. The indicators that determine the level of specific endurance can be divided into:

(a) preservation of the speed of movement (movement in the court, strength)

(b) effective motor action.

The badminton game has a very intense load, close to the maximum in conditions of oxygen deficiency.

As we know, anaerobic work under the conditions of oxygen debt accomplished by means of two interconnected biological mechanisms - creatine phosphate and glycolysis. This means that the training aimed at improving the specific endurance of the badminton players involves, above all, increasing the amount of microelectric compounds in the muscles, increasing the alactate capacity, increasing the glycolysis process and improving the lactate possibilities. For this purpose, specific training and competing exercises is needed.

Method

The present study was conducted during a period of 6 months. It included 40 competitors aged 17-18 with a sporting career of 5-7 years. Players were divided into two groups of 20 subjects: experimental one and control one.

The average weekly training load for each group was 8-9 workouts (a total of 15-17 training hours). The experiment lasted 24 weeks (6 months). During this training period, 2 tests were made.

During the study we measured body height (cm) (X1), body weight (kg) (X2), throwing a solid ball (3 kg) overhead (X3), 5m sprint (X4), 10m sprint (X5), T-test run (X6), semi squat jump (X7) squat jump (X8).

Anaerobic strength, anaerobic capacity and fatigue index were established with a Wingate test (X9). Maximal oxygen consumption was measured with treadmill test with increasing load (VO2max/kg/min) (X10). The received data was subjected to statistical analysis.

In the test period, the training objectives were:

- Increasing the overall functional status of badminton players
- Improve aerobic-anaerobic capacity
- Development of strenght possibilities

Results with discussion

From table 1 you can see that the body weight for both groups did not show any incremental values. This indicates that the specific work on badminton and conditional conditioning did not affect the weight.

Speed quality analysis (5m) in the control group showed minimal improvement, as in the experimental group absolute speeds increased by 0.036 seconds. The case is similar with the dynamics of the speed, measured by the test 10 m from a high start.

Table 1. Variation of the marks after first test.

		N	min	max	X	S	Mann Whitney U
X1	experimental group	15	170.9	183.3	176.1	4.041	.782
	control group	15	171.5	183.1	176.5	4.211	
X2	experimental group	15	61.8	80.6	71.53	6.14	.978
	control group	15	61.9	80.5	71.34	5.46	
X3	experimental group	15	7.87	10.50	8.87	2.237	.823
	control group	15	8.03	10.25	8.62	2.061	
X4	experimental group	15	0.95	1.04	0.982	0.045	.813
	control group	15	0.96	1.05	0.985	0.033	
X5	experimental group	15	1.67	1.77	1.702	0.037	.851
	control group	15	1.66	1.79	1.707	0.041	
X6	experimental group	15	9.21	9.67	9.435	0.171	.923
	control group	15	9.19	9.65	9.421	0.166	
X7	experimental group	15	32.3	45.5	38.75	4.276	.523
	control group	15	32.5	45.3	38.81	4.424	
X8	experimental group	15	35.8	48.2	42.11	4.032	.561
	control group	15	36.0	48.1	41.85	3.792	
X9	experimental group	15	9.2	12.7	10.54	1.03	.943
	control group	15	9.4	12.6	10.58	1.09	
X10	experimental group	15	51.40	60.40	55.32	3.12	.512
	control group	15	50.63	60.24	55.43	3.21	

Table 2. Variation of the marks after second test.

		N	min	max	X	S	Mann Whitney U
X1	experimental group	15	171.0	183.5	176.1	4.126	.797
	control group	15	171.5	183.3	176.7	4.327	
X2	experimental group	15	63.4	81.0	72.32	4.79	.961
	control group	15	63.1	79.9	72.65	4.71	
X3	experimental group	15	8.45	11.98	9.65	2.041	.886
	control group	15	8.35	10.69	9.01	2.012	
X4	experimental group	15	0.91	0.96	0.938	0.017	.761
	control group	15	0.93	1.03	0.981	0.021	
X5	experimental group	15	1.61	1.73	1.655	0.045	.896
	control group	15	1.63	1.77	1.695	1.692	
X6	experimental group	15	8.37	8.84	8.594	0.143	.946
	control group	15	8.89	9.62	9.321	0.191	
X7	experimental group	15	38.2	50.5	45.38	3.763	.618
	control group	15	32.7	47.6	39.84	4.061	
X8	experimental group	15	44.13	54.41	48.66	3.104	.588
	control group	15	37.11	49.77	42.06	3.971	
X9	experimental group	15	10.6	15.4	13.04	1.03	.955
	control group	15	9.9	13.1	11.37	1.01	
X10	experimental group	15	55.22	63.43	59.88	2.11	.634
	control group	15	51.60	60.88	54.01	4.71	

The T-test analysis showed a tendency to minimal increase in the control group, as in higher values of absolute growth in the experimental group.

The values of the dynamics of the dynamic strength of the lower limbs measured with the semi squat jump test shows that the absolute increase of the experimental group in the examined period was 5.54 cm whereas in the control group the absolute increase was 0.20 cm.

The maximum oxygen consumption (VO2 max) was measured to determine the limit of aerobic capacity of the badminton players. It is obvious that the VO2 max in the control group has insignificant increase in the values. An increase in the absolute values of maximum oxygen consumption in experimental group gives us reason to suppose that a base for higher functional capacity creates better adapt to the high volume of workout for the badminton's endurance.

To be possible for the application of specialized training programs to improve the speed endurance of the badminton players, the anaerobic power and the anaerobic capacity were measured.

In the control group, the change was insignificant, as in the experimental group, the values of anaerobic strength marked significant progress.

Data analysis and established marks for the anaerobic strength values of badminton players in the experimental group reveal the objective impact of applied loads on anaerobic capabilities.

Most of the high correlations are between the maximum and dynamic leg and leg strengths, followed by the high weight correlations with 5 m sprint, 10 m sprint, T-test, vertical half squat jump.

In the final test, as well as in the initial test, the high values of the correlation coefficients between the indicators giving the maximum and dynamic strength of the arms and legs dominate, followed by the correlations between the weight, the half squat and the dynamic strength of squat.

In table 3 you can see the correlation interdependencies between the physical activity marks in the control group at the first test. In this study highest value, which records in the maximum and dynamic hand and leg

strengths, followed by the correlation between weight, maximum half-squat and squat, as well as speed and agility tests.

Both in the control and in the experimental group, there is a significant reduction in the number of high correlations between the first and the second testing, but there is a gradual increase in their values.

The quantitative decrease in the number of high correlations in both groups indicates the tendency to accelerate the process of differentiation of physical capacity under the influence of the different training process - in the case of the intensive impact of conditional training.

Table 3. Correlations interdependencies in the control group at the first test.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
X1	-	.343	-.053	-.298	-.301	.112	-.101	-.254	.432	.162
X2		-	-.256	-.072	.056	-.445	-.567	-.593	.601	-.043
X3			-	.081	-.041	.404	.298	.249	-.301	.189
X4				-	.790	.223	-.087	.066	-.123	.043
X5					-	-.232	-.187	-.093	-.031	-.054
X6						-	.158	.321	-.113	.021
X7							-	.887	-.342	.032
X8								-	-.341	.011
X9									-	-.091
X10										-

Table 4. Correlations interdependencies in the control group at the second test.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
X1	-	.381	-.201	-.331	-.298	.064	-.054	-.206	.287	-.141
X2		-	-.265	-.191	.043	-.156	-.487	-.632	.543	.100
X3			-	.387	.111	.243	.189	.453	-.101	.084
X4				-	.852	.083	.061	.241	.032	-.043
X5					-	-.254	-.193	-.066	.161	-.203
X6						-	-.162	.051	-.254	.321
X7							-	.843	-.333	.064
X8								-	-.443	-.012
X9									-	-.016
X10										-

Table 5. Correlations interdependencies in the experimental group at the first test.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
X1	-	.373	-.011	-.382	-.323	-.024	-.164	-.335	.053	.212
X2		-	-.253	-.013	.314	-.479	-.543	-.545	.573	.201
X3			-	.157	.012	.314	.343	.216	-.101	.024
X4				-	.792	.211	-.021	.257	-.135	.135
X5					-	-.206	-.132	-.043	.113	-.019
X6						-	.131	.532	-.352	.082
X7							-	.781	-.532	-.234
X8								-	-.511	-.021
X9									-	.198
X10										-

Table 6. Correlations interdependencies in the experimental group at the second test.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
X1	-	.565	-.365	-.248	-.321	.231	-.055	-.304	-.193	.274
X2		-	-.050	.311	.431	-.419	-.617	-.547	.354	.411
X3			-	.489	.592	-.106	.123	.231	.297	.176
X4				-	.942	-.117	-.072	-.006	-.018	-.098
X5					-	-.186	-.304	-.099	.118	.119
X6						-	.343	.495	-.548	-.071
X7							-	.773	-.336	-.238
X8								-	-.505	-.248
X9									-	.392
X10										-

Table 7 presents training exercises to develop the physical development of badminton players.

Table 7. Basic training exercises

Physical qualities	Reps	Volume
I.Speed		
1. Acceleration run	6-8	0.6 km
2. Starts from different starting positions	10-12	0.6 km
3. Runs up to 60 m with an intensity of 95-98%	5-6	0.3-0.4 km
4. Runs Variable intensity intensities (30 - 80 m)	3-4	0.2-0.3 km
5. Flying start (10 m - 20 m)	3-4	0.1 km
II.Speed-strength qualities		
1. Horizontal jumps		
Jump from stand	15-20	15-20
Triple jump from stand	10-15	10-15
2. Vertical jumps		
- Two legs jumps	50-100	50-100
- half squat rebound	40-60	40-60
- Squat jump	40-60	40-60
- Strapping knees to the chest	40-60	40-60
- Plyometric jumps over hurdles	60-80	60-80
4. Circle training		
- pushups	up to 50	up to 50
- jumps with ropes	80-100	80-100
- throw a medicine ball	80-100	80-100
- squats	15-20	15-20
- abs press	60-80	60-80
- exercises with a partner	80-100	80-100
- exercises with overweight	1-2 /week	1-2/ week
- exercise with weights	1 /week	1 /week
5. Running against hill	20	1 km
6. High strength of hands and legs	20-40	20-40
- exercises with rods, dumbbells, puddles	8-10	3-5t
7. Dynamic strength of arms and legs		
- exercises with rods and puddles	12-15	3-5t
III.Endurance		
1. Aerobic endurance		
* pulse 130-150 rpm (La = 2.5 mmol)	6-8	5-6 km
* pulse 151-170 rpm (La = 8 mmol)	4-6	2-3 km
2. Aerobic-anaerobic mode		
* pulse 140 -180 rpm (La = 8 mmol)	4-6	2-3 km
* Pulse above 170 rpm (La = 6 mmol)	5-6	2-3 km
* Pulse to 180 rpm intensive. 83%	5-6	2-3 km
3. Anaerobic-glycolytic mode		
* Intensity 84-90%	4-6	1-2 km
* Intensity 91-95%	4-6	1-1.5 km
4. Anerobic-alactate mode	4-6	0.2-0.5 km

Conclusion

1. The dynamics of the indicators giving information on the speed (5 m, 10 m and T-test) and the dynamic strength of the lower limbs (vertical jump of the half squat and squat) showed uneven and insignificant increases in the growth of these marks in the control group, whereas in the experimental group due to the specific impact of conditional training, a significantly higher increase in these indicators was achieved.

2. Increasing in the absolute values of VO₂max in the experimental group means that a base for higher functional capacity was created and will make better adaptation to the high volume of workout for the badminton's endurance.

3. The data analysis and the established higher values of the growth of the anaerobic strength in the badminton players by the experimental group reveals the objective impact of the applied loads on the anaerobic abilities.

4. The main instruments used by the control group and improved it's condition are: Speed: running up to 60m with intensity above 95% and flying start; Speed-strength: jumping exercises; Strength: Exercises with bar, elastic, medical ball; running against incline; Endurance: aerobic, aerobic-anaerobic, anaerobic.

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SERBIAN SKI INSTRUCTOR'S COMMUNICATION SKILLS

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Introduction

Human communication is a progressive system whose equally important parts of expressing are speaking and body language (Nenadović, 2010). Communication is a fundamental part of today's modern life. Without it, it is impossible to convey cognition nor to learn what happened or what will happen. Being a field which pervades every pore of society, communication represents a very important factor which influences the quality of human relationships. Communication itself does not have a purpose if there is no sender and receiver of the message. No matter what social sphere we talk about, in order to understand the transmitted message, it is necessary that communication flows without excessive interference and setbacks.

Ski tuition is a process which involves almost constant interaction between the ski instructor/teacher and present students, i.e. it seeks realization of quality communication and relationship which will contribute to a better and more efficient learning of ski technique elements. Whether it is about practical teaching on the field, theory teaching in the classroom or a move about ski technique, it is essential the presence of both instructors and students who mutually exchange information, knowledge, thoughts, emotions and questions. A competent ski instructor should be capable to understand what and how to teach and to assimilate his/her behavior in teaching so as to insure that student, content of the lesson, way of communicating and learning itself predominate all together (Aulife, 2007).

So far, in researches there aren't results of direct assessment of ski instructors' communication skills, but it is adequate to assume that they have a firsthand influence on the quality of ski tuition. The aim of this paper was to assess the level of control over the ski instructors' communication skills regarding sex, age, level of education, work experience and professional qualifications, and to use the incurred results as a groundwork for understanding better the newly created situations in communication.

Method

For the purpose of this research, 29 examinees were interviewed (N = 29), from which 17 males and 12 females, average age 28.6 (range: 28-39 years old). The examinees were licensed ski instructors who perform their professional activity at Kopaonik and Zlatibor ski centers. From the total number of examinees, 17 pled to have university degree (Uni.) as the level of education, i.e. 6 of them said to have high school degree (H.S.) and 6 to have higher education (Coll.). 12 examinees said that they had 6 and more years of experience in ski teaching, 11 examinees to have till 3 years of work experience and 6 of them to have between 3 and 6 years of experience in ski teaching. From the total number of examinees, 14 of them pled to have passed the first level for ski instructor, 8 of them the second, 4 instructors have third and 3 instructors have fourth level of professional qualification.

In this research, a standardized questionnaire about communication skills was used (source: Doctoral dissertation on „*Effective teacher communication skills and teacher quality*“ by Kevin John Loy, B.S., M.S., M.A.; „*The Ohio State University 2006*“). The questionnaire consists of two groups of questions. The first group of questions concern common information about examinees (sex, age, professional qualification, experience in ski teaching so far and level of skiing that holds as licensed instructor). The second group concerns 34 claims to which one can answer by circling numbers from 1 to 5, where each number represents a certain claim.

Thus, number 1 presents the claim „ALMOST NEVER", number 2 „RARELY", number 3 „SOMETIMES", number 4 „OFTEN" and number 5 „ALMOST ALWAYS". Questions are grouped in 5 subscales (Listening, Ability to transmit the message clearly, Insight into the communication process, Emotional management in communication, Self-confidence in communication) and those formulated in negative form are recorded in data processing. The result is calculated as an average number of responses to the questions which belong to a certain subscale, and higher score marks better developed communication skill. The examinees had filled in the questionnaires during the winter ski season 2017/2018. Gathering and processing of the data passed through three stages. First stage implied gathering of the data, the second stage its updating and third stage concerned processing the data. Regarding statistical procedures, descriptive statistics, t-test for independent samples and univariate analysis of variance were used.

Results

Based on the claims received by the questionnaire, the results of descriptive index indicates that ski instructors are good at communication skills. The majority of ski instructors answered the questions at average values, from 2.59 to 4.52, which is thought to be highly positive. In chart 1., the average results of responses to the questions for each subscale are shown, i.e. communication skill processed in the questionnaire. Observing the received data, results show that ski instructors best at the *Ability to transmit the message clearly* with average answer of 3.94, and then at the *Self-confidence in communication* with average of 3.85. Afterwards, the skills *Emotional management in communication* with average of 3.67, i.e. *Listening* skill with 3.56 and *Insight into communication process* skill with average of 3.50.

Chart 1. Descriptive statistic for each communication skill (N=29)

Communication skills	MIN	MAX	M	SD
Listening	2.38	4.38	3.56	.51
Ability to transmit the message clearly	2.83	4.83	3.94	.53
Insight into communication process	2.57	4.57	3.50	.54
Emotional management in communication	2.57	4.71	3.67	.52
Self-confidence in communication	2.33	4.83	3.85	.55

In chart 2. the results of correlated analysis between instrument's subscales and ages of examinees are shown. Based on the data collected from filled questionnaires by Pearson's correlative analysis, we came to the conclusion that there is moderate to highly positive correlation between communication skills in the questionnaire. The greatest correlation was obtained between "Emotional management in communication" and "Listening" and the lowest between "Self-confidence in communication" and "Insight into communication process". Not one communication skill is in the correlation with examinees' age, which shows that being good at communication skills does not change with the age of examinees.

Chart 2. The results of Pearson's correlative analysis of communication skills included in the questionnaire

Communication skill	(L)	(ATMC)	(ICP)	(EM)	(SC)	(AE)
Listening (L)	1					
Ability to transmit the message clearly (ATMC)	.53**	1				
Insight into communication process (ICP)	.51**	.61**	1			
Emotional management in communication (EM)	.70**	.55**	.58**	1		
Self-confidence in communication (SC)	.62**	.53**	.44*	.54**	1	
Ages of examinees (AE)	-.19	.06	.09	.16	-.07	1

Coherence of communication skills and half of the examinees has been assessed with T-test for independent samples. The results show that there isn't any difference between male and female examinees on the subscale (Chart 3).

Chart 3. The results of T-test for independent samples

Communication skills	Gender	M	SD	t	df	p
Listening	M	3.57	.50	.02	27	.99
	F	3.56	.56			
Ability to transmit the message clearly	M	4.05	.43	1.37	27	.18
	F	3.78	.63			
Insight into communication process	M	3.57	.54	.87	27	.39
	F	3.39	.56			
Emotional management in communication	M	3.73	.53	.81	27	.42
	F	3.57	.51			
Self-confidence in communication	M	3.95	.47	1.18	27	.25
	F	3.71	.64			

The results of univariate analysis of variance show that there isn't any difference in communication skills, between examinees who differ in years of work experience as instructors (Chart 4), the same with the examinees who have different level of skiing skills (Chart 5), i.e. between examinees who differ at level of education (Chart 6).

Chart 4. The results of univariate analysis of variance based on work experience

Communication skills	Work experience	N	M	MIN	MAX	F	Sig.
Listening	To 3 years	11	3.50	2.38	4.00	.19	.82
	From 3 - 6	6	3.67	2.75	4.38		
	More than 6	12	3.57	2.88	4.25		
Ability to transmit the message clearly	To 3 years	11	3.97	3.17	4.83	.32	.73
	From 3 - 6	6	3.78	2.83	4.33		
	More than 6	12	3.99	3.00	4.83		
Insight into communication process	To 3 years	11	3.42	2.86	4.14	.26	.77
	From 3 - 6	6	3.48	2.57	4.14		
	More than 6	12	3.58	2.57	4.57		
Emotional management in communication	To 3 years	11	3.60	2.86	4.57	.17	.85
	From 3 - 6	6	3.67	3.14	4.71		
	More than 6	12	3.73	2.57	4.29		
Self-confidence in communication	To 3 years	11	3.80	3.33	4.17	.06	.94
	From 3 - 6	6	3.89	2.83	4.67		
	More than 6	12	3.88	2.33	4.83		

Chart 5. The results of univariate analysis of variance based on level of skiing skills

Communication skills	LEVEL	N	M	SD	MIN	MAX	F	Sig.
Listening	I	14	3.63	.44	3.00	4.38	.29	.83
	II	8	3.58	.62	2.38	4.38		
	III	4	3.34	.66	2.75	4.25		
	IV	3	3.54	.58	2.88	3.88		
Ability to transmit the message clearly	I	14	4.10	.46	3.17	4.83	1.28	.30
	II	8	3.67	.50	2.83	4.50		
	III	4	4.04	.69	3.17	4.83		
	IV	3	3.78	.69	3.00	4.33		
Insight into communication process	I	14	3.48	.44	2.57	4.14	.11	.96
	II	8	3.48	.56	2.86	4.14		
	III	4	3.64	.68	2.71	4.14		
	IV	3	3.43	1.03	2.57	4.57		
Emotional management in communication	I	14	3.73	.50	3.00	4.71	.39	.76
	II	8	3.59	.50	2.86	4.29		
	III	4	3.46	.74	2.57	4.14		
	IV	3	3.81	.50	3.29	4.29		
Self-confidence in communication	I	14	3.86	.29	3.50	4.50	1.41	.26
	II	8	3.96	.67	2.83	4.83		
	III	4	4.04	.67	3.33	4.83		
	IV	3	3.28	.92	2.33	4.17		

Chart 6. The results of univariate analysis of variance based on level of education (LED)

Communication skills	LED	N	M	SD	F	Sig.
Listening	H.S.	6	3.6	.43	.43	.66
	COLL.	6	3.7	.41		
	UNI.	17	3.5	.58		
Ability to transmit the message clearly	H.S.	6	4.1	.55	.59	.56
	COLL.	6	3.8	.66		
	UNI.	17	4.0	.49		
Insight into communication process	H.S.	6	3.7	.33	1.03	.37
	COLL.	6	3.6	.69		
	UNI.	17	3.4	.55		
Emotional management in communication	H.S.	6	3.5	.23	.48	.62
	COLL.	6	3.7	.63		
	UNI.	17	3.7	.56		
Self-confidence in communication	H.S.	6	3.9	.27	.30	.74
	COLL.	6	3.7	.64		
	UNI.	17	3.9	.60		

Discussion

The development and mastering of communication skills is very important for ski instructors, since they spend most of the time, during ski tuition, communication with students. Communication skills are not

just important for ski tuition, but also for all other situations which can occur in changing environmental conditions. No matter how the results of this research, i.e. the results of self-evaluation of instructors are valid, orientation on additional development of communication skills would primarily refer to getting to know better how the communication process functions, and then to understand the importance of emotional management in communication process, i.e. to those skills which, according to results, had the lower score than others. The feeling that student experiences during skiing is something that will determine the further continuation with the tuition or, sometimes, giving up. The task of ski instructors is to pass their practical knowledge to students in the simplest way, using verbal and non-verbal communication which is followed by quality demonstration.

In one of the researches, which concerned evaluation of communication skills of tutors, the results showed that there isn't any significant difference in communication skills between tutors of different sexes. Likewise, the results showed that tutors with less years of work experience are better in communication skills from those with more years of work experience (Loy, K.J., 2006).

The results from this research confirmed that communication skills are dependent on each other, i.e. that one skill is connected with others, as well that there are no differences between ski instructors in the matter of sex, work experience, level of skiing skills and level of education. Herewith, we cannot either say precisely nor define by number, in which way and how often the ski instructor, with explicit work experience, level of education and skiing skills, has to develop and master certain communication skills. What is important for profession and understanding of this problem is that communication has developed so much since the beginning of human kind to nowadays, and that it is still developing according to uprising and understanding of man as an individual. Education that is based on inner motives and individual approach, as well as understanding differences from the previous experience, the desire and ability of the student are things that come on first place, so as the instructor - communicator would be on the right path to understand human relationships. Whether it is about more or less experienced instructor, or individuals who has significantly more experience from others, constant improvement is, primarily personal question and as such it has to have the important place in individual life.

Conclusion

The results of this research showed that ski instructors show a relatively high level of communication skills. However, taking into consideration that values from the subscales, which measure different communication skills aren't maximum, we can conclude that there is still room for their mastering. This goal can be achieved with the instructor's individual work, but also with organizing the seminars for professional development concerning communication skills. Taking into consideration that the results of this research are based on self - evaluation of the examinees, in further researches, the level of mastering communication skills based on the evaluation of their students, should be conducted. Also, the sample should embrace a larger number of ski instructors, which would enable more precise conclusions about the coherence of communication skills and other variables that can be connected with them, such as sex, work experience, level of education, etc.

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KOMUNIKACIONE VEŠTINE INSTRUKTORA SKIJANJA U SRBIJI

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Uvod

Ljudska komunikacija je multifokalni sistem čiji su jednako važni delovi izražavanja govorni jezik i jezik telesnih pokreta (Nenadović, 2010). Komunikacija je osnova današnjeg savremenog života. Bez nje nije moguće preneti saznanja niti saznati ono što se dogodilo ili što tek treba da se dogodi. Komunikacija kao oblast koja prožima svaku poru društva predstavlja veoma važan faktor koji utiče na kvalitet međuljudskih veza. Komunikacija sama sebi nema svrhu ukoliko ne postoji pošiljalac i primalac poruke. Bez obzira o kojoj društvenoj sferi se govori, za razumevanje poslate poruke neophodno je da komunikacija teče bez suvišnih ometanja i prepreka.

Obuka skijanja je proces koji predstavlja gotovo stalnu interakciju između instruktora/učitelja skijanja i prisutnih učenika, odnosno zahteva ostvarivanje kvalitetne komunikacije i odnosa koji će doprineti boljem i efikasnijem učenju elemenata skijaške tehnike. Bilo da se radi o terenskoj nastavi, teorijskom predavanju u učionici ili prikazom filma o skijaškoj tehnici, neophodno je prisustvo i instruktora i učenika koji međusobno razmenjuju informacije, znanja, razmišljanja, emocije i pitanja. Dobar instruktor skijanja treba da bude sposoban da razume šta se i kako podučava i prilagodi svoje ponašanje u učenju kako bi se osiguralo da učenik, sadržaj lekcije, način komunikacije i učenja preovlađuju svi zajedno (Aulife, 2007).

U dosadašnjim istraživanjima nema rezultata o direktnoj proceni komunikacionih veština instruktora skijanja ali je opravdano pretpostaviti da one imaju direktan uticaj na kvalitet skijaške obuke. Cilj rada je bio da se ispita nivo ovladanosti komunikacionim veštinama instruktora skijanja u odnosu na pol, uzrast, nivo stručne osposobljenosti, radno iskustvo i stručnu spremu, i da se nastali rezultati iskoriste kao osnova za bolje razumevanje novonastalih situacija u komunikaciji.

Metod

Za potrebe istraživanja anketirano je 29 ispitanika ($N=29$) od čega 17 osoba muškog pola i 12 osoba ženskog pola, prosečne starosti 28,6 godina (raspon: 20-39 godina). Ispitanici su bili licencirani instruktori skijanja koji svoju profesionalnu delatnost obavljaju na ski centrima Kopaonik i Zlatibor. Od ukupnog broja ispitanika 17 se izjasnilo da ima fakultet (FK) kao nivo obrazovanja, odnosno njih 6 da je završilo višu školu (VŠ) i 6 da ima završenu srednju školu (SŠ). 12 ispitanika se izjasnilo da u nastavi skijanja ima 6 i više godina iskustva rada, 11 ispitanika da ima do 3 godine iskustva u radu i 6 njih da ima između 3 i 6 godina iskustva u obuci skijanja. Od ukupnog broja ispitanika njih 14 se izjasnilo da ima položen prvi nivo za instruktora skijanja, njih 8 da ima drugi nivo, 4 instruktora da ima treći nivo i 3 instruktora da ima 4 nivo stručne osposobljenosti.

U istraživanju je korišćen standardizovan upitnik o komunikacionim veštinama (izvor: Doktorska disertacija na temu „*Effective teacher communication skills and teacher quality*“ by Kevin John Loy, B.S., M.S., M.A.; „*The Ohio State University 2006*“). Upitnik se sastoji iz dve grupe pitanja. Prva grupa pitanja se odnosi na opšte informacije o ispitanicima (pol, uzrast, stručna sprema, dosadašnje iskustvo u obuci skijanja i nivo skijanja koji poseduju kao licencirani instruktori). Drugu grupu čine 34 tvrdnje na koje je moguće odgovoriti zaokružujući brojeve od 1 do 5, gde svaki broj predstavlja određenu tvrdnju. Tako broj 1 predstavlja tvrdnju „*SKORO NIKAD*“, broj 2 „*RETKO*“, broj 3 „*PONEKAD*“, broj 4 „*ČESTO*“ i broj 5 „*SKORO UVEK*“. Pitanja su

grupisana u 5 supskala (Slušanje, Sposobnost da se jasno prenese poruka, Uvid u komunikacioni proces, Emocionalni menadžment u komunikaciji, Samopouzdanje u komunikaciji) a ona koja su formulisana u negativnom obliku su rekodirana u procesu obrade podataka. Rezultat se računa kao prosek odgovora na pitanja koja pripadaju određenoj supskali, a veći skor označava bolje razvijenu komunikacionu veštinu. Ispitanici su upitnik popunjavali u toku zimske skijaške sezone 2017/2018. Prikupljanje i obrada podataka su se odvijali kroz tri faze. Prva faza je podrazumevala prikupljanje podataka, druga njihovo ažuriranje i treća se odnosila na obradu podataka. Od statističkih procedura korišćenja je deskriptivna statistika, t-test za nezavisne uzorke i univarijantna analiza varijanse.

Rezultati

Na osnovu dobijenih tvrdnji upitnikom, rezultati deskriptivnih pokazatelja ukazuju da instruktori skijanja veoma dobro vladaju veštinama komunikacije. Većina instruktora je na pitanja odgovorila u proseku vrednostima od 2.59 do 4.52, što se kotira kao visoko pozitivno. U tabeli broj 1. prikazani su prosečni rezultati odgovora za svaku supskalu, odnosno komunikacionu veštinu koja je obrađena u anketi. Posmatrajući dobijene podatke, rezultati pokazuju da instruktori skijanja najbolje vladaju veštinom *Sposobnost da se jasno prenese poruka* sa prosekom odgovora 3.94., zatim veštinom *Samopouzdanje u komunikaciji* sa prosekom odgovora 3.85. Zatim slede veštine *Emocionalni menadžment u komunikaciji* sa prosekom odgovora 3.67, odnosno veština *Slušanje* sa 3.56 i veština *Uvid u komunikacioni proces* sa prosekom odgovara 3.50.

Tabela 1. Deskriptivna statistika za svaku komunikacionu veštinu (N=29)

Komunikacione veštine	MIN	MAX	M	SD
Slušanje	2,38	4,38	3,56	,51
Sposobnost da se jasno prenese poruka	2,83	4,83	3,94	,53
Uvid u komunikacioni proces	2,57	4,57	3,50	,54
Emocionalni menadžment u komunikaciji	2,57	4,71	3,67	,52
Samopouzdanje u komunikaciji	2,33	4,83	3,85	,55

U tabeli broj 2. su prikazani rezultati korelacione analize između supskala instrumenta komunikacionih veština, kao i uzrasta ispitanika. Na osnovu dobijenih podataka iz popunjenih upitnika, Pirsonovom korelacionom analizom se došlo do zaključka da postoji umerena do visoka pozitivna korelacija između komunikacionih veština koje su obuhvaćene upitnikom. Najveća korelacija je dobijena između veština „Emocionalni menadžment u komunikaciji“ i „Slušanje“, a najniža između veštine „Samopouzdanje u komunikaciji“ i veštine „Uvid u komunikacioni proces“. Nijedna komunikaciona veština nije u korelaciji sa uzrastom ispitanika, što ukazuje da se ovladanost komunikacionim veštinama ne menja sa uzrastom ispitanika.

Tabela 2. Prikaz rezultata Pirsonove korelacione analize komunikacionih veština koje su obuhvaćene upitnikom

Komunikacione veštine	(SL)	(SPP)	(UKP)	(EM)	(SP)	(GI)
Slušanje (SL)	1					
Sposobnost da se jasno prenese poruka (SPP)	,53**	1				
Uvid u komunikacioni proces (UKP)	,51**	,61**	1			
Emocionalni menadžment u komunikaciji (EM)	,70**	,55**	,58**	1		
Samopouzdanje u komunikaciji (SP)	,62**	,53**	,44*	,54**	1	
Godine ispitanika (GI)	-,19	,06	,09	,16	-,07	1

Povezanost komunikacionih veština i pola ispitanika procenjena je T-testom za nezavisne uzorke. Rezultati su pokazali da nema razlike između muških i ženskih ispitanika ni na jednoj od supskala (tabela 3).

Tabela 3. Rezultati T-testa za nezavisne uzorke

Komunikacione veštine	Pol	M	SD	t	df	p
Slušanje	M	3,57	,50	,02	27	,99
	Ž	3,56	,56			
Sposobnost da se jasno prenese poruka	M	4,05	,43	1,37	27	,18
	Ž	3,78	,63			
Uvid u komunikacioni proces	M	3,57	,54	,87	27	,39
	Ž	3,39	,56			
Emocionalni menadžment u komunikaciji	M	3,73	,53	,81	27	,42
	Ž	3,57	,51			
Samopouzdanje u komunikaciji	M	3,95	,47	1,18	27	,25
	Ž	3,71	,64			

Rezultati univarijantne analize varijanse su pokazali da nema razlike u komunikacionim veštinama između ispitanika koji se razlikuju na osnovu različitog radnog iskustva u obuci skijanja (tabela 4), kao ni između ispitanika koji poseduju različiti nivo skijaške osposobljenosti (tabela 5), odnosno ni između ispitanika koji se razlikuju po završenoj stručnoj spremi (tabela 6).

Tabela 4. Rezultati univarijantne analize varijanse prema radnom iskustvu

Komunikacione veštine	Radno iskustvo	N	M	MIN	MAX	F	Sig.
Slušanje	Do 3 god,	11	3,50	2,38	4,00	,19	,82
	Od 3 - 6	6	3,67	2,75	4,38		
	Više od 6	12	3,57	2,88	4,25		
Sposobnost da se jasno prenese poruka	Do 3 god,	11	3,97	3,17	4,83	,32	,73
	Od 3 - 6	6	3,78	2,83	4,33		
	Više od 6	12	3,99	3,00	4,83		
Uvid u komunikacioni proces	Do 3 god,	11	3,42	2,86	4,14	,26	,77
	Od 3 - 6	6	3,48	2,57	4,14		
	Više od 6	12	3,58	2,57	4,57		
Emocionalni menadžment u komunikaciji	Do 3 god,	11	3,60	2,86	4,57	,17	,85
	Od 3 - 6	6	3,67	3,14	4,71		
	Više od 6	12	3,73	2,57	4,29		
Samopouzdanje u komunikaciji	Do 3 god,	11	3,80	3,33	4,17	,06	,94
	Od 3 - 6	6	3,89	2,83	4,67		
	Više od 6	12	3,88	2,33	4,83		

Tabela 5. Rezultati univarijantne analize varijanse prema nivou skijaške osposobljenosti

Komunikacione veštine	NIVO	N	M	SD	MIN	MAX	F	Sig.
Slušanje	I	14	3,63	,44	3,00	4,38	,29	,83
	II	8	3,58	,62	2,38	4,38		
	III	4	3,34	,66	2,75	4,25		
	IV	3	3,54	,58	2,88	3,88		
Sposobnost da se jasno prenese poruka	I	14	4,10	,46	3,17	4,83	1,28	,30
	II	8	3,67	,50	2,83	4,50		
	III	4	4,04	,69	3,17	4,83		
	IV	3	3,78	,69	3,00	4,33		
Uvid u komunikacioni proces	I	14	3,48	,44	2,57	4,14	,11	,96
	II	8	3,48	,56	2,86	4,14		
	III	4	3,64	,68	2,71	4,14		
	IV	3	3,43	1,03	2,57	4,57		
Emocionalni menadžment u komunikaciji	I	14	3,73	,50	3,00	4,71	,39	,76
	II	8	3,59	,50	2,86	4,29		
	III	4	3,46	,74	2,57	4,14		
	IV	3	3,81	,50	3,29	4,29		
Samopouzdanje u komunikaciji	I	14	3,86	,29	3,50	4,50	1,41	,26
	II	8	3,96	,67	2,83	4,83		
	III	4	4,04	,67	3,33	4,83		
	IV	3	3,28	,92	2,33	4,17		

Tabela 6. Rezultati univarijantne analize varijanse u odnosu na stepen stručne spreme

Komunikacione veštine	SSS	N	M	SD	F	Sig.
Slušanje	SŠ	6	3,6	,43	,43	,66
	VŠ	6	3,7	,41		
	FK	17	3,5	,58		
Sposobnost da se jasno prenese poruka	SŠ	6	4,1	,55	,59	,56
	VŠ	6	3,8	,66		
	FK	17	4,0	,49		
Uvid u komunikacioni proces	SŠ	6	3,7	,33	1,03	,37
	VŠ	6	3,6	,69		
	FK	17	3,4	,55		
Emocionalni menadžment u komunikaciji	SŠ	6	3,5	,23	,48	,62
	VŠ	6	3,7	,63		
	FK	17	3,7	,56		
Samopouzdanje u komunikaciji	SŠ	6	3,9	,27	,30	,74
	VŠ	6	3,7	,64		
	FK	17	3,9	,60		

Diskusija

Razvoj i usavršavanje komunikacionih veština je veoma važno za instruktore skijanja s obzirom na to da većinu vremena u toku obuke skijanja provode komunicirajući sa svojim učenicima. Komunikacione

veštine su bitne ne samo za obuku skijanja već i za sve ostale situacije koje mogu zadesiti instruktore u veoma promenljivim uslovima spoljašnje sredine. Bez obzira koliko su rezultati ovog istraživanja, odnosno rezultati samoprocene od strane instruktora, validni usmerenje ka dodatnom razvoju komunikacionih veština odnosilo bi se na kvalitetnije upoznavanje funkcionisanja komunikacionog procesa, pre svega, a zatim i na razumevanje važnosti emocionalnog menadžmenta u procesu komunikacije, tačnije na one veštine koje su rezultatima imale manji skor od ostalih. Osećanja koja učenici dožive na skijanju je ono što će ih opredeliti za dalji nastavak obuke ili, neretko, odustajanje. Zadatak instruktora skijanja je da svoja praktična znanja na što jednostavniji način prenesu učenicima, koristeći verbalnu i neverbalnu komunikaciju koju neizostavno prati kvalitetna demonstracija.

U jednom od istraživanja koje se bavilo procenom komunikacionih veština učitelja dobijeni rezultati su pokazali da ne postoje značajne razlike u ovladanosti komunikacionim veštinama između učitelja različitog pola. Takođe, rezultati su pokazali da komunikacionim veštinama vladaju bolje učitelji sa manjim radnim iskustvom u odnosu na učitelje sa dužim radnim stažom (Loy, K.J. 2006).

Dobijeni rezultati ovog istraživanja su potvrdili da su komunikacione veštine veoma zavisne, odnosno da je jedna veština povezana i sa ostalima, kao i da nema značajnih razlika između instruktora skijanja u odnosu na pol, radno iskustvo, nivo skijaške ovladanosti i nivo stručne spreme. S tim u vezi, ne može se tačno odrediti, niti brojačno definisati, na koji način i koliko često instruktor skijanja sa određenim iskustvom u radu, stručnom spremom i skijaškim znanjem treba da razvija i usavršava pojedine veštine komunikacije. Ono što je bitno za struku i razumevanje ove problematike je to da je komunikacija mnogo napredovala od vremena nastanka čoveka pa sve do danas, i da se ona i dalje razvija u skladu sa razvojem i razumevanjem čoveka kao jedinke. Edukacija koja je zasnovana na unutrašnjim motivima i individualnom pristupu, kao i razumevanje različitosti prethodnih iskustava, želja i mogućnosti kod učenika je ono što treba da bude na prvom mestu kako bi jedan instruktor-komunikator bio na pravom putu ka razumevanju međuljudskih odnosa. Bilo da se radi o više ili manje iskusnim instruktorima, ili pojedincima koji imaju znatno više iskustva od drugih, stalno usavršavanje je pre svega pitanje lične prirode i kao takvo mora zauzimati važno mesto u životu pojedinca.

Zaključak

Rezultati ovog istraživanja su pokazali da instruktore skijanja pokazuju relativno visok nivo ovladanosti komunikacionim veštinama. Ipak, uzimajući u obzir da vrednosti dobijene na supskalama koje mere različite komunikacione veštine nisu maksimalne, može se zaključiti da ima još dosta prostora za njihovo usavršavanje. Ovaj cilj se može ostvariti kroz individualni rad instruktora skijanja, ali i kroz organizovanje seminara profesionalnog usavršavanja specifično usmerenih na razvoj komunikacionih veština. Uzimajući u obzir da su rezultati ovog istraživanja dobijeni na osnovu samoprocene ispitanika, u daljim istraživanjima bi trebalo proveriti nivo ovladanosti komunikacionim veštinama instruktora skijanja na osnovu procena njihovih učenika. Takođe, uzorak bi trebao da obuhvati veći broj instruktora skijanja, što bi omogućilo preciznije zaključke o povezanosti komunikacionih veština i ostalih varijabli koje mogu biti povezane sa njima, kao što je pol, radno iskustvo, stručna sprema i slično.

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STUDY ON SPECIAL SPORT-TECHNICAL ABILITIES OF WOMEN DISCUS THROWER

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Introduction

Special sport-technical abilities of women discus throwers appear to be the best index for training process efficiency regarding both physical and technical abilities. [Е. Николов, Гр. Гутев, 2012; И. Лазаров, 2014]

Special sport-technical abilities in the discus throwing discipline are result of the use of exercises (drills), similar by form and content with the discipline. They are the best index for the training process efficiency.

In sport practice are used many exercises in training process. Most informative in the discus throwing event are the discus throw with standard, lighter and heavier implement – throwing from power position and throwing with one-and-a-half rotations. Also interest for the sport theory and practice is the difference in light distance when throwing implements with different weight (lighter and heavier).

In this aspect, it is preferable to analyze the experience of discus throwers proven themselves in sport practice, and we can assume that this high-level result is based on the properly constructed training process [Кръстев, Й. 1976; Karapetrova, R., G. Stoykov, K. Milonas, St. Stoykov, 2015].

Sport practice in the athletic throwing events is full of examples when the preference for quick sport success is based on priority development of strength abilities followed by limitation of sport results realization and early termination of the sport career. [Стойков, Ст., Р. Карапетрова, 2008].

We will open a clamp to note that the experience of the best athletes is either unknown or know to minor extent. In this regard, we have the opportunity to present the experience of discus throwing school that proved itself in the last quarter of the twentieth century, achieving almost all possible awards on the world sport scene.

Method

The aim of the following study is to analyze and trace the level of special sport-technical abilities of different level of sport qualification of elite discus thrower (women).

Respondents of the following study are the best 14 female discus throwers in the Bulgarian history – with results ranging from 59,08 m to 73,22 m. Among the names of the studied athletes are world champion and vice-champion Maria Vergova, world champion and European champion Tsvetanka Hristova and other names from the world elite of the discipline, the majority of which are with personal best (PB) results over 65 meters.

The subject of the study are the special sports and technical abilities, presented by four main indexes of throwers technical potential: throwing from power position, throwing with one-and-a-half rotations (1,5 kg, 1,25 kg and 0,750 kg).

All research data is process using variation, correlation and regression analysis. Also, we applied the sigmal scoring method for evaluation of the level of development of the relevant ability versus sport result.

Results and Discussion

The result from the variance analysis is presented in Table 1. All studied indexes presenting both sport and technical potential are with high informative value. They are integral part of sport preparation of each discus thrower who has achieved certain success in the discipline.

Table 1. Research data variation analysis.

index (m)	implement weight	n	Xmin	Xmax	R	X	S	V	As	Ex
Sport result	1 kg	30	48.84	73.22	24.38	65.06	3.85	8.23	-1.06	1.69
Throwing from power position	1 kg	30	41	61.64	20.64	52.5	2.28	8.92	0.76	0.61
Throwing with one-and-a-half rotations	1.5 kg	30	37.02	55.6	18.58	45.45	2.02	7.48	0.19	-0.48
	1.25 kg	30	39	61.2	22.2	49.2	3.37	8.09	-0.75	0.66
	0.75 kg	30	56	81.2	25.2	64.65	4.01	9.31	-0.94	-0.85

All indexes have high uniformity which is confirmed by the variation coefficient (V%), as well as by the asymmetry (As) and the excess (Es) coefficients.

Respondents sport results has average value of 65.06 m. ranging from 48.84 m to 73.22 m. In practice, this provides opportunity to study the evolving sport result and corresponding sport and technical abilities in wide range – from sport entry level (around 50 m) to world elite level.

The sport result extent in the other studied indexes is a feature of the range in which the latter grow with the increase of sport qualification. Such information is unique in both scientific and methodological aspect.

The correlation data analysis (see Table 2) presents very high level of correlation between studied indexes (over 0.81) – the with the sport result and between the other indexes. This provides us the opportunity to apply regression modeling method.

Table 2. Correlation analysis.

	Sport result 1 kg (m)	Throwing from power position 1 kg (m)	Throwing with one-and-a-half rotations 1.5 kg (m)	Throwing with one-and-a-half rotations 1.25 kg (m)	Throwing with one-and-a-half rotations 0.750 kg (m)
Sport result 1 kg (m)		0.87	0.85	0.9	0.93
Throwing from power position 1 kg (m)	0.87		0.87	0.9	0.81
Throwing with one-and-a-half rotations 1.5 kg (m)	0.85	0.87		0.92	0.84
Throwing with one-and-a-half rotations 1.25 kg (m)	0.9	0.9	0.92		0.90
Throwing with one-and-a-half rotations 0.750 kg (m)	0.93	0.81	0.84	0.90	

In the following tables we present the straight (see Table 3) and reverse (see Table 4) regression models. In the first case, sport result (y) is a function of the corresponding index (x), in the second one – the result in the index (y) is function of the sport result (x).

Table 3. Straight regression model.

index	regression model	Sy/x	r
Throwing from power position 1 kg (m)	$y=-0.24+1.16x$	2.01	0.93
Throwing with one-and-a-half rotations 1.5 kg (m)	$y=9.46+1.15x$	1.99	0.85
Throwing with one-and-a-half rotations 1.25 kg (m)	$y=41.02+0.47x$	2.22	0.9
Throwing with one-and-a-half rotations 0.750 kg (m)	$y=39.07+0.41x$	2.45	0.88

Table 4. Reverse regression model.

index	regression model	Sy/x	r
Throwing from power position 1 kg (m)	$y=9.11+0.70x$		0.95
Throwing with one-and-a-half rotations 1.5 kg (m)	$y=-1.01+0.78x$		0.84
Throwing with one-and-a-half rotations 1.25 kg (m)	$y=15+0.61x$		0.88
Throwing with one-and-a-half rotations 0.750 kg (m)	$y=33.5+0.58x$		0.83

Using this approach, each female discus thrower can reconcile the harmony in the development of her sport and technical abilities based on the experience of some of the best female discus throwers in the end of XX century – the Bulgaria female discus throwers.

Also, as an addition we present another opportunity to assess the degree of special sport and technical abilities development (see Table 5) – five level scale for assessment of each index (low. below average. average. above average and high level).

Table 5. Assessment table.

Assessment	Sport (m)	result	Throwing from power position 1 kg (m)	Throwing with one-and-a-half rotations 1.5 kg (m)	Throwing with one-and-a-half rotations 1.25 kg (m)	Throwing with one-and-a-half rotations 0.75 kg (m)
low	under 55.2		over 47.5	under 42.0	under 44.5	under 54.0
below average	from 55.2 to 59		from 47.5 to 51.5	from 42.0 to 45.0	from 44.5 to 49.5	from 55.0 to 61.0
average	from 59 to 66.6		from 51.5 to 55.5	from 45.0 to 48.0	from 49.5 to 54.5	from 61.0 to 68.0
above average	from 66.6 to 70.4		from 55.5 to 59.5	from 48.0 to 52.00	from 54.5 to 59.5	from 68.0 to 75.0
high	over 70.4		over 59.5	over 52.0	over 59.5	over 75.0

Conclusion

All suggested ways of assessing the level of development the studied indexes are of a relative nature. They are bearers of the traditions and abilities of the best Bulgarian female discus throwers. The high level of validity and comprehensiveness is based on the fact that they reflect the level of studied abilities in the female elite discus throwing.

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Methodical aspects of the effects of physical activity application in physical education

Metodički aspekti primene
fizičke aktivnosti u fizičkom
vaspitanju

INTEGRATED TRAINING FOR PHYSICAL EDUCATION AND PHYSICAL ACTIVITY

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Introduction

The term integration (lat.) Means resuming, updating, making whole. The category of social integration is associated with the state of strong interdependence or consistency between the elements of the whole or the process that leads to it. The term is used in different variants, but it is always associated with an individual - a social system, a social environment. In today's conditions, motor activity is getting less and more complicated to compensate for the lack of movement. As a result, obesity, glandular disorder, decreased muscle strength, rapidity and coordination require targeted work through physical culture and sport.

The development and training of pre-school children is part of the overall preparation for early school-age education and training. The requirements for intellectual preparation and long stay in front of computer and TV screening have been increased. The systematic use of vehicles is also a precondition for immobilizing our children.

At pre-school age and school to compensate for the listed prerequisites and the resulting motor activity deficiency, it is imperative that we fight to prevent the biological needs of children from being disturbed. Very often immobilization is observed for subjective and objective reasons. One of them is a small number of steps. Motor activity is also defined as a regime showing physical effort in everyday life. The diverse social relationships in which the child enters his / her active muscular activity determine the psycho-physical readiness for schooling. Physical culture at pre-school and school age do not yet provide sufficient performance. One of the reasons is the missing or inadequate and outdated material base, insufficient training facilities. Negative influence on the physical development of children has frequent illnesses, unhealthy eating, excessive noise and vibrations, poor living conditions, increased nervous tension, abnormalities in the musculoskeletal system. Increases spinal distortion and other chronic diseases resulting from immobilization.

Today, the world's positions have firmly endorsed physical culture and sport as a systemic model of contemporary man's behaviour as an important value system of behavior and life. The main goal of education, as a component of health culture, is to focus on the formation of the necessary knowledge, skills and habits, and education as a second component, aimed at forming health behaviour and a desire for sport.

In order to counteract the deviations of children's health, programming systems have been developed to help the preschool educator achieve the desired results of his / her work. To actually measure the levels of physical development of children, teachers use diagnostic systems and, depending on the indicators covered, use measures, methodologies and tools with individual focus. Timely parents are informed about deviations from the child's normal development.

Method

Training in physical culture is training in activity, through means / exercises / defined goals, motives and results. The educational content is differentiated in four educational cores:

1. Physical capacity - including generic exercises and guiding exercises.
2. Motion learning: Forming social communication skills in mobile games.

3. Naturally applied motor activity: running, walking, jumping, throwing, drawing, building, rebuilding.

4. Sport-preparative motor activity: mastery of elements of children's basketball, volleyball, football, tennis, handball, etc. Among them are the free-choice ones: swimming, skiing, etc., taking into account the available base, the possibilities of the child, and the area of living.

Besides the planned workload of statutory and optional statutory situations, morning gymnastics, healing procedures / walks /, walks, walks that children engage with great desire and pleasure play an important place in achieving the goals of physical education and training. The knowledge as stated in the Program is the basis of the future cognitive and motor activity of the children and the readiness for school. The motor-cognitive training of the children has a full influence on the shaping of their personality. Effective implementation of various activities successfully solves specific educational, educational and healing tasks. Physical exercises with their diversity, local influence on all organs and systems. The structural and functional building of the body shapes the proper body and develops motor skills. Exercises that have been mastered and motor skills form the ability to consciously manage motor activity. The creative approach to the implementation of compulsory pre-school preparation and initial stage of primary school education presupposes and enables the realization, integration and socialization of children with different educational needs. In this respect, the educator with his / her qualifications and knowledge has a crucial role to play in their training. In some cases, with the assistance of a resource teacher, very good results are achieved. The implementation of appropriate training programs, implemented in a variety of forms, methods, means, good facilities, appliances and tools, specific goals, motivation and activity, can successfully achieve the relevant prophylaxis, impact and training to improve the motor activity and health status of the children.

Differentiating the concept of children with SEN. In pedagogical and psychological literature the concept of SEN children is defined by defining the medical model and the educational / social model. When determining normal child development, mental and physical age development is taken into account.

The conditions are:

1. Normal brain function.
2. Normal physical development of child-ability, tone, behavior.
3. Preserved sensory organs.
4. Systematic and consistent training in kindergarten, family and school.

Normal to the normal development is the leopard. In these children, the teacher should consider their individual abilities. You need to complete the writing technique and work with them individually. They are not children with deviations from normal, but with individuality. Many of them are talented children.

Results

Infringements in children with SEN are defined by the following categories:

- rams in the intellect;
- disorders in mental development;
- hearing disorders;
- visual disturbances;
- disorders in speech;
- Emotional disorders;
- severe multiple abnormalities;
- -isorders of the locomotory system.

Depending on the extent of these disorders, it is associated with the medical or educational social model. A medical system creates a system of special kindergartens and schools categorized by their medical

abuses. The other SEN children whose disabilities result from impaired functions or learning difficulties are admitted to general education schools or kindergartens, with the presence of two of these children forming a class with a minimum number of pupils. Unlike the medical model, education focuses on the type and extent of disorder and SEN needs that these children need. Integrated training in mainstream schools is introduced, creating a new education policy.

The legal basis for the educational integration of children with SEN. The UN Convention on the Rights of the Child recognizes the special needs of mentally and physically disabled children and regulates systematized assistance. Our legislation on equal opportunities for SEN children has also changed. Integrated education has been introduced for them in mainstream schools.

A PDO amendment was made in 2002, and admission to these children's special childcare facilities is taking place after exhaustion of the opportunities in the masses.

The training of children with SEN is carried out according to the SER. According to the Law on the Integration of People with Disabilities to RIE, teams for complex pedagogical assessment of children with psycho-physical abnormalities are set up. Creating resource centers for integrated training at the MES.

Regulation No. 5/2002 introduces the Resource Teacher, which regulates the opening of the job for this position for no less than 5pcs. Children with SEN in two mass schools.

In 2002, Ordinance 6 established SER for children with SEN. This Ordinance is updated with Ordinance 1/2009, specifying the organization of work, the supporting environment, the individual educational programs, the complex pedagogical evaluation and the coordinated activity of the resource centers.

The National Program for Education Development 2006-2015 has been adopted. The main objectives set in the Program are: Equal access to education and quality education for all children who do not have an equal start.

In 2008, a National Strategy for 2008-2018 has been adopted, which includes measures for work with children with SEN: (Cain, Daniel L. Cabbages,1993)

- work with parents;
- information campaigns for positive attitudes towards children with SEN;
- creating a supportive environment;
- qualifications and retraining of pedagogical staff;
- Resource provision for schools with resource teachers;
- optimization of special schools.

Through all the activities, methods, resources, environment, programs, measures, strategy, pedagogical and resource / resource teachers listed above, the results of SEN children would be great.

Conditions of Integrated Education. Integration of children with SEN is a complex process that needs to be carefully prepared to be successful. It is imperative to base the normative documents, strategies, programs, SER on its implementation. All requirements stemming from them must be fulfilled and applied to the need for training each child with SEN. The obligatory procedure, which is to be carried out consistently, is as follows:

- Creating a team for complex pedagogical assessment - including a resource teacher, speech therapist, rehabilitator, psychologist, doctor, kindergarten teacher and pedagogue specialist;
- -approval of an individual card and introduction of conclusions and recommendations for resource education or training in a specialized institution.
- preparation of an individual program for education and development with anticipation of learning outcomes.

- -professional and professional work with children with SEN and monitoring and reporting of learning outcomes, the socialization of these children and their integration into the natural environment of mass schools.

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Conclusion

Pedagogical correction and pedagogical support in integrated education. In the process of integrated education, different specialists participate through their work:

- -adagogical support of the pre-school teacher;
- -adagogical support of a psychologist;
- -co-ordination support of the Resource Teacher.

The concept of successful integration of children with SEN is to identify the potential opportunities for the education and development of each child. The integrated training should be done through teamwork in order to have the expected good results. It is imperative first of all to investigate the potential abilities of the infringing child in order to give a realistic assessment and then to contribute to the further development of each of the possibilities of a child.

This process is slow and complicated, but with the team in training and following the requirements of the normative documents concerning children with SEN, the desired results are achieved!

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EFFECTS OF APPLYING THE INTEGRATIVE PROGRAM IN THE TEACHING OF PHYSICAL EDUCATION

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Introduction

Integrative teaching involves linking the curriculum of several subjects into a special form of teaching making a unique whole of the content envisaged for learning through a specific concept. This concept represents an interdisciplinary approach to the contents of the subject that is learned by combining their goals. Interactive teaching does not involve linking only certain specific topics from different subjects such as conventional teaching (Alghamdi, 2017), but rather involves the restructuring of the curriculum (Rauschenbach, 1996) and its unification (Mammadov, 2016) in order to organize an appropriate teaching method that meets the requirements of multifunctionality. Due to the growing need to respond to the demands of the modern way of life and functioning that relate precisely to the multifunctionality which is one of the main goals of integrative teaching (Hare, 2010), and due to the fact that the physical activity of pupils in schools has been significantly reduced in recent years in all parts of the world (World Health Organization, 2009, Global health risks) where there is an increase in obesity and chronic diseases (World Health Organization, 2009, 2010), it is necessary to organize such a teaching method in which physical activity will become an integral part of all aspects of education. This is supported by the fact that physical education classes are the only physical activity of pupils during the day for over 80% of children (EU, 2008). From the above it can be concluded that it is necessary to introduce integrative teaching in schools because of the multifunctionality of knowledge that is acquired it with a special emphasis on physical activity.

In addition to being proven to have a positive impact on child health, a positive correlation between physical activity and cognitive performance among students in the categories of perceptual skills, intelligence, academic achievement, verbal abilities, mathematics, memory and level of development has been demonstrated (Negi et al. , 2016). Studies have confirmed the correlation between the speed of cognitive processes and motor responses (Popeska, Jovanova, 2016), which leads to the conclusion that it is advisable to organize classes that will stimulate cognitive processes using the motor skills of students. Additionally, physical activity shows positive effects on cognition and concentration (Chomitz et al., 2009). For this reason, we decided to implement the integrative teaching program of mathematics and physical education that we designed for the purpose of this research, in order to examine the effects of such a model of work.

Method

In the first phase of the research, students were tested on the experimental polygon of skills and speed with addition and subtraction, the time and success of crossing the polygon in each student was measured. Then, students were tested in five motor tests. In the second phase of the research, a program of integrative teaching which spanned over six physical education classes was held in correlation with mathematics education and used mathematical games in two separate first grade classes during the last 10 minutes of class. After the application of the experimental program of integrative teaching, the students crossed the same experimental polygon and tested the same motor skills. In the third phase of the research,

we compared the results of the initial testing with the results of the final testing - the performance at the experimental polygon at each check point (CP) and the comparison of motor skills.

The participants to whom the research relates is made up of students of the first grade of a private school in Belgrade, a total of 19 students (11 boys and 8 girls).

Motor skills tests were grouped according to the Bruininks-Oseretsky Test of Motor Proficiency on fine motor skills: body coordination and strength & agility tests (fine motor skills: fine manual coordination and manual coordination). The tests of motor skills used in this study are as follows: speed test (TS - running at 10m flying start), agility test (TA - running 3x10m), coordination test (TC - deflecting the ball from the wall for 15s from two meters away), balance test (TB - standing on one leg on the line with eyes closed, extended arms and one leg raised) and a manual coordination test (TMC - collecting coins with the stronger hand in the bowl for 15s). The experimental skill and speed polygon (APPENDIX 1) used in this study consists of 5 cells that pupils should cross, and for students to cross over the station they must first solve the mathematical task that is in front of them. If the students calculate the exact solution, they go through the station in one way, and if they calculate the incorrect solution, the students pass through the station in another way.

The experimental work program is the mathematical movement game used in the integrative program. These games are:

1. Mathematical Relay

Students are divided into two groups that are arranged in two rows one against the other. Among the groups, a number of cones are placed which are numbered from 1 to 20. When a mathematical expression is added with the addition or subtraction of up to 20, students who are first in the ranks must touch a bar with a baton that represents the solution of the mathematical expression. After touching a cone that they think is the solution to their task, they return to the starting position and hand over the baton to a friend from the same rank.

2. Mathematical line

Students are divided into 4 groups and stand on baseline of the basketball court, one behind the other in a group. The basketball court is divided into 4 equal parts using coloured scotch tape. Each line represents a specific set of numbers. The first line represents numbers from 1 to 5, the second line represents numbers from 6 to 10, the third line represents numbers from 11 to 15, and the fourth line numbers from 16 to 20. When the first students in the groups hear the mathematical task with addition and subtraction should stand on a line that represents a specific set of numbers in which the solution of their task is found and then return to the start of their group in order for the next member to start performing the new task.

3. Collect cards

Students are arranged on the outer edges of a volleyball court and when the teacher throws cards in the middle of the field, students are to pick up two cards which they must add together. Their next task is to find students with the same solution and form a set of the same solutions.

4. Replace the cones

There are cones on the basketball court under which are papers with mathematical tasks with addition and subtraction of up to 20. The number of cones is 3 less than the number of students. When students enter the hall, they must quickly occupy a cone and the students who have not managed to do so start to slowly run between the cones or other students. The teacher tells them to quickly trade places with students who have a solution of a certain number, for example 15, making sure that students who are running freely between them do not take their place. The game is repeated until all students change their place.

5. Mathematical bowling

In front of two groups of students bowling pins are placed with numbers up to 20. When a pupil knocks over the pins, he must collect the numbers that are on them, put them in the upright position and return to the head of their group.

6. The dominoes game

Dominoes are placed on the floor face down, and the students must approach them, turn the dominoes they have taken (each student takes one), sum up the numbers on the dominoes and when calculating the solution, they are carried in a ring that represents a set of even numbers or in a ring that represents a set of odd numbers. The game is repeated but this time with subtraction, as opposed to addition.

Comparison of the results was done by the T-test of the compared samples.

Results

The T-test of compared samples assesses the impact of applying the integrative teaching program of mathematics and physical education, designed for this experimental program, on the motor skills of students and on the academic achievements of students in the areas of addition and subtraction up to 10 over ten.

Table 1 shows the differences between initial and final measurements of students' performance on motor skills tests, in experimental polygon check points, and transition time (TT) through the experimental polygon.

In check point 1 ($p = 0.16$), 2 ($p = 0.05$), 4 ($p = 0.18$) and 5 ($p = 0.27$) on the experimental polygon, there is no significant statistical difference between initial and final measurements on the experimental polygon, of the given alpha level above 0.05 ($p > 0.05$), while in the check point 3 ($p = 0.04$) a statistically significant difference from the moment of the initial measurement to the moment of final measurement $p < 0.05$, the eta-square value shows that the effect of integrative program at check point 3 is large.

There is no significant statistical difference between initial and final measurements in motor tests for estimating speed, agility, coordination and balance, since the value of the given alpha level is above 0.05 ($p > 0.05$), while in the manual coordination assessment ($p = 0.00$) a statistically significant difference from the moment of the initial measurement to the moment of final measurement $p < 0.05$, and the eta-square value shows that the effect of integrative program on manual coordination is large.

A statistically significant difference was made when comparing time transition it took for students to pass the experimental polygon ($\alpha = 0.00$) from the moment of the initial measurement to the moment of the final measurement $p < 0.05$. The eta-square value shows that the effect of integrative instruction on improving the transition time of the polygon is large.

Table 1. Results of the T-test of the initial and final measurements of compared samples in motor skills tests, in the experimental polygon check points, and on the transition time through the experimental polygon

	M	Std. Dev.	t	df	p
TS (I) – TS (F)	-.01000	.21820	-.194	17	.848
TA (I) – TA (F)	.05389	1.15729	.198	17	.846
TC (I) – TC (F)	.722	2.052	1.493	17	.154
TB (I) – TB (F)	.98000	8.67463	.479	17	.638
TMC (I) – TMC (F)	-2.316	1.734	-5.822	18	.000
Check point 1 (I) – check point 1 (F)	.250	.683	1.464	15	.164
Check point 2 (I) – check point 2 (F)	.375	.719	2.087	15	.054
Check point 3 (I) – check point 3 (F)	.250	.447	2.236	15	.041
Check point 4 (I) – check point 4 (F)	.188	.544	1.379	15	.188
Check point 5 (I) – check point 5 (F)	.188	.655	1.145	15	.270
TT (I) – TT (F)	.51063	.63214	3.231	15	.006

Discussion

In variables of motor skills of speed, agility, balance and coordination, no statistically significant differences between initial and final measurements were found, while statistically significant differences were seen in the motor skills of manual coordination, which tells us that the effects of integrative teaching of mathematics and physical education influenced positively on this motoring ability.

In variables of the experimental polygon of skills and speed with mathematical tasks, there was a positive influence on the success of solving this polygon in cell number 3, while in other cells there was no statistically significant difference between the results obtained with the initial and final measurement.

In variables of the transition time of the experimental field of skill and speed with mathematical tasks, a statistically significant difference between the results obtained by the initial and final measurement were found, which tells us that the integrative teaching of mathematics and physical education influenced positively on this variable.

The disadvantages of this pilot study are primarily reflected in the lack of a control group so that the effect of the experimental program can be attributed to the new organization of time and learning process, and a small sample of respondents. Also, one of the disadvantages is the short time interval of the implementation of the experimental program (6 classes of physical education) in order to test the motor skills in a better way.

Conclusion

After the completion of the integration program of physical education and mathematics, created for this research, it can be concluded that the effects of its application in only six school hours positively influenced the manual coordination of students, and that such a program contributed in acquiring functional knowledge. Such research could, in the future, complement a wider picture of the need to introduce integrative teaching of more teaching subjects in the younger school age in order to improve academic achievement and raise the level of education, but also pointed to the need for such a form of planning and realization of the teaching process itself.

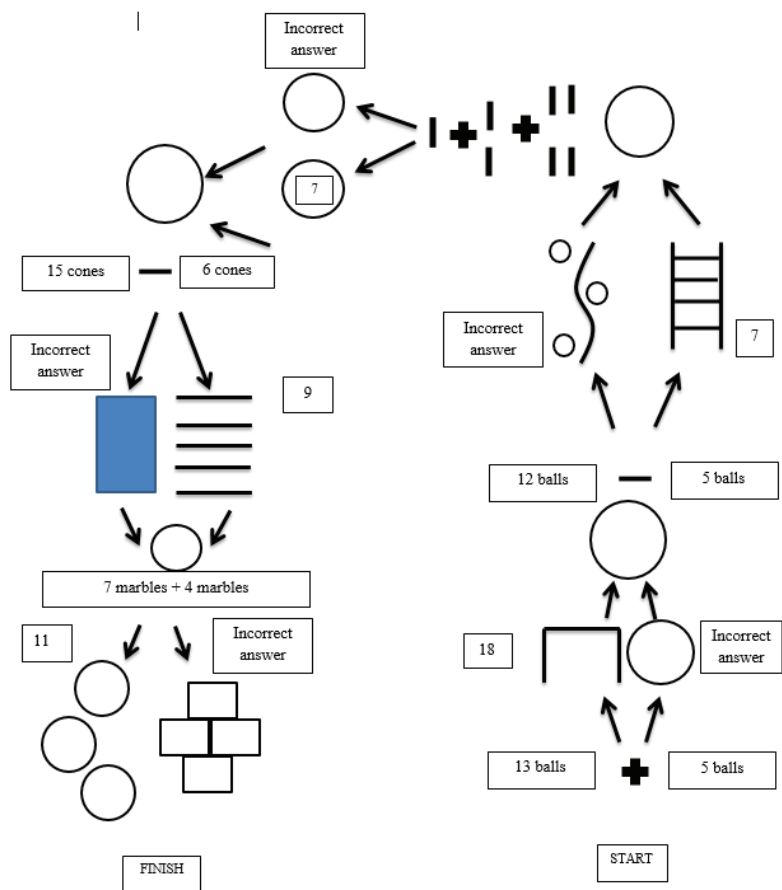
Key words: physical education, integrative teaching, mathematics, motor skills

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APPENDIX 1. Sketch of the experimental polygon



EFEKTI PRIMENE INTEGRATIVNOG PROGRAMA U NASTAVI FIZIČKOG VASPITANJA

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Uvod

Integrativna nastava podrazumeva povezivanje kurikuluma više predmeta u poseban oblik nastave čineći jedinstvenu celinu sadržaja predviđenih za učenje kroz poseban kocept. Taj kocept predstavlja interdisciplinarni pristup sadržajima predmeta koji se uče objedinjujući njihove ishode. Interaktivna nastava ne podrazumeva povezivanje samo određenih tema iz različitih nastavnih predmeta poput konvencionalne nastave (Alghamdi, 2017), već podrazumeva restrukturiranje kurikuluma (Rauschenbach, 1996) i njegovo sjedinjavanje (Mammadov, 2016) kako bi se organizovala svrsishodna nastava koja odgovara zahtevima multifunkcionalnosti. Usled sve veće potrebe da se odgovori na zahteve savremenog načina života i funkcionisanja koji se odnose upravo na multifunkcionalnost koja je jedna od glavnih odlika integrativne nastave (Hare, 2010), i usled činjenice da je u poslednje vreme fizička aktivnost učenika u školama značajno smanjena u svim delovima sveta (World Health Organization, 2009, Global health risks) pri čemu dolazi do povećanja stope gojaznosti i hroničnih bolesti (World Health Organization, 2009, 2010), neophodno je organizovati takvu nastavu kojom će fizička aktivnost postati integralni deo svih aspekata obrazovanja. Tome u prilog govori i podatak da su časovi fizičkog vaspitanja jedina fizička aktivnost učenika tokom dana za preko 80% dece (EU, 2008). Iz navedenog se može zaključiti da je neophodno uvesti integrativnu nastavu u škole zbog multifunkcionalnosti znanja koja se njome stiču sa posebnim akcentom na fizičkoj aktivnosti.

Osim što je dokazano da ima pozitivan uticaj na dečje zdravlje, dokazana je i pozitivna veza između fizičkih aktivnosti i kognitivnih performansi kod učenika u kategorijama: perceptualnih veština, inteligencije, akademskih postignuća, verbalnih sposobnosti, matematike, memorije i nivoa razvoja (Negi et al., 2016). Istraživanja su potvrdila povezanost brzine kognitivnih procesa i motoričkih reakcija (Popeska, Jovanova, 2016), što dovodi do zaključka da je poželjno i organizovanje nastave koja će stimulisati kognitivne procese koristeći motoričke sposobnosti učenika. Dodatno, fizička aktivnost pokazuje pozitivne efekte na kogniciju i koncentraciju (Chomitz et al., 2009). Zbog svega navednog, odlučili smo da sprovedemo program integrativne nastave matematike i fizičkog vaspitanja koji smo konstruisali za potrebe ovog istraživanja, kako bismo ispitali efekte takvog modela rada.

Metode istraživanja

U prvoj fazi istraživanja učenici su testirani na eksperimentalnom poligonu spretnosti i brzine sa sabiranjem i oduzimanjem izmereno je vreme i uspešnost prelaska poligona kod svakog učenika. Zatim su učenici testirani kroz pet motoričkih testova. U drugoj fazi istraživanja, održan je program integrativne nastave u trajanju od šest časova fizičkog vaspitanja u korelaciji sa nastavom matematike kroz matematičke igre u odeljenjima prvog jedan i prvog dva u poslednjih 10 minuta časova fizičkog vaspitanja. Nakon primene eksperimentalnog programa integrativne nastave, učenici su testirani istim eksperimentalnim poligonom i testirane su iste motoričke sposobnosti. U trećoj fazi istraživanja vršili smo poređenje rezultata inicijalnog testiranja sa rezultatima finalnog testiranja – uspešnost i vreme na eksperimentalnom poligonu kod svake stanice i poređenje motoričkih sposobnosti.

Populacija na koju se istraživanje odnosi, čine učenici prvog razreda jedne privatne škole u Beogradu, ukupno 19 učenika (11 dečaka i 8 devojčica). Testove motoričkih sposobnosti smo grupisali prema BOT podeli (Bruininks-Oseretsky Test of Motor Proficiency) na testove fine motorike (fine motor skills: fine manual coordination and manual coordination) i na testove grube motorike (gross motor skills: body coordination and strength & agility). Testovi motoričkih sposobnosti koji su se koristili u ovom istraživanju su sledeći: test brzine (TB - trčanje na 10m letećim startom), test agilnosti (TA - trčanje 3x10m), test koordinacije (TK - odbijanje lopte od zida za 15s sa dva metra udaljenosti od zida), test ravnoteže (TP - stajanje na jednoj nozi na liniji sa zatvorenim očima, raširenim rukama i podignutom jednom nogom) i test manualne koordinacije (TMK - sakupljanje novčića jačom rukom u posudu za 15s). Eksperimentalni poligon spretnosti i brzine (PRILOG 1), koji je korišćen u ovom istraživanju se sastoji iz 5 stanica koje učenici treba da pređu, a da bi učenici prešli preko stanice prethodno moraju da reše matematički zadatak koji je pred njima. Ukoliko učenici izračunaju tačno rešenje, prolaze kroz stanicu na jedan način a ukoliko izračunaju netačno rešenje učenici prelaze kroz stanicu na drugi način.

Eksperimentalni program rada predstavljaju matematičke igre sa kretanjem koje su se koristile u integrativnom programu. Te igre su:

1. Matematička štafeta

Učenici su podeljeni u dve grupe koje su raspoređene u dva reda jedna naspram druge. Između grupa je postavljen niz čunjeva na koje su zalepljeni brojevi od jedan do 20. Kada se izgovori matematički izraz sa sabiranjem ili oduzimanjem do 20, učenici koji su prvi u redovima moraju da dodirnu palicom koju imaju kod sebe čunj koji predstavlja rešenje matematičkog izraza. Nakon što dodirnu čunj za koji misle da je rešenje njihovog zadatka vraćaju se na početnu poziciju i predaju štafetu svom drugu iz svog reda.

2. Matematička linija

Učenici su podeljeni u 4 grupe i stoje na kraćoj aut liniji košarkaškog terena, jedan iza drugog u okviru grupa. Košarkaški teren je podeljen na 4 jednaka dela selotejp trakom u boji. Svaka linija predstavlja određen skup brojeva. Prva linija predstavlja skup brojeva od 1 do 5, druga linija predstavlja skup brojeva od 6 do 10, treća linija predstavlja skup brojeva od 11 do 15 i četvrta linija predstavlja skup brojeva od 16 do 20. Kada učenici koji su prvi u svojim grupama čuju matematički izraz sa sabiranjem i oduzimanjem treba da stanu na liniju koja predstavlja određeni skup brojeva u kom se nalazi rešenje njihovog zadatka i da se potom vrate na začelje svoje grupe kako bi njihov sledeći član krenuo u izvršenje novog zadatka.

3. Sakupi karte

Učenici su raspoređeni po spoljnim ivicama odbojkaškog terena i kada učitelj baci karte na sredinu terena, učenici pritrčavaju i sakupljaju po dve karte koje treba da saberu. Njihov sledeći zadatak je da pronađu učenike sa istim rešenjem i da formiraju skup istih rešenja.

4. Zameni čunjeve

Na košarkaškom terenu se nalaze čunjevi ispod kojih su nalepljeni papirići sa matematičkim izrazima sa sabiranjem i oduzimanjem do 20. Čunjeva ima 3 manje nego učenika. Kada učenici uđu u salu, brzo zauzimaju po jedan čunj a učenici koji nisu uspeli da zauzmu čunjeve počinju lagano da trče između čunjeva odnosno ostalih učenika. Učitelj govori da se brzo zamene sa mestima učenici kod kojih je rešenje određeni broj npr. 15, vodeći računa o tome da im učenici koji trče slobodno između ne zauzmu mesto. Igra se ponavlja dok svi učenici ne zamene svoje mesto.

5. Matematičko kuglanje

Ispred učenika koji su podeljeni u dve grupe se postavljaju čunjevi za kuglanje na koje su zalepljeni brojevi do 20. Kada učenik obori čunjeve, mora da im pritrči, sabere brojeve koji su na njima, ispravi čunjeve i vrati se na začelje svoje grupe.

6. Igra dominama

Na podu se nalaze domine okrenute licem na dole, učenici im prilaze, okreću domine koje su uzeli (svako po jednu), sabiraju brojeve na dominama i kada izračunaju rešenje, nose je u obruč koji predstavlja skup parnih brojeva ili u obruč koji predstavlja skup neparnih brojeva. Igra se ponavlja ali sa operacijom oduzimanja.

Poređenje rezultata je izvršeno T-testom zavisnih uzoraka.

Rezultati istraživanja

T-testom zavisnih uzoraka procenjen je uticaj primene programa integrativne nastave matematike i fizičkog vaspitanja, osmišljenog za ovaj eksperimentalni program, na motoričke sposobnosti učenika i na akademska postignuća učenika u oblastima sabiranja i oduzimanja u okviru desetice i sa prelaskom preko desetice.

U tabeli 1. prikazane su razlike između inicijalnog i finalnog merenja uspešnosti učenika na testovima motoričkih sposobnosti, kod stanica eksperimentalnog poligona, i vremena prelaska (VP) preko eksperimentalnog poligona.

Kod stanica 1 ($p = 0.16$), 2 ($p = 0.05$), 4 ($p = 0.18$) i 5 ($p = 0.27$) na eksperimentalnom poligonu, ne postoji značajna statistička razlika između inicijalnih i finalnih merenja na eksperimentalnom poligonu, jer je vrednost zadatog alfa nivoa iznad 0.05 ($p > 0.05$), dok je kod stanice 3 ($p = 0.04$) uočena statistički značajna razlika od trenutka inicijalnog merenja do trenutka finalnog merenja $p < 0.05$, vrednost eta kvadrata pokazuje da je uticaj integrativne nastave kod stanice 3 veliki.

Kod motoričkih testova za procenu brzine, agilnosti, koordinacije i ravnoteže ne postoji značajna statistička razlika između inicijalnih i finalnih merenja jer je vrednost zadatog alfa nivoa iznad 0.05 ($p > 0.05$), dok je kod testa procene manualne koordinacije ($p = 0.00$) uočena statistički značajna razlika od trenutka inicijalnog merenja do trenutka finalnog merenja $p < 0.05$, a vrednost eta kvadrata pokazuje da je uticaj integrativne nastave na manualnu koordinaciju veliki.

Utvrđena je statistički značajna razlika prilikom upoređivanja vremena koje je bilo potrebno učenicima da pređu eksperimentalni poligon ($\alpha = 0.00$) od trenutka inicijalnog merenja do trenutka finalnog merenja $p < 0.05$. Vrednost eta kvadrata pokazuje da je uticaj integrativne nastave na poboljšanje vremena prelaska poligona veliki.

Tabela 1. Rezultati T-testa zavisnih uzoraka inicijalnog i finalnog merenja na testovima motoričkih sposobnosti, kod stanica eksperimentalnog poligona, i vremena prelaska preko eksperimentalnog poligona

	M	Std. Dev.	t	df	p
TB (I) – TB (F)	-,01000	,21820	-,194	17	,848
TA (I) – TA (F)	,05389	1,15729	,198	17	,846
TK (I) – TK (F)	,722	2,052	1,493	17	,154
TR (I) – TR (F)	,98000	8,67463	,479	17	,638
TMK (I) – TMK (F)	-2,316	1,734	-5,822	18	,000
Stanica 1 (I) – stanica 1 (F)	,250	,683	1,464	15	,164
Stanica 2 (I) – stanica 2 (F)	,375	,719	2,087	15	,054
Stanica 3 (I) – stanica 3 (F)	,250	,447	2,236	15	,041
Stanica 4 (I) – stanica 4 (F)	,188	,544	1,379	15	,188
Stanica 5 (I) – stanica 5 (F)	,188	,655	1,145	15	,270
VP (I) – VP (F)	,51063	,63214	3,231	15	,006

Diskusija

U varijablama motoričkih sposobnosti brzine, agilnosti, ravnoteže i koordinacije nisu utvrđene statistički značajne razlike između inicijalnog i finalnog merenja, dok su se kod motoričke sposobnosti

manualne koordinacije utvrđene statistički značajne razlike što nam govori da su efekti primene integrativne nastave matematike i fizičkog vaspitanja uticali pozitivno na ovu motoričku sposobnost.

U varijablama stanica eksperimentalnog poligona spretnosti i brzine sa matematičkim zadacima, primećen je pozitivan uticaj na uspešnost rešavanja ovog poligona kod stanice broj 3, dok kod ostalih stanica nije zabeležena statistički značajna razlika između rezultata dobijenih inicijalnim i finalnim merenjem.

U varijablama vremena prelaska eksperimentalnog poligona spretnosti i brzine sa matematičkim zadacima, uočena je statistički značajna razlika između rezultata dobijenih inicijalnim i finalnim merenjem, što nam govori da je integrativna nastava matematike i fizičkog vaspitanja imala pozitivan uticaj na ovu varijablu.

Nedostaci ovog pilot istraživanja ogledaju se prvenstveno kroz nepostojanje kontrolne grupe kako bi se sa sigurnošću efekat eksperimentalnog programa mogao pripisati novoj organizaciji časa i procesu učenja, i mali uzorak ispitanika. Takođe, jedan od nedostataka predstavlja kratak vremenski interval sprovođenja eksperimentalnog programa (6 časova fizičkog vaspitanja) kako bi se kvalitetnije ispitale testirane motoričke sposobnosti.

Zaključak

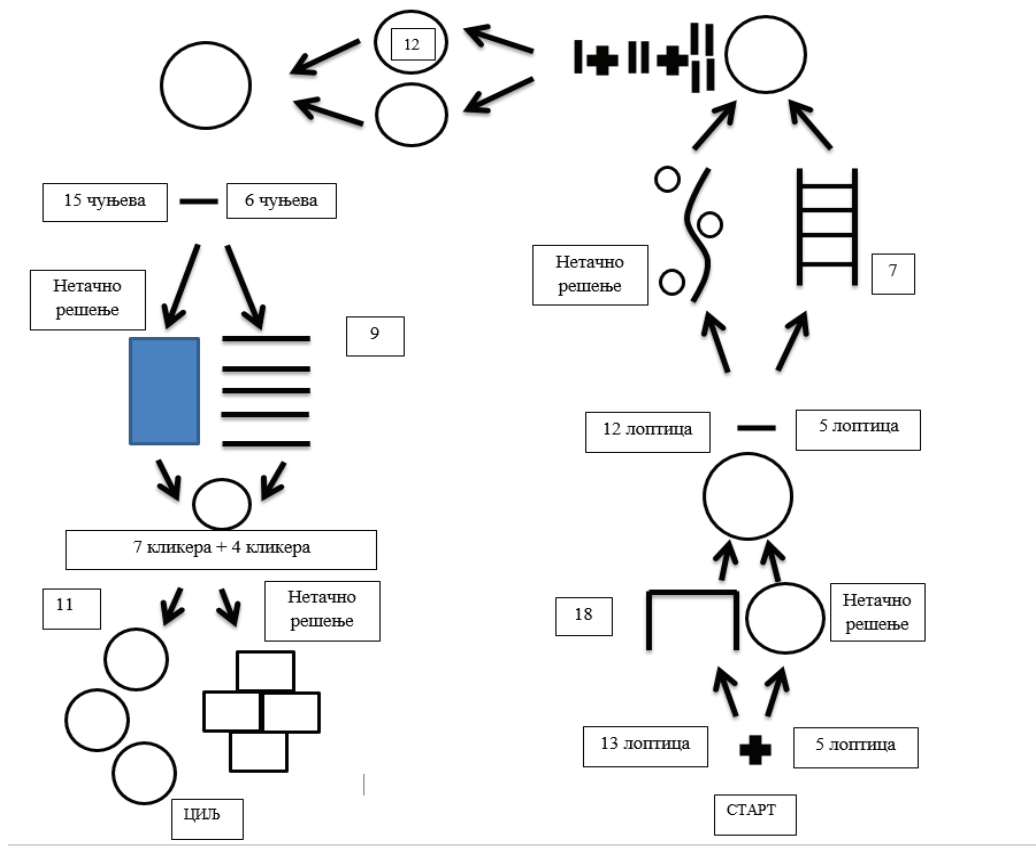
Nakon završetka primene programa integrativne nastave fizičkog vaspitanja i matematike, kreiranog za potrebne ovog istraživanja, može se zaključiti da su efekti njegove primene za samo šest školskih časova pozitivno uticali na manualnu koordinaciju učenika, i da je ovakav program doprineo učenicima u sticanju funkcionalnih znanja. Ovakva istraživanja bi ubuduće mogla upotpuniti jednu širu sliku o potrebi uvođenja integrativne nastave više nastavnih predmeta u mlađem školskom uzrastu kako bi se učenička akademska postignuća unapredila i nastava podigla na jedan viši nivo, ali i ukazalo na neophodnost ovakvog oblika planiranja i realizovanja samog procesa nastave.

Ključne reči: fizičko vaspitanje, integrativna nastava, matematika, motoričke sposobnosti

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Prilog 1. Skica eksperimentalnog poligona



AN OVERVIEW ON RESEARCH INTO PHYSICAL ACTIVITY AND OBESITY IN CHILDREN OF SCHOOL AGE FROM 7 TO 10 YEARS

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Introduction

Obesity (lat. Obesity) is a chronic disease manifested by an excessive accumulation of body fat and increase in body weight.¹ Any increase in body weight by 10% or more of the ideal is referred to as obesity. The increasing prevalence of obesity carries a risk in childhood for the formation of associated metabolic, endocrine, cardiovascular, orthopedic, and other diseases and disorders. The nutritional status of children is one of the important indicators of children's health, their mental and physical capabilities and potential for normal healthy growth and development. The main cause of obesity is an imbalance between food intake and energy consumed. Consumption of energy can be divided into three main components: the energy consumption in the standby mode, the thermal physical activity and food effects. Physical activity of children has decreased significantly in recent years and the energy intake is too high in relation to the reduced activity.² The legacy is one factor that has a strong influence on the occurrence of obesity. The last few years have increasingly showing about the connection between obesity and epigenetic factors. Epigenetic factors are modified phenotype due to changes in gene expression that are not caused by changing the DNK sequence. Certain substances, known as the "endocrine disrupting chemicals" may alter the function of the gene and the fetus, and changing a metabolic system, preordination it for obesity in later life. This code is called epigenetic code.³ The epidemic of this disease is around the world continues to increase, while the largest increase in the number of obese recorded in the United States, and obesity among the major diseases of modern civilization, reaching almost epidemic proportions, and more recently in childhood.^{4,5}

Method

In this study I have used the applied method. Accordingly, it was carried out collecting the necessary scientific research, their review and analysis of current knowledge about the connection between these two categories.

Results with discussion

Physical activity of children has significantly decreased in recent years, and energy intake significantly increased compared to the reduced activity. Obesity is more common in children who watch television on a daily basis due to reduced energy consumption and the simultaneous intake of high calorie foods. Children in schools from first to fourth grades have physical education three times a week, a little number of children engaged in regular physical activity in their free time. Studies have found a link between obesity and time spent watching television (especially three or more hours), both in adults and children. The results of several studies in relationship between the number of hours spent next to tv place and obesity in children have shown that obese children will be 50% more than those who frequently watch television (more than 35 hours per week). Results of a large number of studies carried out over the last two decades have shown that the prevalence of overweight receives epidemic character in many parts of the world. The prevalence of obesity among children and adolescents aged 5-17 years in the world is 2-3%, and overweight, including obesity 10%.⁶ It is estimated that in the world today there are approximately 150 million obese

children. The study for the prevention of obesity - Kiel Obesity Prevention Study (KOPS), conducted in Germany investigated the risk factors for obesity in children and young people. Cross-sectional study included 6 249 children and young people aged 5 - 16 years and 1 087 children aged 5 - 11 years, followed by the fourth period. For both girls and boys, factors are overweight and obese parents, brother and sister overweight, smoking parents, living with a single parent.⁷ Some of the consequences brought by the obesity of children were operated and are manifested in adulthood include the following: type 2 diabetes mellitus, myocardial infarction, cancer, osteoarthritis, complicated pregnancies. Also, obesity in childhood is monitored and the effects of the cardiovascular system (early atherosclerosis, hypertension) and metabolic (hyperinsulinism, insulin resistance, Impaired Glucose Tolerance, Diabetes mellitus type 2 DM, irregular menstruation). According to Zdravkovic D. (2008), about 60-85% of obese school-aged children remain obese in adulthood. At the same time, emphasizes Zdravkovic, the probability that obese children aged from four years to be obese in adulthood is approximately 20%, and for obese adolescents to 80%. The conclusion is: Obesity in childhood increases the risk of morbidity in later age, regardless of whether it is present in adulthood. Obesity in childhood reaches epidemic proportions in all industrialized countries, with the largest increase registered in the United States. According to WHO, obesity is highest in the countries of North America, Central and Eastern Europe as well as countries in the Middle East. In Europe, from the consequences of obesity, 350. 000 people died annually of which 30% were obese in childhood. It is anticipated that in Europe about 26 million (36%) of school children to be overweight, and that of this number, eight million will be obese.⁸ Different studies in Europe estimate that 10-30% of children aged 7 - 11 overweight. The highest prevalence of obesity was registered in Southern European countries, especially in Spain (27% children), Italy (36% of children aged 9 years) and Greece (26% of boys and 19% of girls aged 6 - 17 years). In the countries of Northern Europe, the prevalence of obesity was slightly lower in the UK 20% of children, 18% of Sweden at the age of 10 years, Finland 13% dece.⁹ interesting results have come and Bonvin et al in their study, conducted in 2012 in Switzerland. They study included 58 children's institutions and randomly allocated 529 children. They studied their motor skills, physical activity, and their body weight. The results showed that 13% of children are obese, and the boys are less common because they are much more active than girls. Today, at a time of rapid urbanization and technological development, obesity in children takes on the character of the epidemic. Children who have a higher volume of daily activities, about 45-55 minutes with a normal body weight, whereas children who spend less on physical activity (18 minutes a day) and watch more TV and sit at the computer becoming obese. Increased physical activity can help prevent the occurrence of obesity, particular in school-Strauss uzrasta.¹⁰ RS (2000) conducted a study to psychological factors during 4 using the sample of the 1 520 children aged 9-10 years, which has been directed to the influence of obesity the samopoštovnje. The results showed that 19% of obese children feel sad, 48% feel boredom and 21% feel nervous. Compared with their normal weight children is 8% feel sad, 42% feel boredom and 12% anxiety. By analyzing the results of research in 22 countries in Europe, in children aged about 10 years, overweight and obesity according to the criteria in most BMI kg / ITT think-tank ranges from 13% in Finland to 36% in Italy, while in our 16-17 %. The study "Physical activity is a significant factor in preventing obesity in children", which was conducted in Bosnia and Herzegovina, which was intended to show the influence of physical activity and sedentary lifestyle on the development of moderate obesity in children. The study involved 1,204 students between the ages of 6-10 years old in the region of Banja Luka. moderate obesity and obesity according to the criteria in most BMI kg / ITT think-tank ranges from 13% in Finland to 36% in Italy, while in our 16-17%. The study "Physical activity is a significant factor in preventing obesity in children", which was conducted in Bosnia and Herzegovina, which was intended to show the influence of physical activity and sedentary lifestyle on the development of moderate obesity in children. The study involved 1,204 students between the ages of 6-10 years old in the region of

Banja Luka. moderate obesity and obesity according to the criteria in most BMI kg / ITT think-tank ranges from 13% in Finland to 36% in Italy, while in our 16-17%. The study "Physical activity is a significant factor in preventing obesity in children", which was conducted in Bosnia and Herzegovina, which was intended to show the influence of physical activity and sedentary lifestyle on the development of moderate obesity in children. The study involved 1.204 students between the ages of 6-10 years old in the region of Banja Luka. The prevalence of obesity in boys aged 6-10 years was 10.4% and with an elevated body mass was 15.7% of respondents. Physical activity of the child has been defined the practice of sports activities, as follows: 1. by little and rarely, 2. Occasionally 3. I often and regularly. Of all respondents recorded 12.2% moderately obese and 6% obese. Only in girls found significant correlation between several hours of television viewing and obesity level. Girls who are to television carried out for 1 hour had significantly lower BMI than females that have been carried out before the TV 4 or more hours. Boys who spent 4 hours or more before the TV had the highest BMI, while in girls is not found between obesity and time spent in front of computer. This study showed the positive effect of intense physical activity on a normal BMI in girls and boys. In Montenegro at present there are no reliable data on the number of obese children but according to an analysis of systematic review of students can be concluded that this figure is about 20%. According to research by the Center for Combating nutrition, Podgorica more than 50% of the food you eat pupils in the schools make the snacks, 40% of the fast food and sandwiches, a fruit accounts for less than 5% of their menu. The most popular food for them as potato, fast food and slatkiši.¹¹ More than 60% of the children did not know the details of your height and weight. In the frame of a status which is in cooperation with UNICEF, implemented by the Institute of Public Health in 2007 in children aged 6-11 years, were carried out and anthropometric measurements. Based on these results 29. 5% of students above age had overweight.¹¹ The problem of overweight was more pronounced among boys (36.6%) than in girls (22.4%), in Italy. Distribution and level of obesity in children and adolescents is significantly increased in the Republic of Serbia. Strategies to increase physical activity is one of the key elements in the treatment of obese children with proper nutrition. In Serbia, there are no national standards of growth and development of children (growth charts), which further complicates the problem of monitoring. The survey conducted by the Ministry of Health of the Republic of Serbia in 2013 ukazaje the growing trend of obesity among the population of the Republic of Serbia. Compared to 2006 in children has been an increase from 8.5% to 13.7% obese. The study, which was conducted as an epidemiological cross-sectional study and is part of the project "Monitoring the growth and development of children in Serbia", which are conducted under the auspices of UNICEF Institutes of Health in Serbia and health centers in 2002 and 2003. In this paper, the data as obtained by anthropometric measurements 10 274 of the children (5 Phone: 021 boys and 5 253 girls), the territory of Nisava district from the four age groups (since the age of six to seven years from the age of eight to nine years from the age of 11 and up to 12 years from age 14 and up to 15 years of age). Obesity of children of school age in the area of Nisava district is becoming an increasingly important public health problem. Body mass index over the 85 th percentile had a total of 14.3% of girls aged 7 to 15:19% girls aged 12 examined children Nisava District. Representation of obesity in children Nisava district is similar in Vojvodina, a little lower than in developed countries. In 2009, on the territory of the examined 192 children aged 7 and 9 years old. Assessment of nutritional status of children was carried out based on the following indicators: body height, body mass, and calculated body mass index values were compared with the reference value minus the tables of growth and development of children of the World Health Organization in 2008. Assessment of nutritional examined children showed that the sample was inadequately nourished 73 children (38.02%) of which is overweight were 32 (16.67%), obese 34 (17.71%), and 10 (21.5%) were undernourished. Research conducted by Ostojic and colleagues aimed to: a) investigate the prevalence of overweight and obesity among school children in Serbia, b) determine the relationship between physical activity and body weight in children of school age in the

Republic of Serbia. The research was conducted on a sample of 754 boys and 367 girls aged 6-14 years. All study subjects were taken antropometry rate, BMI, waist circumference, body fat, aerobic capacity, and condition of the physical ability. A significant difference was found in the prevalence of obesity between boys and girls. The boys have a much smaller volume of BMI, waist diameter, values of skinfold thickness and body fat than girls. From this study it was concluded that there is a negative relationship between body fat and VO2 max, that this relationship is very high, ie. that is a strong relationship between negaivno aerobic capacity and physical thickness.¹² The fact that a fifth of children in Serbia are moderately overweight requires the mobilization of the entire community in the development and promotion of organized programs of obesity prevention at the primary level of health care and education in the direction of desirable nutritional habits and a healthy lifestyle. How obesity in children in the world begins to take the epidemiological situation, a large number of scientists and health professionals dedicated to solving the problem. Accordinally he executed a large number of studies from which they obtained numerous programs. One of the programs implemented to reduce body weight and maintaining it in children's Mend program, which exists in England. Mend is changing the way of life, which is a fun course for parents and children whose weight is above the average for their ages. It provides practical and sound advice about healthy eating Mend (Mind, Exercise, Nutrition, Do-it) program lasts nine weeks and after that children 8 to 12 years are becoming healthier, and more confident than before. Before the beginning of the program performs the measurement as at the end of the program, and all the time he followed technical field, contacts that include letters, meetings and phone conversations. Mend program shows a pleasant and interesting ways for children to consent to the movement and removes the feeling of competition. Eca gradually raise your level of fitness, strength and agility. There is evidence that during and after the completion of the MEND program, children feel better physically, mentally and emotionally as well as parents perceive the overall positive transformation in their children. MEND program monitors the progress of each child as well as the success of any prgram using online communities analyzing data as database development and improving their services. System ONLINE offers calculate BMI for DDEC ages of 5 - 13 years, where they can base on the results to see how their child is obese as well as more information on obesity and what offers MEND program how and where they can join in the program, the address is access all day. 18 The problem of child and adolescent obesity in Serbia tends to increase, and taken significant measures in the prevention and prophylaxis of these diseases. The Ministry of Health has approved the project "Prevention and treatment gojaynosti when children and adolescents in Serbia", and allow the creation of programs for solving this problem. The program is implemented in the Special Hospital for metabolic diseases Čigota Zlatibor, called "Čigotica", and it is on a team of experts in the field of medicine, psychology and physical culture. In Serbia, strong interest to participate in the program "Čigotica", expressed in the past few years by obese children and their parents throughout the Republic of Serbia and neighboring countries.

Conclusion

The prevalence in obesity of children is increasing across the world especially in the developed industrialized countries, but also many developing countries. Various studies in Europe estimate that 10-30% of children aged 7-11 years old overweight. The highest prevalence of obesity was registered in Southern European countries, especially in Spain (27% of children and adolescents), Italy (36% of children aged 9 years) and Greece (26% of boys and 19% of girls aged 6 - 17 years). In the countries of Northern Europe, the prevalence of obesity was slightly lower in the UK 20% of children, 18% in Sweden at the age of 10 years, Finland 13% of children. Based on the results of research on the impact of physical exercise on obesity in school-age children from 7-10 years, we can conclude that physical activity primarily affects the prevention of obesity and its treatment. Also, it should be noted that physical activity is not a method which

leads to a fast reduction of body weight, or in combination with a dietary food, makes it easy to achieve and maintain a therapeutic effect achieved. For long-term success is crucial to initiating treatment at an early stage of development of obesity. Initially excess calories usually lead to an increase in size (hypertrophic obesity), and when fat cells reach their maximum volume, their number begins to increase ("hiperplasia obesity"). Vukavić, T. concludes that prevention of obesity can be achieved: "A planned education of the population, especially the education of pre-school and school children. Correction obesity is achieved only through persistent and long-lasting work of a professional team with motivated cooperation of the child or adolescent they do, through the combined intervention measures. We need to create the objectives of the intervention in a child or adolescent periods and their parents should be involved.

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PREGLED ISTRAŽIVANJA O POVEZANOSTI FIZIČKE AKTIVNOSTI I GOJAZNOSTI KOD DECE ŠKOLSKOG UZRASTA OD 7 DO 10 GODINA

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Uvod

Gojaznost (lat. *obesitas*) je hronična bolest, koja se ispoljava prekomernim nakupljanjem masti u organizmu i povećanjem telesne težine. Svako povećanje telesne težine za 10% i više od idealne označava se kao gojaznost.¹ Rastuća prevalencija gojaznosti nosi rizik već u detinjstvu za nastanak udruženih metaboličkih, endokrinih, kardiovaskularnih, ortopedskih, i drugih bolesti i poremećaja. Uhranjenost dece je jedan od važnih pokazatelja zdravlja dece, njihovih psihofizičkih mogućnosti i potencijala za normalan zdrav rast i razvoj. Osnovni uzrok gojaznosti je disbalans između unete hrane i utrošene energije. Energetska potrošnja može da se podeli u tri glavne komponente: energetska potrošnja u mirovanju, fizička aktivnost i termički efekti hrane. U dečjem uzrastu sadržaj masti se menja uzrastom.² Fizička aktivnost dece je značajno smanjena poslednjih godina, energetska unos hrane je previsok u odnosu na smanjene aktivnosti. Nasleđe je jedan od faktora koji ima snažan uticaj za pojavu gojaznosti. Poslednjih nekoliko godina sve više ima govora o povezanosti gojaznosti sa epigenetskim faktorima. Epigenetski faktori su izmene fenotipa usled promena genske ekspresije koje nisu uzrokovane promenom sekvence DNK. Određene materije, poznate kao "endocrine disrupting chemicals" mogu izmeniti funkcionisanje gena i fetusa, i menjajući njegov metabolički sistem, preodrediti ga za gojaznost u kasnijem životu. Ovakav kod se naziva epigenetski kod i prenosi se na kasnije ćelijske generacije, a ponekad i na potomstvo.³ Epidemija ovog oboljenja je širom sveta u stalnom porastu, dok je najveće povećanje broja gojaznih zabeleženo u SAD, pa se gojaznost svrstava među vodeće bolesti savremene civilizacije, dostižući praktično epidemijske razmere, a u novije vreme i u detinjstvu.^{4,5} Cilj ovog rada je da kroz pregled niza izvršenih istraživanja, u svetu i u Republici Srbiji ukaže na stepen povezanosti fizičke aktivnosti i gojaznosti kod dece školskog uzrasta od 7 do 10 godina kako bi se utvrdio uticaj redovnog sprovođenja fizičke aktivnosti na prevenciju gojaznosti.

Metod

U radu je korišćena primenjena metoda. Shodno tome je obavljeno prikupljanje neophodnih naučnih istraživanja, njihovom pregledu i analizi dosadašnjih saznanja o povezanosti ove dve kategorije.

Rezultati sa diskusijom

Gojaznost nastaje kao rezultat neravnoteže između energetske potrošnje i energetske unosa. Fizička aktivnost dece je značajno smanjena poslednjih godina, energetska unos značajno povećan u odnosu na smanjene aktivnosti. Gojaznost je češća kod dece koja svakodnevno gledaju televiziju zbog smanjene potrošnje energije i istovremenog unosa visoko kalorične hrane. Deca u školama od prvog do četvrtog razreda imaju nastavu fizičkog vaspitanja 3 puta nedeljno, a sve manji broj dece se bavi redovnom fizičkom aktivnošću u slobodnom vremenu. Istraživanja su utvrdila postojanja veze između gojaznosti i vremena provedenog u gledanju televizije (posebno tri ili više sati), kako kod odraslih tako i kod dece. Rezultati nekoliko studija o povezanosti između broja sati provedenog kraj tv-a i gojaznosti kod dece pokazuju da će deca biti gojazna 50% više od onih koji često gledaju televiziju (više od 35 sati nedeljno).

Rezultati velikog broja studija izvedenih u poslednje dve decenije su pokazali da učestalost prekomerne telesne mase dobija epidemijski karakter u mnogim delovima sveta. Prevalencija gojaznosti u populaciji dece i adolescenata uzrasta od 5-17 godina u svetu iznosi 2-3%, a prekomerne uhranjenosti, uključujući gojaznost 10%.⁶ Procenjuje se da danas u svetu ima oko 150 miliona gojazne dece. Studija za prevenciju gojaznosti – Kiel Obesity Prevention Study (KOPS), sprovedena u Nemačkoj je istraživala faktore rizika za nastanak gojaznosti kod dece i mladih. Studija preseka je obuhvatila 6 249 dece i mladih uzrasta 5 – 16 godina, i 1 087 dece uzrasta 5 – 11 godina, praćeno u četvorogodišnjem periodu. Kod oba pola činioci su predgojaznost i gojaznost roditelja, predgojaznost breće i sestara, pušenje roditelja, život sa jednim roditeljem.⁷ Neke od posledica koje sa sobom nosi gojaznost iz dečjeg uzrasta i ispoljavaju se u odrasloj dobi su sledeći: dijabetes melitus tipa 2, infarkt miokarda, maligne bolesti, osteoartritis, komplikovana trudnoća. Takođe, gojaznost u detinjstvu je praćena i posledicama kardiovaskularnog sistema (rana ateroskleroza, hipertenzija) i metaboličkog (hiperinsulinizam, rezistencija na insulin, poremećaj tolerancije na glukozu, dijabetes melitus tipa 2, neredovnost menstruacija). Po rečima D. Zdravkovića (2008), približno 60-85% gojazne dece školskog uzrasta ostaje gojazno u odrasloj dobi. Pri tome, naglašava Zdravković, verovatnoća da gojazno dete uzrasta od četiri godine bude gojazno i u odrasloj dobi iznosi približno 20%, a za gojaznog adolescenta čak 80%. Zaključak je da gojaznost u detinjstvu povećava rizik od morbiditeta u kasnijem uzrastu, bez obzira da li je prisutna i u odrasloj dobi. Gojaznost u detinjstvu dostiže epidemijske razmere u svim industrijalizovanim zemljama, pri čemu je najveći porast registrovan u Sjedinjenim Američkim Državama. Prema podacima SZO, gojaznost je najveća u zemljama Severne Amerike, srednje i istočne Evrope, kao i u zemljama Srednjeg istoka. U Evropi, od posledica gojaznosti, umire 350. 000 ljudi godišnje od kojih je 30% bilo gojazno u dečjem uzrastu. Predviđa se da će u Evropi oko 26 miliona (36%) dece školskog uzrasta biti preuhranjeno, a da će od tog broja osam miliona biti gojazno.⁸ Različite studije u Evropi procenjuju da je 10-30% dece uzrasta od 7 - 11 preuhranjeno. Najveća prevalencija gojaznosti je registrovana u južnoevropskim zemljama, posebno u Španiji (27% dece), Italiji (36% dece uzrasta 9 godina), I Grčkoj (26% dečaka, odnosno 19% devojčica uzrasta 6 - 17 godina). U zemljama Severne Evrope prevalencija gojaznosti je nešto niža: u Velikoj Britaniji 20% dece, Švedskoj 18% u uzrastu od 10 godina, a Finskoj 13% dece.⁹ Do zanimljivih rezultata su došli i Bonvin i saradnici u svom istraživanju, sprovedenom 2012. godine u Švajcarskoj. Oni su istraživanjem obuhvatili 58 dečjih ustanova i nasumično izdvojili 529 dece. Proučavali su njihove motoričke sposobnosti, fizičke aktivnosti, i njihovu telesnu težinu. Rezultati istraživanja su pokazali da je čak 13% dece, već u tom uzrastu gojazno, kao i da su dečaci manje zastupljeni, jer su mnogo više aktivniji od devojčica. Ishrana dece i fizička aktivnost se menjaju poslednjih nekoliko decenija. Urbanizacija, sa smanjenjem površina predviđenih za igru prepreka je za bavljenje fizičkom aktivnošću a tome velikim udelom doprinosi i napredak visokih tehnologija (kompjuteri, tv, video igre, telefoni, društvene mreže). Rezultat tehnološkog napretka su smanjena fizička aktivnost i sedentirani način života. Danas, u vreme urbanizacije i ubrzanog tehnološkog razvoja, gojaznost kod dece poprima karakter epidemije. Deca koja imaju veći obim dnevnih aktivnosti, oko 45-55 minuta imaju normalnu telesnu težinu, dok deca koja se manje troše na fizičke aktivnosti (18 minuta dnevno), a više gledaju televiziju i sede za kompjuterom postaju gojazna. Pojačana fizička aktivnost preventivno deluje na pojavu gojaznosti, posebno kod dece školskog uzrasta.¹⁰ Strauss RS (2000) je sproveo istraživanje psiholoških faktora u trajanju od 4 godine na uzorku od 1.520 dece uzrasta od 9-10 godina koje je bilo usmereno na uticaj gojaznosti na samopoštovnje. Rezultati su pokazali da 19% gojazne dece se oseća tužno, 48% oseća dosadu i 21% oseća nervozu. U poređenju sa njima normalno uhranjena deca se 8% osećaju tužno, 42% oseća dosadu i 12% nervozu. Analizom rezultata istraživanja u 22 zemlje u Evropi, kod dece uzrasta oko 10 godina, umerena gojaznost i gojaznost prema kriterijumima u većini BMI kg/itT IOTF kreće se od 13% u FInskoj, do 36% u Italiji, dok je kod nas 16-17%. Studija "Fizička aktivnost značajan faktor u sprečavanju gojaznosti u dečjem uzrastu", koja je sprovedena u

Bosni i Hercegovini, a koja je imala za cilj da ukaže na uticaj fizičke aktivnosti i sedentarnog načina života na razvoj umerene gojaznosti kod dece. Studija je obuhvatila 1.204 učenika uzrasta od 6-10 godina u regiji Banja Luke. Prevalencija gojaznosti kod dečaka uzrasta 6-10 godina bila je 10.4% dok je sa povišenom telesnom masom bilo 15.7% ispitanika. Fizička aktivnost deteta je bila definisana upražnjavanjem sportske aktivnosti i to: 1. po malo i retko, 2. povremeno 3. često i redovno. Od svih ispitanika zabeleženo je 12.2% umereno gojaznih i 6% gojaznih. Jedino je kod devojčica pronađena značajna povezanost između višečasovnog gledanja televizije i stepena gojaznosti. Devojčice koje su pred televizijom provodile 1 sat imale su značajno manji ITM od devojčica koje su pred televizijom provodile 4 i više sati. Dečaci koji su provodili 4 sata i više pred TV imali su najveći ITM, dok kod devojčica nije pronađena povezanost gojaznosti i vremena provedenog pred kompjuterom. Ova studija je pokazala pozitivan uticaj intenzivne fizičke aktivnosti na normalan ITM kod devojčica i dečaka. U Crnoj Gori trenutno nema pouzdanih podataka o broju gojazne dece ali se prema analizi sistematskih pregleda učenika može zaključiti da je ta brojka oko 20%. Prema istraživanjima Centra za borbu protiv uhranjenosti, iz Podgorice više od 50% hrane koju jedu učenici u školama čine grickalice, 40% je brza hrana i sendviči, a voće čini manje od 5% njihovog jelovnika. Najpopularnija hrana za njih su krompir, brza hrana i slatkiši.¹¹ Više od 60% dece nije znalo podatke o svojoj visini i težini. U okviru istraživanja jednog statusa koje je u saradnji sa UNICEF-om realizovao Institut za javno zdravlje u 2007. godini kod dece uzrasta 6-11 godina, vršena su i antropometrijska merenja. Na osnovu tih rezultata 29.5% učenika navedenog uzrasta je imalo prekomernu telesnu masu. Problem prekomerne telesne mase je bio izraženiji kod dečaka (36.6%), nego kod devojčica (22.4%), u Italiji. Rasprostranjenost i nivo gojaznosti kod dece i adolescenata se značajno povećava i u Republici Srbiji. Sedentirani i nizan nivo fizičke aktivnosti predstavljaju značajne faktore koje je potrebno preduprediti kako bi se gojaznost kod dece smanjila a samim tim prenela i u odraslo doba. Strategije za povećanje fizičke aktivnosti jedan su od ključnih elemenata u lečenju gojazne dece zajedno sa pravilnom ishranom. U Republici Srbiji ne postoje nacionalni standardi rasta i razvoja dece (grafikoni rasta), što dodatno otežava problem monitoringa. Istraživanje koje je sproveo Ministarstvo zdravlja Republike Srbije u 2013. godini ukazuje na trend porasta gojaznosti među stanovništvom Republike Srbije. U odnosu na 2006. godinu kod dece je primetan porast sa 8.5% gojaznih na 13.7%. Istraživanje koje je radjeno kao epidemiološka studija preseka i deo je projekta "Praćenje rasta i razvoja dece u Srbiji" koji su pod pokroviteljstvom UNICEFA sproveli Instituti i Zavodi za zaštitu zdravlja u Srbiji i Domovi Zdravlja tokom 2002. i 2003. godine. U ovom radu su prikazani podaci dobijeni antropometrijskim merenjem 10 274 dece (5 021 dečaka i 5 253 devojčica) sa teritorije Nišavskog okruga iz četiri uzrasne grupe (od navršene šeste do sedme godine, od navršene osme do devete godine, od navršene 11-te do 12-te godine i od navršene 14-te do 15-te godine). Gojaznost dece školskog uzrasta na prostoru Nišavskog okruga postaje sve značajniji socijalno medicinski problem. Indeks telesne mase preko 85-og percentila imalo je ukupno od 14,3 % devojčice uzrasta 7 godina, do 15.19 % devojčice uzrasta 12 godina ispitane dece Nišavskog okruga. Zastupljenost gojaznosti kod dece Nišavskog okruga je slična sa područjem Vojvodine, a nešto manja u odnosu na razvijene zemlje. Tokom 2009. godine, na teritoriji Vojvodine je ispitano 192 deteta, uzrasta od 7 i 9 godina. Procena ishranjenosti dece vršena je na osnovu sledećih pokazatelja: telesne visine, telesne mase, kao i izračunate vrednosti indeksa telesne mase su upoređivane sa referentnim vrednostima u tablicama rasta i razvoja dece Svetske zdravstvene organizacije iz 2008. godine. Procena ishranjenosti ispitane dece je pokazala da je u uzorku bilo neodgovarajuće ishranjeno 73 dece (38.02%), od čega je sa prekomernom telesnom masom bilo 32 (16.67%), gojazno 34 (17.71%), a 10 (5.21%) ih je bilo pothranjeno. Istraživanje koje su sproveli Ostojić i saradnici imalo je za cilj da: a) istraže učestalost prekomerne težine i gojaznosti među školskom decom u Srbiji, b) odrede vezu između fizičke aktivnosti i telesne mase kod dece školskog uzrasta u Republici Srbiji. Istraživanje je vršeno na uzorku od 754 dečaka i 367 devojčica uzrasta 6-14 godina. Svim ispitanicima uzimane su antropometrijske mere, BMI, obim struka,

telesna masnoća, aerobni kapacitet, i stanje fizičkih sposobnosti. Značajna razlika je pronađena u učestalosti gojaznosti između dečaka i devojčica. Dečaci imaju znatno manji obim BMI, prečnik struka, vrednosti debljine kožnog nabora i telesne masnoće u odnosu na devojčice. Iz ove studije zaključeno je da postoji negativan odnos između telesne masnoće i VO2 max, da je taj odnos veoma visok, tj. da je negativno snažan odnos između aerobnog kapaciteta i telesne debljine.¹² Činjenica da je petina dece u Srbiji umereno gojazna nalaže mobilizaciju čitave zajednice u razvijanju i unapređivanju organizovanih programa prevencije gojaznosti na primarnom nivou zdravstvene zaštite i edukaciji u pravcu poželjnih nutritivnih navika i zdravog stila života. Kako gojaznost kod dece u svetu počinje da poprima epidemiološke razmere, veliki broj naučnika i zdravstvenih radnika posvetio se rešavanju problema. Shodno tome je izvršen veliki broj istraživanja iz kojih su dobijeni mnogobrojni programi. Jedan od programa koji se sprovodi za redukciju telesne mase i njeno održavanje kod dece je Mend program, koji postoji u Engleskoj. Mend je menjanje načina života, koji predstavlja zabavan kurs za decu i roditelje čija je težina iznad proseka za njihove godine koji obezbeđuje servis za pomaganje deci i njihovim porodicama, da nauče kako da oboljšaju zdravlje, fizičku aktivnost i da vole svoje telo. Pruža praktične i zdrave savete o zdravoj ishrani Mend (Mind, Exercise, Nutrition, Do-it), program traje devet nedelja i nakon toga deca od 8-12 godina postaju zdravija, i samopouzdanija nego ranije. Pre početka programa vrši se merenje kao i na kraju programa, a sve vreme je praćeno porgramima, kontaktima koji uključuju pisma, okupljanja i telefonske razgovore. Mend program pokazuje prijatne i zanimljive načine da se deca privole na pokret i odstrani osećaj takmičenja. Deca postepeno podižu svoj fitness nivo, snagu i agilnost. Dokazano je da se u toku i nakon završetka MEND programa deca osećaju bolje fizički, mentalno i emotivno kao i da roditelji opažaju ukupnu pozitivnu transformaciju kod svoje dece. MEND program prati napredak svakog deteta kao i uspeh svakog programa pomoću ONLINE Sistema, analizirajući bazu podataka kao i poboljšavajući razvoj njihovih usluga. Sistem ONLINE nudi izračunavanje BMI za decu uzrasta od 5 – 13 godina, gde mogu na osnovu rezultata da vide koliko je njihovo dete gojazno kao i da se više informišu o gojaznosti i šta nudi MEND program kako i gde se mogu priključiti u program, adresa je dostupna svakodnevno svima.¹⁸ Problem dečje i adolescentne gojaznosti u Srbiji ima tendenciju porasta, pa se preduzimaju značajne mere u prevenciji kao i profilaksi ove bolesti. Ministarstvo zdravlja je odobrilo projekat "Prevencija i lečenje gojaznosti kod dece i adolescenata u Srbiji", i omogućilo stvaranje programa za rešavanje ovog problema. Program se sprovodi u Specijalnoj bolnici za bolesti metabolizma Čigota na Zlatiboru, pod nazivom "Čigotica", i u njega je uključen tim stručnjaka iz oblasti medicine, psihologije i fizičke culture. U Republici Srbiji, izuzetno interesovanje za učešće u program "Čigotica", iskazano je u proteklih nekoliko godina od strane gojazne dece i njihovih roditelja širom Republike Srbije i susednih zemalja, kao i prvi rezultati u redukciji telesne mase kod gojazne dece, veoma su ohrabrujući. To ukazuje na jačanje svesti dece o individualnog odgovornosti za sopstveno zdravlje (što je osnovni cilj i ključni elemenat programa za prevenciju, lečenje i rehabilitaciju gojazne dece, zaslužuje punu podršku i solidarnost društva. U centru za prevenciju i lečenje gojaznosti kod dece i adolescenata od avgusta 2008. do oktobra 2015. godine je lečeno 3 950 gojaznih iz Republike Srbije i susednih zemalja.

Zaključak

Prevalencija gojaznosti kod dece se povećava širom sveta posebno u razvijenim industrijalizovanim zemljama, ali i brojnim zemljama u razvoju. Različite studije u Evropi procenjuju da je 10-30% dece uzrasta 7-11 godina prekomerno uhranjeno. Najveća prevalencija gojaznosti je registrovana u južnoevropskim zemljama, posebno u Španiji (27% dece i adolescenata), Italiji (36% dece uzrasta od 9 godina), i Grčkoj (26% dečaka, odnosno 19% devojčica uzrasta od 6 – 17 godina). U zemljama Severne Evrope prevalencija gojaznosti je nešto niža: u Velikoj Britaniji 20% dece, u Švedskoj 18% u uzrastu od 10 godina, a Finskoj 13% dece. Na osnovu prikazanih rezultata istraživanja o uticaju fizičkog vežbanja na gojaznost kod dece školskog

uzrasta od 7-10 godina, možemo zaključiti da fizička aktivnost prvenstveno utiče na sprečavanje gojaznosti i njeno lečenje. Takođe, treba istaći da fizička aktivnost nije postupak koji dovodi do brze redukcije telesne mase, ali u kombinaciji sa dijetetskom ishranom, olakšava postizanje i održavanje postignutog terapijskog efekta. Za dugoročan uspeh od ključnog značaja je počinjanje lečenja u što ranijem stadijumu razvoja gojaznosti. U početku višak kalorija dovodi uglavnom do porasta dimenzija (hipertrofična gojaznost), a kada masne ćelije dostignu svoju maksimalnu zapreminu, njihov broj počinje da se povećava ("hiperplastilna gojaznost"). Vukavić, T. zaključuje da prevencija gojaznosti može da se postigne: "samo planskom edukacijom stanovništva, posebno edukacijom predškolske i školske dece. Korekcija gojaznosti postiže se tek upornim i dugotrajnim radom tima profesionalaca, uz motivisanu saradnju deteta ili adolescenta kojim se bave, kroz kombinovane interventne mere. Veća je verovatnoća da će se postići interventni ciljevi kod deteta ili adolescenta, ako se i roditelji, kao njihov model ponašanja uključe. Za postizanje uspeha u lečenju gojaznosti redovni kontrolni pregledi kod nadležnog pedijatra su od izuzetnog značaja. Takođe, predškolske ustanove, osnovne i srednje škole, univerziteti moraju biti nosioci zdravstvene prevencije kroz sticanje znanja i navika vezanih za zdrav način života, putem ishrane i fizičke aktivnosti. Potrebno je kreiranje savremenih modela edukacije o pravilnim nutritivnim navikama i zdravom načinu života dece.

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PHYSICAL ACTIVITY AMONG MEDICAL STUDENTS

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Introduction

Physical inactivity has been singled out as a leading risk factor for chronic non-communicable disease (1). It has been associated with obesity, metabolic syndrome, cardio-vascular disease, type 2 diabetes, breast and colon cancer, but also with depression and anxiety (2).

During the transition from late adolescence to early adulthood, physical activity levels decrease (3). Young adults spend a lot of their time in sedentary activities, they often consume lot of alcohol, and smoking prevalence is high, which all present risk factors for cardio-vascular disease (4). World health organization (WHO) recommends minimum of 150 minutes of physical activity of moderate intensity per week, or 75 minutes of vigorous physical activity per week (5). Intensity of physical activity is defined based on energy expenditure, expressed in METs. Low intensity physical activities are those with energy expenditure of 1.8-2.9METs, moderate physical activities are those with expenditure of 3.0-5.9METs, while vigorous physical activities are those with energy expenditure of more than 6 METs (6).

Medical students, a specific group of young adults, are familiar with all the benefits of physical activity and recommendations, but theoretical knowledge is rarely accompanied with healthy lifestyles (3, 7). Factors associated with physical activity levels in this population group are not well researched (8). On the other hand, medical students are exposed to high levels of stress (9), which can have negative influence on their cognition and learning capacity (9, 10), and consequential poor academic success. Association between physical activity and cognition, self-esteem, alertness, mood, stress level and increase of attention span and focus is well established (9).

Medical students are future health professionals and will be responsible for conduction of health promotion programs (8) and for advising patients about minimal physical activity levels, its intensity, form and duration (11). Study done among physicians in United States showed that only 10% of physicians advised their patients about physical activity, or organized some education (12). This is concerning, since repeated advising of patients about physical activity, done by their health care provider are proven to increase physical activity (13). Since general practitioners see the high number of patients and are commonly the first contact of patients with health care system, this is particularly true for them (13). Possibilities for improvement of physical activity level of large number of people in general population lie in a fact that 90% of patients admitted that they would start to be physically active if their physician advices them to be, and almost 70% of adults visit their general practitioner at least once a year (14).

Physicians own physical activity is also of high importance, since physically active doctors are more likely to give advice to their patients about the necessity of physical activity, but they also give more detailed instructions on type, frequency and intensity of advised activity (8, 11, 15). Opposite is also true, physicians who do not comply with minimum physical activity recommendations, obese and overweight physicians are less likely to give advice about physical activity (16). US data show that 55% of male and 25% of female physicians are overweight or obese, and that very small percentage of them complies with recommendations for physical activity (17).

Physical activity level can be assessed with various objective and subjective measures (18). Most commonly used objective measures are accelerometers and pedometers, while questionnaires and diaries are used as subjective measures (18).

Physical activity of general population in Serbia was studied as a part of National Health Survey in 2013 (19), and it showed that nearly 90% of adults in Serbia do not comply with recommendations about minimal physical activity on weekly basis. These results are similar to those from a National Health Survey in 2000, when 86.3% of population was physically inactive (20). Results from a National Survey in 2006 were significantly better, as 25.5% of adults said they have vigorous physical activity at least three times per week (21). Physical activity was also assessed among school children in Belgrade (22), which showed that only 31% of them reach recommended levels.

To the best of our knowledge no study on physical activity done among students in Serbia assessed physical activity levels or type of physical activity done by students, as well as factors associated with physical activity. Frequency of physical activity of students at Belgrade University was studied indirectly, as a part of research on quality of life, and this research showed that only 28% of students have some type of physical activity on regular basis (23).

With all this in mind, we designed the study to assess physical activity level among first and fifth year students at Medical Faculty, Belgrade, which could lead to development of health promoting programs aimed at this specific population group.

Methods

Cross-sectional study, among 1006 students, was done between the October and December of 2016, at the Medical Faculty Belgrade. Study population included 549 first and 457 fifth year students, who attended the classes at Social Medicine department during the fall semester. Response rate was 87.3% (878/1006). Research instrument was a pretested questionnaire. Pretesting was done in three stages in order to determine if the questions are clear, understandable, if their order and duration was adequate. Final questionnaire was designed as an online questionnaire, available on Google platform. It consisted of 77 questions divided in eight sections. Sections were: 1. Socio-demographic and socio-economic data; 2. Current physical activity level; 3. Satisfaction with current physical activity; 4. Desired physical activity level; 5. Preferred form of physical activity; 6. Self-rated well-being; 7. Health status and family health history; 8. Lifestyle.

Students were asked to fill in the questionnaire during the class. This was voluntary and anonymous. All students who agreed to participate in the research had their height, weight and waist circumference measured by one of the researchers. Measurements were done individually, in order to provide privacy for the participants.

Total of 44 variables were included into the research. These variables were: sex, age, self-perceived financial status, transportation, commuting time, physical activity level, energy expenditure in METs and in Kcal, Body mass index, satisfaction with current physical activity level, reasons for omitting physical activity, desire to improve physical activity, preferred type of physical activity, types of physical activity students plan to participate in, smoking status, cannabis consumption in the past year, anxiety medications, binge drinking in the past year, and daily intake of fruit and vegetables.

As an indicator of physical activity Metabolic equivalents were used (METs). Energy expenditure was calculated for each participant based on data on type of physical activity, frequency and duration of physical activity.

Energy expenditure for physical activity of high intensity was calculated using the following formula: MET/week=number of days with physical activity*duration in minutes*8. Energy expenditure for physical

activity of moderate intensity was calculated using the following formula: MET/week=number of days with physical activity*duration in minutes*4. Energy expenditure for physical activity of low intensity was calculated using the following formula: MET/week=number of days with physical activity*duration in minutes*3.3. Based on energy expenditure students were then classified into three groups, according to recommendations by World Health Organization (24).

In the group with low level of physical activity were students with energy expenditure of <600 METs, moderate physical activity group was consisted of students with energy expenditure of 601-3000 METs, while students of energy expenditure of >3000METs were in high physical activity group.

Daily calorie expenditure was then calculated using the data on students' weight. Body mass index was expressed as kg / m². Binge drinking was defined as consumption of six or more alcoholic beverages during one occasion at least once in the past 12 months. Use of anti-anxiety medications was defined as use of any substance with anti-anxiety effect before the exam or when preparing for the exam.

Ethical committee of Belgrade Medical Faculty approved the research. Students were informed about the purpose for the research. Participation was voluntary and anonymous. Students could decide to withdraw from the research at any point. We considered that students who filled in the questionnaire gave the consent for participation.

Descriptive analysis included absolute and relative numbers (percentages). Chi-square test and T-test were used in order to assess differences between students with different levels of physical activity regarding socio- demographic characteristics and lifestyle characteristics. All variables which were significant ($p < 0.05$) were entered into a multinomial regression model (including Odds Ratio - OR and 95% Confidence Interval - CI) with physical activity level as outcome variable. The IBM SPSS Statistics 19.0 package was used for these analyses.

Results

Prevalence of students with high levels of physical activity was 22.7% (199/878), 97 among first year students (19.6%) and 102 (26.7%) among fifth year students, $p=0.004$.

Majority of students were female (67.7%), most of the students used public transportation for daily commute (77.6%).

Students in the groups of low, moderate and high physical activity differed on sex, with males having the higher frequency of students with high level of physical activity (27.6% vs. 20.4%, $p=0.025$). Among the students who perceived their own health as 'good' 22.9% had a high levels of physical activity, compared to only 6.3% among the students how perceived their health as 'poor', $p=0.048$. (Table 1)

Table 1. Students' characteristics and physical activity level

Characteristics	Physical activity level				p-value
	Total No (%)	Low No (%)	Moderate No (%)	High No (%)	
Sex					
Male	283 (32.2)	35 (12.4)	170 (60.1)	78 (27.6)	0.025
Female	594 (67.7)	102 (17.2)	371 (62.5)	121 (20.4)	
Transportation					
Car	8 (0.9)	3 (37.5)	3 (37.5)	2 (25.0)	0.161
Bicycle	21 (2.4)	4 (19.0)	9 (42.9)	8 (4.0)	
Public transport	681 (77.6)	110 (16.2)	418 (61.4)	153 (22.5)	
Walking	168 (19.1)	20 (11.9)	112 (66.7)	36 (21.4)	
<i>Average commute time</i>	29.11±0.66	26.86±1.357	28.88±0.75	31.32±1.83	
Self-perceived financial status					
Poor	144 (16.7)	22 (15.3)	88 (61.1)	34 (23.6)	0.943
Average	319 (37.1)	51 (16.0)	193 (60.5)	75 (23.5)	
Good	397 (46.2)	57 (14.4)	252 (63.5)	88 (22.2)	
Self-perceived health					
Poor	16 (1.8)	6 (37.5)	9 (56.3)	1 (6.3)	0.048
Average	111 (12.7)	19 (17.5)	73 (65.8)	19 (17.1)	
Good	749 (85.5)	112 (15.0)	458 (61.1)	179 (23.9)	

There was not a statistically significant difference in average BMI of students with low, moderate and high levels of physical activity (22.08 ±0.29 vs. 22.25±0.14 vs. 22.71±0.23, respectively, p=0.153). Almost a half of the students with high levels of physical activity were satisfied with their physical activity level (41.4%), along with only 4.4% of students with low level of physical activity, p<0.001. (Table 2)

Table 2. Satisfaction with current physical activity level

	Level of physical activity				p-value
	Total No (%)	Low No (%)	Moderate No (%)	High No (%)	
Satisfied with physical activity level	173 (19.8)	6 (4.4)	85 (15.7)	82 (41.4)	<0.001
Physical activity during previous week					
Decreased	368 (41.9)	67 (18.2)	245 (66.6)	56 (15.2)	<0.001
Average	465 (53.0)	66 (14.2)	279 (60.0)	120 (25.8)	
Increased	45 (5.1)	4 (8.9)	18 (40.0)	23 (51.1)	
I would like to increase my physical activity level	825 (94.1)	130 (15.8)	519 (62.9)	176 (21.3)	<0.001

Almost three quarters of students with low levels of physical activity named lack of time as main reason for omitting physical activity during the previous week (73.7%). On the other hand, this was named as a reason by 60.9% of students with moderate and only 44.2% of students with high levels of physical activity, p<0.001. More than a third of students with low level of physical activity named tiredness (36.5%), while almost a fifth named a lack of will as a reason for omission of physical activity. (Table 3)

Table 3. The most common reasons for omission of physical activity among students with low, moderate and high levels of physical activity

	Level of physical activity				p-value
	Total No (%)	Low No (%)	Moderate No (%)	High No (%)	
Lack of time	519 (59.1)	101 (73.7)	330 (60.9)	88 (44.2)	<0.001
Tiredness	272 (31.0)	50 (36.5)	175 (32.3)	47 (23.6)	0.024
Lack of will	124 (14.1)	27 (19.7)	83 (15.3)	14 (7.0)	0.002
I do not like exercising	42 (4.8)	12 (8.8)	26 (4.8)	4 (2.0)	0.017
Other	40 (4.6)	7 (5.1)	25 (4.6)	8 (4.0)	0.891

Students with high levels of physical activity in a significantly higher percent named individual workout in a gym and team sports as their favorite forms of physical activity. (Table 4)

Table 4. Favorite forms of physical activities of students with low, moderate and high levels of physical activity

	Level of physical activity				P-value
	Total No (%)	Low No (%)	Moderate No (%)	High No (%)	
Hiking	458 (52.2)	69 (50.4)	296 (56.4)	93 (46.7)	0.147
Running/jogging	263 (30.0)	33 (24.1)	159 (29.3)	71 (35.7)	0.065
Walking	578 (65.8)	85 (62.0)	367 (67.7)	126 (63.3)	0.319
Individual gym workout	220 (25.1)	27 (19.7)	128 (23.6)	65 (32.7)	0.012
Group gym workout	156 (17.8)	19 (13.9)	100 (18.5)	37 (18.6)	0.429
Team sport	239 (27.2)	28 (20.4)	140 (25.8)	71 (35.7)	0.004
Swimming	275 (31.3)	47 (34.3)	167 (30.8)	61 (30.7)	0.714
Skiing/winter sports	135 (15.4)	28 (20.4)	79 (14.6)	28 (14.1)	0.199
Dancing	205 (23.3)	33 (24.1)	132 (20.4)	40 (20.1)	0.467
Other	33 (3.8)	3 (2.2)	18 (3.3)	12 (6.0)	0.131

Students with low levels of physical activity in a significantly higher percent named hiking as an activity they are planning to take on (51.8% of students with low physical activity level, 45.6% of students with moderate physical activity level and 38.2% of students with high physical activity level, $p=0.041$). Students with high levels of physical activity in a significantly higher percent said they are planning to start with individual workouts in a gym (35.2% of students with high, 28.8% of students with moderate and 20.4% of students with low levels of physical activity, $p=0.014$). (Table 5)

Table 5. Physical activities students are planning to take on in the next month

	Level of physical activity				p-value
	Total No (%)	Low No (%)	Moderate No (%)	High No (%)	
Hiking	394 (44.9)	71 (51.8)	247 (45.6)	76 (38.2)	0.041
Running/jogging	271 (30.9)	39 (28.5)	162 (29.9)	70 (35.2)	0.310
Individual gym workout	254 (28.9)	28 (20.4)	156 (28.8)	70 (35.2)	0.014
Group gym workout	138 (15.7)	19 (13.9)	89 (16.4)	30 (15.1)	0.734
Team sports	128 (14.6)	16 (11.7)	76 (14.0)	36 (18.1)	0.220
Swimming	172 (19.6)	26 (19.0)	107 (19.7)	39 (19.6)	0.980
Skiing/winter sports	65 (7.4)	16 (11.7)	34 (6.3)	15 (7.5)	0.097
Dancing	112 (12.8)	17 (12.4)	78 (14.4)	17 (8.5)	0.106
Other	13 (1.5)	2 (1.5)	5 (0.9)	6 (3.0)	0.112

There was a significantly higher percent of students who admitted taking antihypertensive medications among students with high level of physical activity (8.0%) compared to 4.1% among students with moderate and 2.9% among students with low levels of physical activity, $p=0.043$. (Table 6)

Table 6. Lifestyle characteristics, diet and substance use among students with low, moderate and high levels of physical activity

	Physical activity level				p-value
	Total No (%)	Low No (%)	Moderate No (%)	High No (%)	
Antihypertensive medications use	42 (4.8)	4 (2.9)	22 (4.1)	16 (8.0)	0.043
Current smokers	189 (21.6)	31 (22.6)	106 (19.6)	52 (26.3)	0.137
Use of cannabis in the past 12 months	91 (10.4)	9 (6.6)	57 (10.5)	25 (12.7)	0.201
Binge drinking	419 (47.8)	60 (43.8)	256 (47.3)	103 (51.8)	0.336
Anxiety medications use	110 (12.5)	19 (2.9)	59 (3.5)	32 (5.0)	0.146
Daily intake of fruit and vegetables	165 (18.8)	27 (19.7)	104 (19.2)	34 (17.1)	0.771

Multinomial regression analysis showed that students with high levels of physical activity had higher likelihood of being satisfied with own physical activity level (OR: 15,053, 95% CI: 6,304-35,943), to like team

sports (OR: 2,152, 95% CI: 1,264-3,663), to plan to start working out in a gym (OR: 2,103, 95% CI: 1,238-3,571), but they also had a lower likelihood for use of antihypertensive medications (OR: 0,284, 95% CI: 0,089-0,907). Students with moderate levels of physical activity also had higher likelihood of being satisfied with their physical activity level when compared to students with low physical activity. (Table 7)

Table 7. Multinomial regression analysis with physical activity level as an outcome variable

	Level of physical activity	
	Moderate OR (95% CI)	High OR (95% CI)
Satisfied with physical activity during the previous week	3.992 (1.703-9.357)	15.053 (6.304-35.943)
I prefer team sports	1.332 (0.839-2.114)	2.152 (1.264-3.663)
I plan to start working out in a gym	1.539 (0.973-2.434)	2.103 (1.238-3.571)
Antihypertensive medications use	0.659 (0.222-1.958)	0.284 (0.089-0.907)

*reference category: low level physical activity

Discussion

Total of 83.4% of students were in a groups of moderate or high physical activity, which means that we had a higher percentage of physically active students compared to previously published studies (1, 9). Male students were more physically active than females, which is in accordance with the results from a study of students' lifestyles in Poland which showed that 60% of male and only 49.5% of female students were sufficiently physically active on regular basis (25). The most common reason for omission of physical activity by our students was a lack of time, which confirms the results from Brazil, in which more than 50% of students named a lack of time as a main reason for omitting regular physical activity (26). The main reason for this is in the fact that students have a lot of work related to the faculty and are forced to make compromises regarding the way they spend their free time, and the majority of them would rather give up on a physical activity than some other, mostly, passive forms of relaxation, or meeting with friends.

Our study showed that students with high level of physical activity had a four times lower likelihood of need to use antihypertensive medications. Although, positive effects of physical activity on patients with hypertension is beyond any doubt (27, 28, 29), direct association between physical activity level among young adults and arterial pressure at that age is still to be confirmed (26).

Although, we did not find a significant difference in most of preferred forms of physical activity between the students with low, moderate and high levels of physical activity, students with high levels of physical activity had a two times higher odds to prefer team sports or individual gym workout. Considering the fact that both team sports and gym workouts are the most widely available forms of physical activity, this could be one of the reasons why students who prefer these exact types of activity have higher levels of it. Intrinsic motivation, which directly emanates from enjoyment in some activity, has a major influence on sustaining the healthy lifestyles (30).

This study was the first to examine the levels of physical activity, among large sample of students, as well as factors associated with it. One of the strengths of this study is also high response rate (87.3%). This study has several limitations. Since this is a cross sectional study causal relationship between the variables cannot be established. This study was done on a population of Medical students, and since this is specific population, these results cannot be generalized to entire student population. Data were collected with a questionnaire, and consequently there is a possibility for a recall bias or that even though the questionnaire was anonymous some participants did not want to share some information, which is also something that should be kept in mind when interpreting the study findings.

Conclusion

Medical students have high level of physical activity. There are significant differences between students with different levels of physical activity. Physical activity should be made more accessible to students through development of collaboration between sports centers and students organizations. Internal motivation of students to fulfill their free time with physical activity rather than passive forms of rest should be thoroughly fostered.

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TEACHER'S COMPETENCES FOR PERFORMING PHYSICAL EDUCATION FOR PUPILS WITH PHYSICAL DISABILITIES

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Introduction

Children with developmental difficulties are children who are experiencing difficulties in development that and because of that will not be able to reach or maintain a certain level of health or development. Their health or development is likely to be seriously damaged or worsened unless they receive additional support and support from institutions in the areas of health care, rehabilitation, education, social welfare and others. (Išpanović, Radojković, 2007, according to Bouillet, 2010). Pupil with disability is a pupil whose ability to interact with the surrounding factors limits his effective, full and equal participation in the educational process with other students (Rule book on Primary and Secondary Education and Pupils with Disabilities (Official Gazette 24/15), Article 2). Although the integration of pupils with disabilities into regular schools is increasing, there is still fear and numerous challenges that accompany involment of pupils with disabilities in the regular classroom. According to Report about people with disabilities in the Republic of Croatia, which has been conducted every year by Croatian Public Health Institute, number of pupils with physical disabilities is increasing, and right now there are about 40.000 pupils with some kind of physical disability attending regular schools. Having that on mind, it is very important for elementary school teachers to have specific skills or competences which are supposed to be used to conduct Physical Education class for the pupils with disabilities. Competences represent a dynamic combination of cognitive and metacognitive knowledge, skills and understanding of interpersonal, practical and interpersonal skills and ethical values. The goal of each educational program is to develop competencies that are developed in all program units and defined in different degrees of program. Some competences are specific to the subject, ie specific to a particular discipline, and some are generic and common to all programs. This competency is given to the future teacher by various Teacher Studies in the Republic of Croatia. The aim of this research is to determine how many teachers are competent for performing Physical and Health Education classes with pupils with disabilities. Reviewing all Teacher Study Programs in the Republic of Croatia as the primary institutions where teachers acquire competences can gain insight into the attendance of courses that are exclusively focused on working with pupils with disabilities. Taking that into considiration, the second part of the research will refer to survey of all Teacher Studies in the Republic of Croatia.

Method

Given that future teachers in the Republic of Croatia acquire competences in six different higher Education institutions, a survey was conducted on primary school teachers in Slavonski Brod regarding their level of competences for conducting P.E. with pupils with disabilities. For the purposes of this research, a network survey was used, consisting of 9 questions. The survey is completely anonymous and participation in the research is not binding. The survey collected data on age, sex, years of working in primary education, their experience in working with pupils with disabilities, expert services assistance with working with pupils with disabilities, teachers level of competence for performing classes with pupils with disabilities, their proposals for improving working conditions both for pupils with disabilities and for teachers who have those pupils in their classroom. The study involved 119 examinees, 114 of whom were female and 4 male. One

person did not put sex in questionnaire. The highest number of teachers are between 35-45 years old (35.3%), while the minimum number of teachers are older than 56 years (4.2%). The average working time for teachers involved in this research is 15.39 years which tells us how tested teachers are experienced in the work. The research also includes independent research of study programs in six different higher Education institutions in the Republic of Croatia in order to find out the level of competences that students acquire during their studies.

Results

In the survey question about teachers experience with pupils with disabilities in their classroom, 109 teachers answered they had pupils with disabilities, while 10 teachers did not encounter a disadvantaged pupil. It is clear that 91.6% of respondents responded to what was to be expected. That is why it is very important that teachers have competences to work with such pupils and are prepared to provide the pupils with the disabilities what they need. Teachers also responded to the difficulties they encountered in dealing with children with disabilities (Figure 1). From the diagram it is evident that the respondents most frequently encountered pupils with intellectual disabilities (52.1%) and pupils with impaired linguistic-speech-voice communication and specific learning disabilities (42.9%). The least represented damage is hearing impairment (11.8%). According to data from the school year 1999/2000 (Vizek, Vidović, 2003), most of the pupils were learning disabilities and the least pupils were with hearing impairment and damage to organs and organic systems. It is evident that data after 18 years has not changed drastically.

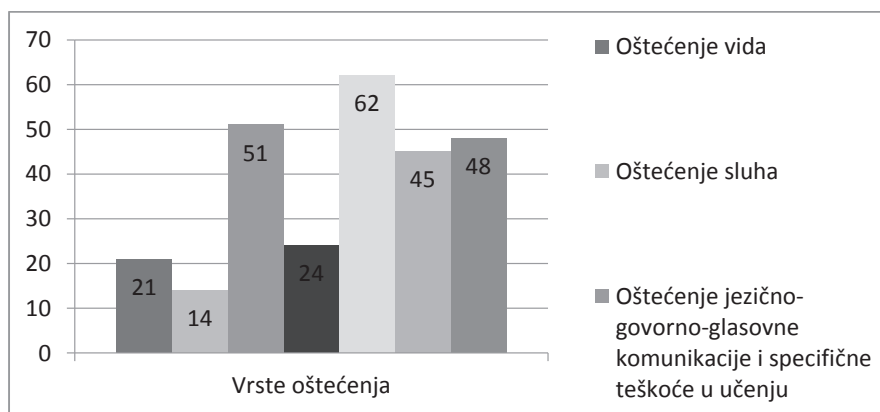


Figure 1: Types of difficulties teachers encounter

In a question related to the assistance of professional services in the preparation and implementation of classes with disadvantaged students, 91% of respondents, or 101 teachers answered that they did not have the support of professional services when planning physical and health education for pupils with disabilities while 9% of respondents (10 teachers) got that help. The key is the cooperation of teachers with a professional service that can greatly facilitate and assist teachers in developing plans and programs for pupils with disabilities. In the next question the teachers answered about conditions for the implementation of teaching with pupils with disabilities, possessing the necessary didactic materials for easier teaching. Of the 118 respondents who answered this question, 92.4% or 109 teachers did not have access to didactic materials for pupils with disabilities. Thus, only 9 teachers or 7.6% of them have access to the necessary didactic materials for conducting P.E. with pupils with disabilities. In the next question, teachers evaluated their competences for performing classes with pupils with disabilities (Figure 2). 42.9% of respondents replied that they did not agree or disagree with the statement of competence in questionnaire. Only 5% of

teachers answered that they are fully considered competent to conduct physical and health education classes with pupils with disabilities, which is a worrying, but not surprising fact.

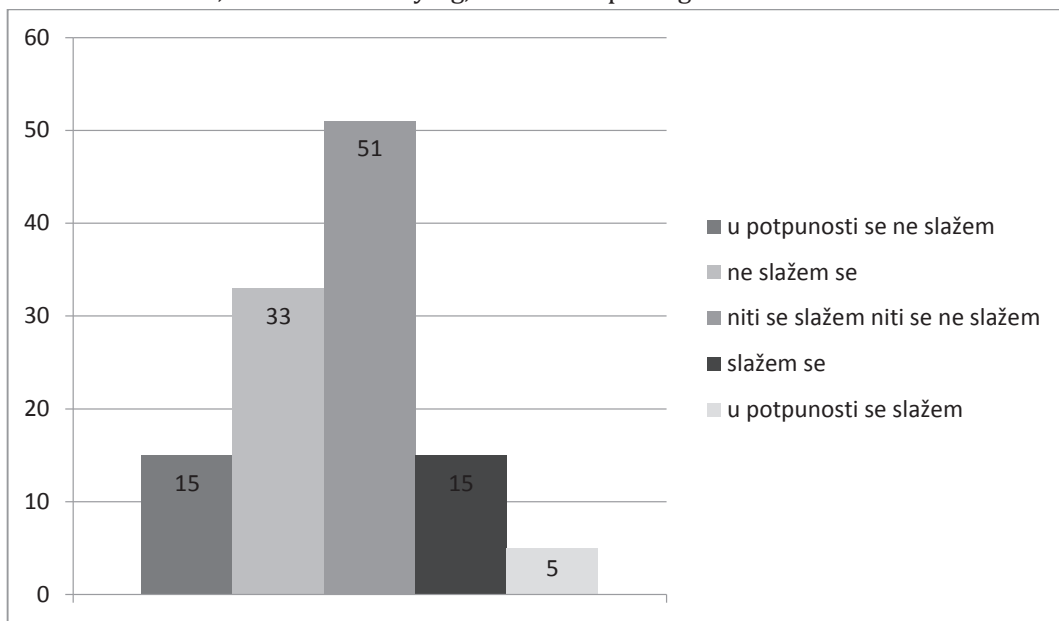


Figure 2: Teacher competence for teaching pupils with disabilities

In the next set of questions, teachers respond about conditions in education, whether changes need to be made to improve work with pupils with disabilities or are satisfied with the current situation, their thinking about integrating pupils with disabilities in regular schools and institutions that should educate pupils with different developmental difficulties. For a long time now we are talking about how we should introduce changes in education system to the wellbeing of our teachers and students. And in this case, 93.3% of respondents believe that it is necessary to introduce change in education to improve teacher education and quality of teaching. 60.3% or 70 teachers think that pupils with disabilities should be integrated into regular primary schools, and 39.6% (46 teachers) believe that they should attend classes in special institutions. We consider that the percentage of 60.3% is low in terms of encouraging the inclusion of pupils with disabilities in regular classes and that teachers did not accept such an idea. This may also be due to dissatisfaction with school system and different problems teacher encounter today. Figure 3 shows teachers answers on institutions in which pupils with various disabilities should be educated.

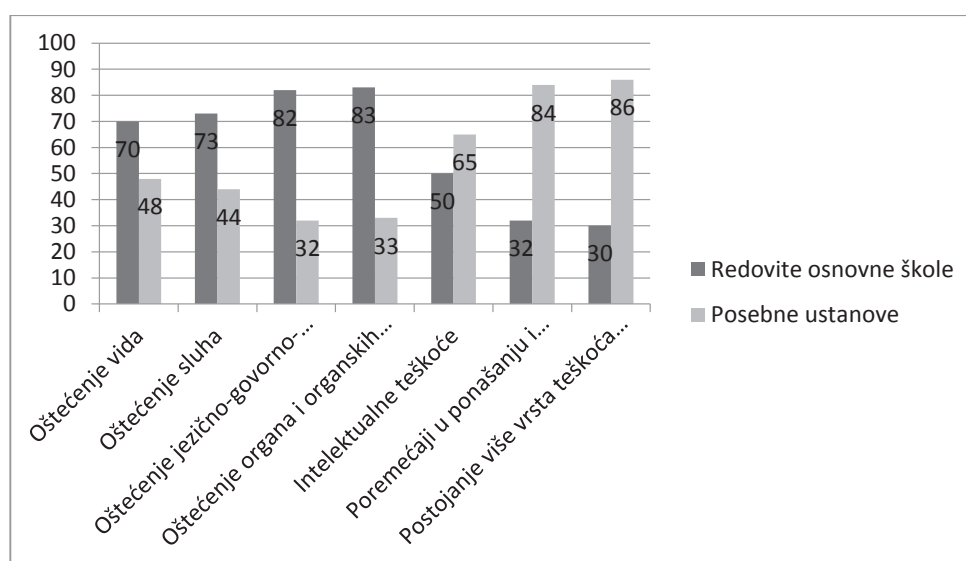


Figure 3: Teachers view of classification pupils with disabilities

From the graph it is evident that the teachers are for integration into regular classes for the first three mentioned difficulties, while for the last three in special institutions, mostly for the existence of multiple types of psychophysiological development where the difference is the largest, 74.1% of respondents is to educate such pupils in special institutions. From the 2nd question of this survey, it is evident that the percentage of children with multiple types of psychophysiological problems with which the respondents worked among the largest, 40.3%. In order to find out the level of competences that students acquire during their studies, we approached the review of study programs of all the Teacher Studies in the Republic of Croatia. There are 6 institutions in the Republic of Croatia for educate future primary teachers (1 - 4 grades of elementary school). The following tables (1 - 6) show courses that focus on acquiring competences for working with children with disabilities.

Table 1. Courses for acquireing competences to work with pupils with disabilities

Department for Teacher and educator, University of Zadar	
Course	Hours per semester
1. YEAR	
General Pedagogy	45
Developmental Psychology II	45
2. YEAR	
Educational psychology	45
3. YEAR	
Children with Developmental Disabilities	45
4. YEAR	
Children with specific learning disabilities (elective)	30

Table 2. Courses for acquireing competences to work with pupils with disabilities

Teachers Faculty in Rijeka, University of Rijeka			
Course	SATNICA		
	P	S	V
1. YEAR			
Psychology of Education	45	30	
2. YEAR			
Kinesiology Culture III			30
Inclusive Education and Education	45	15	15
Kinesiological culture IV			30

Table 3. Courses for acquireing competences to work with pupils with disabilities

Teachers Faculty in Zagreb, University of Zagreb			
Course	SATNICA		
	P	S	V
1. YEAR			
Psychology of Learning and Teaching	1 (per week)	1 (per week)	0
Developmental Psychology 1	30	15	
Developmental Psychology 2	15	15	
3. YEAR			
Inclusive pedagogy	30	15	
Methodology of Music Culture 1	15		30
Early Social Native Intervention	15	15	
4. YEAR			
Kinesiological Methodology 2	15		30
Methodology of Music Culture 2	15		30
Kinesiological Methodology 3	15		30
5. YEAR			
Methodology of the Croatian Language 4	15	15	

Table 4. Courses for acquireing competences to work with pupils with disabilities

Faculty of Educational Sciences of Osijek, JJ Strossmayer University of Osijek			
Course	SATNICA		
	P	S	V
2. YEAR			
Developmental Psychology (W)	2 (per week)	0	0
Developmental Psychology (S)	2 (per week)	1	0
Methodology of Music Culture II	2 (per week)	0	2
3. YEAR			
Psychology of Education (Z)	2 (per week)	1	0
Psychology of Education (LJ)	1 (per week)	1	0
4. YEAR			
Methodology Mathematics II	2 (per week)	0	2
Methodology Mathematics II	1 (per week)	0	1
Applied Developmental Psychology	1 (per week)	1	0
5. YEAR			
Pedagogy of children with special needs	2 (per week)	2	0

Table 5. Courses for acquireing competences to work with pupils with disabilities

Teacher Program In Split, Faculty of Philosophy, University of Split			
Course	SATNICA		
	P	S	V
1. YEAR			
Developmental psychology	45	15	
Pedagogical Psychology 1	30	15	
2. YEAR			
Pedagogical Psychology 2	30	15	
Child in society	15	15	
3. YEAR			
Pedagogy of children with special needs	30	30	
4. YEAR			
Methodology of Mathematics 1	30	30	
Methodology of working with children with special needs (optional)	15		15
5. YEAR			
Methodology of working with children with special needs (optional)	15		15

Table 6. Courses for acquiring competences to work with pupils with disabilities

Faculty of Educational Sciences of Pula, J Dobrila University of Pula			
Course	P	SATNICA	
		S	V
2. YEAR			
Pedagogy of children with special needs	30	15	15
Educational Psychology 2	15	15	
3. YEAR			
Social pedagogy	30	15	
Methodology of Music Culture 1	30		15
4. YEAR			
Methodology of Music Culture 2	15		45
Methodology of Croatian Language 3	15		45
Methodology of Music Culture 3	15		45
5. YEAR			
Methodology of Art Culture 3	15		45
Kinesiological Methodics 3	15		45

Discussion

The results of the research showed that only 5% of respondents considered themselves fully competent to carry out physical and health education classes with disadvantaged students. Kudek Mirošević and Jurčević Lozancic (2014) conducted research on attitudes of educators and teachers about inclusion and came to a similar conclusion. Teachers do not consider themselves to be competent to work with pupils with disabilities, and although they feel that inclusion is needed, they believe that pupils in special educational institutions receive the necessary attention and individualized procedures. As the number of children with disabilities increases (Table 7), a figure of only 5% of teachers who are considered competent to perform classes with pupils with disabilities is concerning.

Table 7. Report on Disabled Persons in the Republic of Croatia

Calendar year	Number of people with disabilities (0-19 years old)	The decision on the appropriate form of education
2013.	39 266	30 539
2014.	41 988	36 012
2015.	42 836	38 942
2016.	42 425	40 589
2017.	39 055	40 687

Also, educators are more than willing to undertake additional education to acquire specific competences in working with pupils with disabilities, as shown in this study, as 27% of respondents stated that they did not further educate about teaching pupils with disabilities, and this is not a negligible percentage. Most respondents believe that it is necessary to introduce change in education to improve the situation, and thus the quality of teaching. Šumanović et al. (2016) in their research on the attitudes of teachers about the difficulties in the teaching of physical and health education reveal that the teachers consider their kinesiological competence and fear of pupils with disability get injured the cause of the difficulties that are most pronounced in the work with pupils with disabilities. Teachers find it difficult to work with disadvantaged pupils because such work requires special kinesiological training, which is absent from faculty-educated teachers. 91% of them do not have any help from professional services, and 92.4% schools does not have any didactic materials that would facilitate teaching with pupils with disabilities. Kudek Mirošević and Jurčević Lozanić (2014) also come to the conclusion that teachers are not satisfied with

the quantity of the required specialized didactic resources in their schools. According to research results, 60.3% of respondents believe that pupils with disabilities should integrate into regular teaching. The data is not significant, but still the majority. Skočić Mihić, Gabrić and Bošković (2015) came to the conclusion that teachers find that pupils with disabilities should, whenever possible, be included in regular classes because it develops independence and improves the general development of pupils with disabilities. The limitations of the survey are sample size and representation of all parts of the Republic of Croatia. In the following surveys, a larger sample should be selected and teachers from different parts of the Republic of Croatia who have completed a study in all six institutions for the education of the classroom teachers.

Conclusion

The research results show that only 5% of respondents consider themselves fully competent to perform Physical and Health Education classes with pupils with disabilities. Also, 92.4% of teachers lack the necessary teaching materials for pupils with disabilities. All this makes it more difficult for teachers to work, which only 27% of them are further educated about working with pupils with disabilities. They believe that it is necessary to introduce changes in education and provide greater support to teachers who work with such pupils. Also, consideration should be given to change the study programs of teacher studies in the Republic of Croatia because, according to the results, teachers do not acquire enough knowledge and competences to work with pupils with disabilities. As the number of pupils with disabilities constantly increasing, which can be seen from the Report on Disabled Persons in the Republic of Croatia, it is very important to provide students with courses in which they will acquire competences for working with pupils with disabilities and to further invest in teachers education and supplementary materials for teaching classes with pupils with disabilities.

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CONSTRUCTION AND VALIDATION OF A TEST FOR EVALUATING THE TEACHING PROCESS QUALITY IN PHYSICAL EDUCATION

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Introduction

The ability of a teacher to articulate a quality lesson, as far as the content and organisation are concerned, and to implement it successfully as a whole, as well as all its parts, greatly determines the quality of the overall educational process. Prskalo, Findak and Neljak (2007) point out that the ability to plan, organise, implement and control the teaching process is crucial for achieving teaching objectives, and for satisfying bio-psycho-social needs of learners, representing integrative imperatives of Physical Education.

Teaching process management methodology includes an entire range of complex functions, such as selecting goals and tasks for adequate teaching contents, choosing and applying adequate work methods, organising and implementing of the teaching process through adequate didactical organisational forms of work, and finally managing and controlling the educational process itself. Also, efficiency of the entire system of kinesiological education ultimately depends on a successful implementation of the previously mentioned aspects. There is also a research on the trail of the previously mentioned, conducted by Findak, Prskalo and Pejčić (2003), who in their observations emphasise that achieving goals of Physical Education significantly depends on the methods of class management as well as on adequate selection of didactical organisational forms of work. The research particularly emphasises the importance of quality of organisation of the teaching process through selection of adequate didactical procedures and adequate didactical organisational forms of work (Prskalo&Babin, 2006; Prskalo, Findak&Babin, 2003; Prskalo&Findak, 2003). Coker (1999) also indicates that an increased active participation of pupils as well as effective exercising demands a quality preparation, organisation and implementation of the teaching process by a teacher. From this it is clear how important organisational aspect of a lesson is, regarding quality preparation of a lesson plan, choosing adequate lesson content, applying optimal work methods, implementing adequate didactical organisational forms of work and applying a system of controlling the teaching process. Therefore, with the aim of effect optimisation of the process of kinesiological education, it is extremely important to understand internal structure and micro-dynamics of the lesson as a whole, as well as specificities of all its parts.

Modern kinesiological science, especially in the area of kinesiological didactics, identifies the problem of quality of the teaching process as one of its priority goals. Such imperative is imposed on both theory of didactics and everyday teaching practice. The answer to the question on quality of the teaching process represents a precondition for understanding or improving this process. Therefore, in order to plan, programme, implement, control or modify a process, it is necessary to have a valid insight into the degrees of its quality. This imperative could also be applied to the area of kinesiological education, since teaching, in terms of its structure and dynamics, is a management process itself. Therefore, with the aim of optimisation of the teaching process it is, above all, necessary to provide a valid methodology of teaching evaluation.

The aim of this research is to construct a measuring instrument for evaluation of parameters of the teaching process quality and to determine measuring characteristics of that instrument.

Model of the teaching process

According to the official didactical articulation, a Physical Education lesson which lasts 45 minutes, is implemented in five consecutive stages (Findak, 2003, p. 37), as follows:

- ***Introductory lesson part*** – lasts 3 to 5 minutes. Introductory lesson part aims are organisational, physiological and emotional preparation of learners for the following stages.
- ***Preparatory lesson part***– lasts 7 to 10 minutes. This lesson part aims to prepare the body for increased physiological efforts following in the next stages by applying adequate general preparatory exercises.
- ***Main A lesson part***– lasts 15 to 20 minutes. The primary aim of this lesson part is adopting skills and improving motor achievements by applying teaching topics provided by the syllabus. Considering its duration and complexity, tasks of the main A lesson part include development of the overall anthropological status.
- ***Main B lesson part*** – lasts 10 to 15 minutes. The aim of this lesson part is to use dynamic movement structures to provide optimal conditions for development of the overall anthropological status, especially anthropometric characteristics as well as motor and functional abilities.
- ***Closing lesson part***– lasts 3 to 5 minutes. Closing lesson part aims to bring all the physiological and psychological functions back to the initial status as they were prior to the lesson.

Work methods

Sample of subjects

The sample of subjects, for the needs of this research, included female and male students from the third and fourth year of study from the University of Split, Faculty of Kinesiology. Students on the project had passed, before the testing started, professional-pedagogical practice in the course Kinesiological Didactics for both primary and secondary school in the duration of fifteen days. Subjects voluntarily participated in the project after learning the research subject and the testing procedure.

The experiment included 120 subjects, 55 female students and 65 male students, in the ratio as follows:

- 3rd year of study – female students: 27 subjects
- 3rd year of study – male students: 33 subjects
- 4th year of study – female students: 28 subjects
- 4th year of study – male students: 32 subjects

Methodology of data collection

Five evaluators, all graduated kinesiologists, collected data on quality of the teaching process by the method of direct observation of students' public lessons and by marking the mentioned dimensions using the evaluation questionnaire. Evaluators learned all the parameters as well as the marking methodology before the testing started.

Construction of the measuring instrument

In order to provide measurements of the teaching process in Physical Education, a ***Teaching process evaluation questionnaire UN1*** (U for the Croatian word for 'questionnaire'*Upitnik*– N for the Croatian word for 'teaching'*Nastava*, version **1**).

The UN1 Questionnaire consists of 20 qualitative parameters divided into five groups according to the lesson articulation. This way each lesson part is evaluated with four different marks: 1) *quality of*

teaching lesson organisation, 2) quality (adequacy) of teaching content, 3) quality of teaching content presentation and 4) quality of teaching content realisation. Defined parameters were evaluated on the five-point Likert Scale. The UN1 Questionnaire may be found in Appendix 1.

Marks obtained as previously described were treated as sub-items for forming items and constructing variables. Methodology of constructing variables is described in details in chapter *Methodology of constructing variables*.

Quality of the teaching process is also evaluated through a total mark which served as criterion for comparison with partial quality indicators.

Methodology of constructing variables

Since the UN1 Questionnaire was based on defining quality of dimensions of the teaching process through evaluating adequate parameters by five evaluators, the methodology of constructing variables was implemented through the following phases:

- 1) Each of the five evaluators gave a mark for every parameter defined in the evaluation questionnaire.
- 2) The obtained marks were treated as sub-items of each evaluator.
- 3) By condensing the belonging sub-items for dimensions of the teaching process defined by the model, adequate items were separately formed for each evaluator.
- 4) Further condensation of the obtained items, that is of marks for each dimension and for each evaluator, led to formation of variables.

Described methodology resulted in formation of the following six variables for evaluation of quality of the teaching process:

1. Quality of introductory lesson part – NUDS
2. Quality of preparatory lesson part – NPDS
3. Quality of main A lesson part – NGADS
4. Quality of main B lesson part – NGBDS
5. Quality of closing lesson part – NZDS
6. Total mark for quality of the teaching process – NGOS

Variable *Total mark for quality of the teaching process (NGOS)* was obtained from direct condensation of items, that is from marks given by each evaluator. Condensation of sub-items, that is items, while calculating the total result was computed by the use of the Burt's method of simple summation and calculation of the mean for each variable.

Methods of data processing

In order to generate from the obtained data methodologically valid and interpretable scientific conclusions, and to verify the hypotheses, adequate methods for data processing were applied.

Software Statistica version 7.0 was used for statistical data processing.

Reliability and objectivity were determined by the calculation of the following parameters: Pearson correlation coefficient (r), Cronbach's alpha coefficient (Cronbach's α)

Sensitivity of the newly constructed measuring instrument was defined by the following descriptive parameters: mean (\bar{x}), minimum result (min), maximum result (max), standard deviation (σ), skewness (α_3), kurtosis (α_4)

A test for normality distribution of data was executed by application of the Kolmogorov-Smirnov Test (KS-Test). Testing also included calculation of maximum deviation between the empiric and theoretical relative cumulative frequency (max d). Comparison of this parameter with the KS-Test critical value for a certain number of subjects at the error level of 0.05, is a determined form of distribution.

Factorial validity of the newly constructed measuring instrument was tested by the application of factorial analyses of the belonging variables from the test. The method of factor extraction was executed following the model of principal components, and the Kaiser criterion was used for determining the number of significant components. As indicators of factorial validity the following parameters were calculated: factor loading (factor coefficients or saturations, f), communality (h^2), and percentage of the interpreted variance (% var).

Results and discussion

Reliability and objectivity

Tables 1-6 show results of testing reliability and objectivity for each variable from the UN1 Questionnaire.

Table 1. Inter-correlation of item matrix – Variable Quality of introductory lesson part (NUDS)

Evaluator	Female students					Male students				
	A	B	C	D	E	A	B	C	D	E
A	1.00					1.00				
B	0.87	1.00				0.95	1.00			
C	0.91	0.82	1.00			0.95	0.94	1.00		
D	0.88	0.86	0.83	1.00		0.93	0.91	0.90	1.00	
E	0.77	0.80	0.73	0.72	1.00	0.90	0.94	0.90	0.85	1.00
	Cronbach's $\alpha=0.957$					Cronbach's $\alpha=0.980$				

Inter-correlation of item matrix for variable *Quality of introductory lesson part (NUDS)* showed high positive correlation coefficients among certain items in both groups of subjects. Coefficient values range from 0.72 to 0.91 for female students, which is in conformity with moderate to high correlation, and from 0.85 to 0.95 for male students which is in conformity with high correlation. The obtained results indicate a high degree of objectivity during the measurement procedure, since there was a noticed significant correlation of results of all evaluators for this lesson part.

The values of Cronbach's α at the level of 0.957 for female students, and 0.980 for male students indicate a high internal co-existence of the observed dimension of the measuring instrument, that is a high reliability of the observed dimension of the measuring instrument.

Table 2. Inter-correlation of item matrix – Variable Quality of preparatory lesson part (NPDS)

Evaluator	Female students					Male students				
	A	B	C	D	E	A	B	C	D	E
A	1.00					1.00				
B	0.88	1.00				0.90	1.00			
C	0.91	0.83	1.00			0.95	0.87	1.00		
D	0.82	0.79	0.75	1.00		0.84	0.77	0.83	1.00	
E	0.75	0.74	0.67	0.57	1.00	0.76	0.80	0.78	0.64	1.00
	Cronbach's $\alpha=0.944$					Cronbach's $\alpha=0.956$				

The coefficient values of inter-correlation of items for variable *Quality of preparatory lesson part (NPDS)* range from 0.57 to 0.91 for female students, and from 0.64 to 0.95 for male students, which in both subsamples is in conformity with moderate to high correlation. The obtained results indicate that some evaluators were highly objective during the measurement procedure, since noticed correlation of results of the evaluators was significant during the process of evaluation of this lesson part.

If we add high values of Cronbach's α in both subsamples of subjects, and at the level of 0.944 for female students and 0.956 for male students, it can be concluded that the observed dimension of the measuring instrument satisfies the condition of reliability.

Table 3. Inter-correlation of item matrix – Variable Quality of main A lesson part (NGADS)

Evaluator	Female students					Male students				
	A	B	C	D	E	A	B	C	D	E
A	1.00					1.00				
B	0.95	1.00				0.93	1.00			
C	0.92	0.91	1.00			0.91	0.89	1.00		
D	0.86	0.88	0.83	1.00		0.78	0.77	0.77	1.00	
E	0.81	0.78	0.73	0.64	1.00	0.84	0.84	0.78	0.68	1.00
	Cronbach's $\alpha=0.961$					Cronbach's $\alpha=0.957$				

The coefficient analysis of inter-correlation of items for variable *Quality of main A lesson part(NGADS)* indicated a significant moderate high to high correlation of some items ranging from 0.64 to 0.95 for female students, and 0.68 to 0.93 for male students. The obtained results indicate a high degree of objectivity of the measuring procedure for evaluation of the mentioned dimension.

High values of Cronbach's α at the level of 0.961 for female students, and 0.957 for male students indicate a significant degree of reliability of the observed dimension of the measuring instrument.

Table 4. Inter-correlation of item matrix – Variable Quality of main B lesson part (NGBDS)

Evaluator	Female students					Male students				
	A	B	C	D	E	A	B	C	D	E
A	1.00					1.00				
B	0.95	1.00				0.93	1.00			
C	0.94	0.89	1.00			0.92	0.92	1.00		
D	0.87	0.88	0.86	1.00		0.87	0.82	0.82	1.00	
E	0.87	0.90	0.86	0.79	1.00	0.82	0.88	0.83	0.76	1.00
	Cronbach's $\alpha=0.972$					Cronbach's $\alpha=0.968$				

Coefficients for inter-correlation of items for variable *Quality of main B lesson part (NGBDS)* range from moderate high to high correlation, from 0.79 to 0.95 for female students and from 0.76 to 0.93 for male students. The obtained results indicate a high degree of correlation of marks given by evaluators for the observed dimension, which confirms objectivity of the implemented measuring procedure.

High reliability of the observed dimension of the measuring instrument is also confirmed by the values of Cronbach's α at the level of 0.972 for female students, and 0.968 for male students.

Table 5. Inter-correlation of item matrix – Variable Quality of closing lesson part (NZDS)

Evaluator	Female students					Male students				
	A	B	C	D	E	A	B	C	D	E
A	1.00					1.00				
B	0.90	1.00				0.92	1.00			
C	0.89	0.85	1.00			0.92	0.89	1.00		
D	0.75	0.68	0.71	1.00		0.84	0.83	0.83	1.00	
E	0.85	0.87	0.79	0.65	1.00	0.83	0.83	0.77	0.76	1.00
	Cronbach's $\alpha=0.951$					Cronbach's $\alpha=0.962$				

Coefficients for inter-correlation of items for variable *Quality of closing lesson part (NZDS)* range from 0.65 to 0.90 for female students, and from 0.76 to 0.92 for male students. The obtained results indicate a moderate high to high correlation of items, that is a satisfactory degree of objectivity of the measuring procedure.

Satisfactory reliability of the observed dimension of the measuring instrument is also confirmed by Cronbach's α coefficients at the level of 0.951 for female students and at the level 0.962 for male students.

Table 6. Inter-correlation of item matrix – Variable Totalmark for quality of the teaching process (NGOS)

Evaluator	Female students					Male students				
	A	B	C	D	E	A	B	C	D	E
A	1.00					1.00				
B	0.87	1.00				0.93	1.00			
C	0.91	0.86	1.00			0.91	0.90	1.00		
D	0.82	0.86	0.83	1.00		0.88	0.86	0.86	1.00	
E	0.77	0.83	0.81	0.74	1.00	0.88	0.86	0.89	0.80	1.00
	Cronbach's $\alpha=0.960$					Cronbach's $\alpha=0.973$				

Inter-correlation of item matrix for variable *Total mark for quality of the teaching process (NGOS)* shows a significant correlation of marks given by evaluators for the observed dimension. Coefficients of inter-correlation range for female students from 0.74 to 0.91 which is in conformity with moderate high to high correlation, while the correlation for male students was at the level of high correlation ranging from 0.80 to 0.93. The obtained results indicate a high degree of objectivity of the measuring instrument for evaluating total quality of the lesson.

A high degree of internal consistence of the observed dimension of the measuring instrument is also confirmed by the Cronbach's α coefficients of reliability at the level of 0.960 for female students, and at the level of 0.973 for male students.

Sensitivity

Tables 7 and 8 show parameters of descriptive statistics, and the Kolmogorov-Smirnov Test for normality of data distribution for both subsamples of female and male students.

Table 7. Descriptive statistics parameters and the KS-Test for the subsample of female students

Variable	\bar{x}	min	max	σ	α_3	α_4	max d
NUDS	3.94	2.50	4.95	0.65	-0.10	-1.04	0.101
NPDS	3.65	2.00	4.65	0.63	-0.61	-0.10	0.090
NGADS	3.72	2.35	4.85	0.63	-0.22	-0.71	0.080
NGBDS	3.60	1.35	4.85	0.87	-0.73	-0.05	0.115
NZDS	3.96	1.90	5.00	0.69	-0.93	0.69	0.128
NGOS	3.24	1.00	5.00	0.99	-0.58	-0.08	0.096

Threshold max d ($p < 0.05$) = 0.180

By comparing the means (\bar{x}) and belonging standard deviations (σ) in the subsample of female students, it can be concluded that average deviations of the results do not exceed one third of the mean value of each variable. The values of skewness (α_3) range within an interval from -1.31 to -0.10, indicating a high degree of skewness for all the observed variables. The kurtosis (α_4) assumes values within an interval from -1.04 to 1.01, not representing a more significant deviation from the referent values of the normal distribution of all variables.

Normality test for distribution of data indicate normal data distribution of all variables.

Table 8. Descriptive statistics parameters and the KS-Test for the subsample of male students

Variable	\bar{x}	min	max	σ	α_3	α_4	max d
NUDS	3.61	1.70	4.90	0.90	-0.25	-1.31	0.137
NPDS	3.33	2.00	4.90	0.67	0.32	-0.56	0.074
NGADS	3.61	2.65	4.95	0.57	0.26	-0.75	0.092
NGBDS	3.51	1.35	4.90	0.81	-0.37	-0.56	0.083
NZDS	3.79	2.25	4.90	0.73	-0.51	-0.65	0.095
NGOS	2.89	1.00	5.00	1.09	0.17	-0.83	0.115

Threshold max d ($p < 0.05$) = 0.166

Analysis of the obtained values of the means (\bar{x}) and standard deviations (σ) for each variable in the subsample of male students indicate an acceptable level of the average deviations of results from the values of the belonging arithmetic means. A slight deviation was noticed in variable *Total mark for quality of the teaching process (NGOS)*, having the value of standard deviation ($\sigma_{NGOS} = 1,09$) exceeding one third of the arithmetic mean value ($\bar{x}_{NGOS} = 2,89$). The values of skewness (α_3) range within an interval from -0.85 to 0.32 leading to a conclusion on having a satisfactory skewness for all the observed variables. The kurtosis (α_4) assume values within an interval from -1.31 to 0.05, not representing a more significant deviation from the values of normal distribution.

Since the results of the Kolmogorov-Smirnov Test indicate that, for all the variables, maximum deviations between empiric and theoretical relative cumulative frequencies (max d) do not exceed the critical value of the KS-Test of 0.166, it can be concluded that there is no statistically significant deviation of empiric distributions from the normal distribution for all the observed variables.

Factorial validity

In order to determine factorial validity of the newly constructed measuring instrument, factor analysis was carried out for the belonging dimensions or variables of the tests, since it can be assumed that the defined dimensions test the same subject of the measurement. Method of factor extraction was carried out according to a model of principal components (Fulgosi, 1979, pp. 102-107), and the Kaiser criterion was used for determining a number of significant components (Fulgosi, 1979, pp. 120-121).

Table 9 shows the results of factor analysis for dimensions of the measuring instrument *Teaching process evaluation questionnaire (UN1)*. Analysis included dimensions of the instrument, that is belonging variables, referring to the lesson parts, since it can be assumed that they evaluate a unique subject of measurement.

Table 9. Results of factorial validity for dimensions of the UN1 measuring instrument

Variable	Female students		Male students	
	f	h ²	f	h ²
NUDS	-0.60	0.36	-0.68	0.47
NPDS	-0.75	0.57	-0.81	0.65
NGADS	-0.85	0.72	-0.85	0.73
NGBDS	-0.91	0.82	-0.82	0.68
NZDS	-0.81	0.65	-0.76	0.58
% var	0.62		0.62	

The carried factor analysis isolated an important factor in both subsamples of subjects, which confirms the assumption that variables in the model evaluate the same subject of measurement. The isolated factor explains 62 % of the total variability of the principal subject of measurement both in female and male students.

The factor loadings (f) for female students were satisfactory, indicating a significant correlation of the variables with the principal subject of measurement. The highest projection on the factor at the level of -0.91 was noticed in variable *Quality of main B lesson part (NGBDS)*, while the lowest projection was noticed in variable *Quality of introductory lesson part (NUDS)* at the level of -0.60. The communalities (h²) for all variables in the model were satisfactory, indicating that the common principal component explains a respectable part of the total variance of the manifest variables. The highest value of the communality (h²) was noticed in variable *Quality of main B lesson part (NGBDS)* at the level of 0.82, while the lowest one was noticed in variable *Quality of introductory lesson part (NUDS)* at the level of 0.36.

The factor loadings (f) for male students were also satisfactory, indicating a significant correlation of the variables with the principal subject of measurement. The highest value of the projection on the principal component was noticed for variable *Quality of main A lesson part (NGADS)* at the level of -0.85, while the lowest projection was noticed for variable *Quality of introductory lesson part (NUDS)* at the level of -0.68. The values of communalities (h²) for all variables indicate that the isolated principal component explains the satisfactory part of the total variability of the variables in the model. The highest value of the communality (h²) was noticed for the variable *Quality of main A lesson part (NGADS)* at the level of 0.73, while the lowest one was noticed for variable *Quality of introductory lesson part (NUDS)* at the level of 0.47.

It can be concluded that the observed dimensions of the *Teaching process evaluation questionnaire (UN1)*, that is its corresponding variables, evaluate a unique subject of measurement, indicating a satisfactory factorial validity of the newly constructed measuring instrument.

Conclusion

The *Teaching process evaluation questionnaire (UN1)* was constructed for providing a scientifically valid quality evaluation of the teaching process in Physical Education. The newly constructed measuring instrument evaluates six dimensions of the teaching process defined as: *Quality of introductory lesson part (NUDS)*, *Quality of preparatory lesson part (NPDS)*, *Quality of main A lesson part (NGADS)*, *Quality of main B lesson part (NGBDS)*, *quality of closing lesson part (NZDS)* and *Total mark for quality of the teaching process (NGOS)*.

Analysis of the metric characteristics of the measuring instruments included determining indicators of objectivity, sensitivity and factorial validity.

All dimensions of the measuring instrument are satisfactory in regards to the degree of reliability, and the measuring procedure met the requirement of objectivity for evaluation of all dimensions of the teaching process in both groups of subjects. It is possible to conclude that the procedure of measurement was independent of non-systematic factors, that is the measuring instrument optimally evaluated the subject of measurement. Also, the results of subjects are independent of evaluators, that is the degree of accordance of results obtained for the subjects and evaluated by different evaluators, show a statistically significant degree of compatibility. The mentioned indicate to a conclusion of having a solid construction of the measuring instrument through choosing quality items, good training and high number of evaluators, as well as an elaborated and standardised procedure of measurement.

Analysis of indicators of data dispersion confirmed that the measuring instrument successfully differs subjects according to the subject of measurement. Indicators of form and distribution normality indicate a normal data distribution for all variables. Therefore, it can be concluded that the newly constructed measuring instrument meets the requirement of sensitivity.

Results of testing factorial validity indicate to a conclusion that the analysed measuring instrument, that is certain dimensions of the measuring instrument, evaluate a unique subject of measurement. It is possible to say that the measuring instrument evaluates factors for which measurement it was constructed, and is therefore diagnostically valid.

From all the previously mentioned it can be concluded that the measuring instrument *Teaching process evaluation questionnaire (UN1)* provides a collection of scientifically valid data for both subsamples of female and male students, and it represents a valuable kinesimetric instrument for studying quality of the teaching process.

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RELATION BETWEEN EXECUTIVE FUNCTIONS AND BODY MASS INDEX IN PRE-ADOLESCENTS

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Introduction

Excess body weight is an increasingly growing health issue present in modern society. The adverse effects of excess body weight and obesity in children are associated with an increased risk of cardiovascular diseases, diabetes, and negative psychological consequences (Reilly et al., 2003), both in childhood and in adulthood (Guo, Wu, Chumlea, & Roche, 2002). Childhood is an important period for establishing an active lifestyle and developing healthy eating habits. One of the factors essential for developing and maintaining healthy eating habits of an individual is self-regulation (Dohle, Diel, & Hofmann, 2018). Self-regulation in eating behaviour implies the individual's motivation and capacity to act in accordance with their knowledge of the importance of good nutrition as well as in accordance with their healthy eating goals. The individual's capacity for effective self-regulation is associated with higher-order cognitive functions - executive functions (Hofmann, Schmeichel, & Baddeley, 2012).

Executive functions (EF) include higher-order cognitive processes that enable the coordination of thoughts and actions in accordance with a set goal (Miller & Cohen, 2001; Miyake et al., 2000). According to the model developed by Miyake et al., there are three relatively independent executive functions: inhibition, shifting and updating.

Inhibition is the ability to inhibit the responses to a dominant stimulus that is not in line with the individual's goal or task as well as to respond to a weaker stimulus that is in line with the goal/task. In the context of self-regulation in eating behaviour, inhibition would refer to the individual's ability to refrain from eating the tasty high-calorie foods that increase an amount of body fat and have harmful health effects. The findings of the studies so far have indicated the relationship between low inhibition and excess body weight in the children of pre-adolescent and adolescent age (Anzman & Birch, 2009; Nederkoorn, Coelho, Guerrieri, Houben, & Jansen, 2012). (Hofmann et al., 2012).

Shifting is the ability to shift attention flexibly from one task, goal or mental set to another. This implies neglecting the information that is currently irrelevant and focusing on the relevant information. This ability can enable the individual to change their eating behaviour flexibly in accordance with a situation (e.g. to find an adequate substitute for the food they wanted to eat, or, in some cases, to eat the food that they should not consume as a reward for their being disciplined with food) (Hofmann et al., 2012).

Updating is the ability that implies retaining and coding the information relevant to the task. Namely, the out-dated and irrelevant information is updated in working memory, i.e. replaced with the new information that is relevant to the task. This executive function represents a type of working memory and plays an important role in more complex executive functions, such as planning (Karbach & Unger, 2014). The capacity of working memory and updating are significant determinants of the individual's ability to act in accordance with their long-term eating goals and dietary strategies (Dohle et al., 2018). Although there is a lack of the studies examining the relation between updating and eating habits/BMI in pre-adolescence, it has been found, on the sample of adults ($M = 19.79$, $SD = 1.95$), that updating is positively correlated with the consumption of fruit and vegetables (Allom & Mullan, 2014). This indicates the significance of updating for

displaying a desired eating behavior, unlike the executive function of inhibition that is significant for preventing an undesired eating behavior.

The significance of executive functions for maintaining ideal body weight has been determined in the previous studies. However, there is no research which examined the relation between all executive functions and body mass indexes in pre-adolescents. The aim of this study was to examine the relationship between the three core executive functions - inhibition, shifting and updating and the body mass index in the pre-adolescent boys and girls.

Method

Sample

The sample was non-random and included 137 students of the 3rd grade of primary school (70 girls and 67 boys) of the average age of 9.6 years ($SD = 0.28$). According to the report of the school counsellor, there were no students with any attention deficit disorders or those using an individual learning plan included in the sample.

Variables and instruments

1. Executive functions

Three executive functions (inhibition, shifting and updating) were measured applying the experimental tasks adjusted to be used on a computer.

Inhibition was measured with the Modified Stroop task (Stroop, 1935). This task was adapted according to the Miyake's computer version (Miyake et al., 2000). The respondents' task was to indicate a number of the stimuli presented on the screen (one, two or three) by pressing a key on the keyboard. All the stimuli belonged to one of the three categories: neutral stimuli - letters, congruent stimuli - number/numbers congruent to the total number of displays (e.g. number 3 written 3 times), incongruent stimuli - number/numbers incongruent to the total number of displays (e.g. number 3 written 2 times). The inhibition value (RTdiff) was calculated by subtracting the average reaction times for incongruent stimuli from the average reaction times for neutral stimuli, and by subtracting the proportions of errors for incongruent stimulus from the proportions of errors for neutral stimuli (PEdiff) as well. The measures of inhibition were represented by negative numbers, with higher values indicating a better inhibition.

Shifting was measured with the Smiley task based on the task-switching paradigm (Rogers & Monsell, 1995). The respondents were shown a picture of a large square divided into four smaller squares, with one of the squares containing a smiley image. The task consisted of three blocks: the first and the second block contained 40 stimuli, and the third one included 80 stimuli. In the first block, there was an arrow pointing up and down, presented below the square. The respondents' task was to indicate whether the smiley was shown at the top or at the bottom, by pressing a key (arrow) on the keyboard. In the second block, there was an arrow pointing left and right presented below the square. The respondents' task was to indicate whether the smiley was shown on the left or on the right, by pressing a key (arrow) on the keyboard. The third block included the requests of the first and the second block altering pseudo-randomly, and the respondents were required to provide correct answers, using the keyboard, by shifting quickly from one request to another. The shifting value (RTdiff) was calculated by subtracting the average reaction times achieved in the first two blocks taken together from the average reaction times achieved only in the third block, and by subtracting the proportion of errors in the first two blocks taken together from the proportion of errors in the third block (PEdiff). The measures of shifting were represented by negative numbers, with higher values indicating a better shifting.

Updating was measured with the Letter memory task, which is an adapted version of the same-named task developed by Miyake and colleagues (Miyake et al., 2000). The respondents were sequentially shown the

series of letters (a total of 20 series), and after each series of letters was displayed, their task was to reproduce, i.e. recall and enter, using the keyboard, the two last letters displayed within each of the first five series, then the three last letters displayed within each of the ten following series and the four last letters displayed within each of the last five series of letters. In order to provide the updating performed by the respondents, they were instructed to silently repeat the required number of the last letters presented within a series (i.e. the last two, three or four letters) at any time. A length of the series was ranged from 5 to 15 letters, and for the purpose of holding the respondents' attention, the series of various length were alternating pseudo-randomly. Upon a notification about starting the task, the instruction stating how many last letters should be remembered was displayed on the screen. Afterwards, the letters were shown one after another, with a fixation cross marker appearing between the letters displayed. At the end of the series, the respondents were required to type, using the keyboard, the last two, three or four letters of a given series, depending on the task. The measure of updating was represented by a number of the series which included the required last letters recalled correctly.

2. Anthropometric variables

Body height was measured using an anthropometer and expressed in centimetres, with an accuracy of 0.1 centimetres. *Body weight* was measured using a portable weighing scale and expressed in kilograms, with an accuracy of 0.1 kilogram.

Based on the body height and body weight measured, *body mass index (BMI)* was calculated, by dividing the body weight in kilograms by the body height in meters squared.

3. Control variables

The impact that *intelligence* has on the relationship between EF and BMI was controlled, taking into consideration the findings about the relation between intelligence and executive functions in pre-adolescents (Brydges, Reid, Fox, & Anderson, 2012). The intelligence was tested using a combination of the standard and advanced version of Raven's progressive matrices (Pallier et al., 2002). The test consisted of 18 items whereby the respondents were shown a 3x3 matrix containing specific symbols, and only the square in the bottom right corner was empty. The respondents' task was to select one of the five answers offered below the matrix which should be logically included in the bottom right square. The tasks were presented starting from the easier tasks to the more difficult ones and the time required to complete the tasks was limited to 6 minutes.

The students' engagement in sports - *sports experience* was controlled due to a possible impact of physical exercise on EF (Diamond & Lee, 2011) and BMI (Poitras et al., 2016). The students' parents filled in a questionnaire where they specified the sport/sports their children have been engaged in so far as well as the duration of such an engagement. The sports experience value was represented by the total number of months of practising the sport/sports.

Procedures and data analysis

The EF testing was carried out during two days within the same working week, in an IT classroom. The students, divided into the groups of eight, performed the experimental tasks using the computers and provided their answers using the keyboard. Intelligence was tested in the course of regular classes, and the students' body height and body weight were measured during one physical education class.

Within the statistical analysis applied in the Smiley and Stroop tasks, which provided the values of reaction times, only the reaction times exceeding 200 ms were analysed, and only in regard to those stimuli which were responded correctly. Furthermore, a double data trimming procedure was applied - between and

within the respondents. On the basis of an overview of the response time distribution for all the tasks, the critical value was determined to be ± 3 standard deviations from the average reaction time for the specified task, and all the reaction times that were higher/lower than the critical value were replaced by it. The statistical analyses included descriptive statistics and partial correlation of the EF and BMI measures, while controlling for Sports experience and Intelligence.

Results

Table 1 shows the descriptive indicators of the EF, BMI, Sports experience and Intelligence, separately for the sub-samples of boys and girls. The results show there is no difference in the data distribution between the sub-samples of boys and girls regarding any variable, except for Shifting (RTdiff).

Table 1. Descriptive indicators of the EF, BMI, Sports experience and Intelligence (N=137)

	Boys			Girls			K-S(p)
	Min	Max	M (SD)	Min	Max	M (SD)	
Inhibition (RTdiff)	-477.01	144.03	-64.22 (97.67)	-220.77	184.74	-65.19 (74.45)	.360
Inhibition (PEdiff)	-0.41	0.11	-0.07 (0.08)	-0.39	0.08	-0.07 (0.08)	.960
Shifting (RTdiff)	-598.84	-127.62	-308.24 (95.29)	-1152.79	-122.13	-418.85 (179.63)	.000
Shifting (PEdiff)	-0.20	0.05	-0.07 (0.05)	-0.46	0.09	-0.09 (0.07)	.102
Updating	4.00	20.00	10.52 (3.66)	2.00	17.00	10.49 (3.38)	.980
BMI	14.70	29.00	19.11 (3.24)	12.20	26.50	18.81 (3.10)	.798
Sports experience	0.00	60.00	33.63 (17.64)	0.00	66.00	25.34 (19.56)	.089
Intelligence	2.00	17.00	9.61 (2.60)	4.00	16.00	10.76 (2.14)	.380

Legend: N – sample size; Min – minimum; Max – maximum; M – mean value; SD – standard deviation; K-S (p) – significance level for Kolmogorov-Smirnov test of differences in the results distribution in the sub-samples of boys and girls, RTdiff – differential score for reaction time; PEdiff – differential score for proportion of errors.

Table 2 shows the differences between the sub-samples of boys and girls regarding all the variables examined in this study. The results of the t-test show that there are differences between the boys and the girls in the shifting, sports experience and intelligence values. The boys achieved better results in the shifting indicators and they also have longer sports experience, whereas the girls have higher intelligence.

Table 2. Differences between the boys and the girls regarding the EF, BMI, Sports experience and Intelligence

	gender	M	SD	t	p
Inhibition (RTdiff)	male	-64.22	97.67	0.06	0.95
	female	-65.19	74.45		
Inhibition (PEdiff)	male	-0.07	0.08	-0.13	0.90
	female	-0.07	0.08		
Shifting (RTdiff)	male	-308.24	95.29	4.53	0.00
	female	-418.85	179.63		
Shifting (PEdiff)	male	-0.07	0.05	2.32	0.02
	female	-0.09	0.07		
Updating	male	10.52	3.66	0.06	0.95
	female	10.49	3.38		
BMI	male	19.11	3.24	0.55	0.58
	female	18.81	3.10		
Sports experience	male	33.63	17.64	2.60	0.01
	female	25.34	19.56		
Intelligence	male	9.61	2.60	-2.82	0.01
	female	10.76	2.14		

Table 3 shows the correlation of the EF and BMI measures, while controlling a possible impact of the sports experience and intelligence on the relationship between these variables. The results of the correlation analysis have shown that the Inhibition was negatively correlated with BMI for the girls, $r = -0.27, p < .05$, while there was no relationship between these variables found in the boys' sub-sample. These findings indicate that the girls with a lower inhibition have a higher body mass index (BMI). The remaining two executive functions - Shifting and Updating were not related to BMI in any sub-sample.

Table 3. Correlation between BMI and EF in the sub-samples of boys and girls when controlling for the Sports experience and Intelligence

	BMI	
	Boys	Girls
Inhibition (RTdiff)	-.12	-.27
Inhibition (PEdiff)	.11	-.17
Shifting (RTdiff)	.07	.15
Shifting (PEdiff)	-.05	-.01
Updating	.06	-.07

Discussion

This study examined the relationship between executive functions, as important cognitive functions in the self-regulation of pre-adolescents, and BMI, as a possible indicator of their eating behaviors. The findings have shown that there is no difference found in the results distribution between the boys and the girls, except for the Shifting RTdiff. Also, the t-test results have shown that there are no differences found between the boys and the girls in the BMI and EF values, except in the shifting indicators and in the control variables. However, the results of the partial correlation analysis have indicated the differences between the sub-samples. A negative correlation between Inhibition and BMI was determined in the sub-sample of girls. This means that the girls with a lower inhibition have a higher BMI, i.e. they may show an increased risk of obesity.

These findings are in accordance with the results of the previous studies which indicate the importance of the executive function of inhibition for refraining from the consumption of delicious, high-fat and high-calorie foods, which may consequently affect BMI (Anzman & Birch, 2009; Nederkoorn et al., 2012). Another important factor for maintaining a desired level of BMI is physical activity, whose impact on the relationship between inhibition and BMI was partially controlled through Sports experience, i.e. the total duration of practising a sport/sports. The results of our study have shown that girls are, on average, less likely to be engaged in sports than boys, therefore, the interventions aimed at reducing the body weight in girls might include both the inhibition improvement and the inclusion of girls in systematic physical activities (e.g. sports activities).

The findings of this study have indicated no correlation found between the remaining executive functions – shifting and updating and BMI in regard to any sub-sample. In addition to the specificity of a small sample of the respondents examined, it may be assumed that the reason for such findings might be the complexity of displaying these executive functions when they influencing eating behaviors. Namely, the executive function of shifting involves flexible changes in eating behaviors (Hofmann et al., 2012), which implies the analysis of a situation when it would be reasonable to modify the selection criteria in relation to the type or quantity of foods or food consumption strategy. The children aged 9 to 10, regardless of their shifting ability, are likely to use this EF inefficiently in the context of a desired eating behavior.

Updating is important for an individual's ability to act in accordance with their long-term eating goals and strategies (Dohle et al., 2018). This implies that a child should often refrain from tasty food and make food-choices in accordance with somewhat abstract ideas regarding the goal of his/her eating behavior (e.g.

he/she will be healthier, live longer, etc.) which is very complex and demanding for the children at this age, given their intelligence development phase. A complexity of the role of updating in regard to this desired eating behavior may be the reason for no correlation found between this EF and BMI in the sample of pre-adolescents.

Conclusion

This study has pointed out a potential relevance of the executive function of inhibition for maintaining the ideal body weight of pre-adolescent girls. The determined correlation represents the basis for examining a possible causal relation between these variables in a longitudinal research. The relationship between inhibition and BMI in boys should be examined on a larger sample, bearing in mind the findings of the previous studies which, almost consistently, indicated the relation between inhibition and BMI in pre-adolescents of both genders.

The relationship between shifting/updating and BMI should be examined on a larger sample, but also at different ages, in order to determine a possible time dynamics of the activation of these executive functions in an individual's desired eating behavior.

In the future research, a greater number of the EF measures should be applied as well as more accurate indicators of excess body weight (determining the proportion of body fat in body composition).

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POVEZANOST EGZEKUTIVNIH FUNKCIJA I INDEKSA TELESNE MASE PREADOLESCENATA

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Uvod

Prekomerna masa tela je problem koji je sve više izražen u savremenom društvu. Negativni efekti prekomerne mase tela i gojaznosti dece odnose se na povećan rizik od kardiovaskularnih bolesti, dijabetesa, negativnih psiholoških posledica (Reilly et al., 2003), kako u detinjstvu, tako i u odraslom dobu (Guo, Wu, Chumlea, & Roche, 2002). Period detinjstva je važan za uspostavljanje aktivnog stila života i zdravih navika u ishrani. Jedan od bitnih faktora stvaranja i održavanja zdravih navika u ishrani pojedinca je samoregulacija ponašanja (Dohle, Diel, & Hofmann, 2018). Samoregulacija ponašanja koje se odnosi na ishranu podrazumeva motivaciju i kapacitet pojedinca da deluje u skladu sa znanjem o važnosti zdrave ishrane i u skladu sa svojim ciljem da se zdravo hrani. Kapacitet pojedinca za efikasnu samoregulaciju je povezan sa višim kognitivnim funkcijama – egzekutivnim funkcijama (Hofmann, Schmeichel, & Baddeley, 2012).

Egzekutivne funkcije (EF) obuhvataju više kognitivne procese koji omogućavaju koordinaciju misli i akcija u skladu sa postavljenim ciljem (Miller & Cohen, 2001; Miyake et al., 2000). Prema modelu Mijakija i saradnika postoje tri relativno nezavisne EF: inhibicija, premeštanja i ažuriranje.

Inhibicija predstavlja sposobnost inhibiranja reakcije na dominantan stimulus koji nije u skladu sa ciljem ili zadatkom pojedinca i reagovanje na slabiji stimulus koji je u skladu sa ciljem/zadatkom. U kontekstu samoregulacije ponašanja u vezi sa ishranom, inhibicija bi se odnosila na sposobnost pojedinca da se odupre želji da pojede ukusnu, visokokaloričnu hranu koja uvećava količinu telesnih masti i ima negativne posledice po zdravlje. Nalazi dosadašnjih istraživanja ukazuju na povezanost niske inhibicije i prekomerne mase tela dece preadolescentnog i adolescentnog uzrasta (Anzman & Birch, 2009; Nederkoorn, Coelho, Guerrieri, Houben, & Jansen, 2012).

Premeštanje predstavlja sposobnost fleksibilnog prebacivanja pažnje sa jednog na drugi zadatak, cilj ili mentalni set. Ovo podrazumeva zanemarivanje informacije koje je trenutno irelevantna i fokusiranje na relevantnu informaciju. Ova sposobnost može uticati na pojedinca da svoje ponašanje u vezi sa ishranom fleksibilno menja u skladu sa situacijom (na primer da pronade adekvatnu zamenu za hranu koju je želeo da pojede ili da u pojedinim situacijama pojede i hranu koju ne bi trebalo, kao nagradu za svoju disciplinovanost u ishrani) (Hofmann et al., 2012).

Ažuriranje predstavlja sposobnost koja podrazumeva zadržavanje i kodiranje informacija značajnih za zadatak. Naime, stare i irelevantne informacije se ažuriraju u radnoj memoriji, odnosno zamenjuju se novim informacijama, značajnim za rešavanje zadatka. Ova EF predstavlja jedan vid radne memorije i ima važnu ulogu u kompleksnijim EF, kao što je planiranje (Korbach & Unger, 2014). Kapacitet radne memorije i ažuriranje su bitne determinante delovanja pojedinca u skladu sa dugoročnim ciljevima i strategijama ishrane (Dohle et al., 2018). Iako nedostaju istraživanja u kojima se ispituje veza ažuriranja sa navikama u ishrani i BMI preadolescenata, na uzorku odraslih ($M = 19,79$, $SD = 1,95$) utvrđeno je da je ažuriranje pozitivno povezano sa unosom voća i povrća (Allom & Mullan, 2014). To ukazuje na važnost ažuriranja za ispoljavanje poželjnog ponašanja u ishrani, za razliku od EF inhibicije koja je značajna za sprečavanje neželjenog ponašanja u vezi sa ishranom.

U prethodnim istraživanjima je utvrđen značaj EF za održavanje optimalne mase tela, ali ne postoji istraživanje u kome je ispitan odnos svih EF sa pokazateljima mase tela preadolescenata. Cilj ovog istraživanja je da se ispita povezanost tri osnovne egzekutivne funkcije – inhibicije, premeštanja i ažuriranja sa indeksom telesne mase kod dečaka i devojčica preadolescentnog uzrasta.

Metod

Uzorak

Uzorak je prigodan i činilo ga je 137 učenika 3. razreda osnovne škole (70 devojčica i 67 dečaka) prosečnog uzrasta 9.6 godina ($SD=0.28$). Prema izveštaju pedagoško-psihološke službe škole, ni jedan učenik iz uzorka nema poremećaj pažnje, niti radi po individualnom obrazovnom planu (IOP-u).

Varijable i instrumenti

1. Egzekutivne funkcije

Tri egzekutivne funkcije (inhibicija, premeštanje i ažuriranje) merene su pomoću eksperimentalnih zadataka prilagođenih kompjuterskom zadavanju.

Inhibicija je merena korišćenjem Modifikovanog Strupovog zadatka (Stroop, 1935). Ovaj zadatak je adaptiran prema Mijakijevoj verziji za kompjutersko zadavanje (Miyake et al., 2000). Zadatak ispitanika je da pritiskom dirke na tastaturi označe koliko stimulusa ima na ekranu (jedan, dva ili tri). Svi stimulusi pripadaju jednoj od tri kategorije: neutralni stimulusi – slova, kongruentni stimulusi – broj/brojevi kongruentni svom ukupnom broju (na primer broj 3 napisan 3 puta), nekongruentni stimulusi – broj/brojevi nekongruentni ukupnom broju tih brojeva (na primer broj 3 napisan 2 puta). Mera inhibicije (RTdiff) se računa oduzimanjem prosečnih vremena reakcije za inkongruentne stimuluse od prosečnih vremena reakcije za neutralne stimuluse, kao i oduzimanjem proporcije grešaka za inkongruentne stimuluse od proporcije grešaka za neutralne stimuluse (PEdiff). Mera inhibicije su negativni brojevi, a veće vrednosti ukazuju na bolju inhibiciju.

Premeštanje je mereno korišćenjem testa Smajli koji se temelji na paradigmi premeštanja (Rogers & Monsell, 1995) Ispitanicima se prikazuje slika velikog kvadrata podeljenog na četiri manja kvadrata, a u jednom od njih je slika smajlija. Zadatak se sastoji od tri bloka: prvi i drugi blok sadrže po 40 stimulusa, a treći blok 80 stimulusa. U prvom bloku se ispod slike kvadrata nalazi strelica koja je usmerena gore-dole. Zadatak ispitanika je da pritiskom dirke na tastaturi (strelice) označi da li se smajli nalazi gore ili dole. U drugom bloku se ispod slike kvadrata nalazi strelica koja je usmerena levo-desno. Zadatak ispitanika je da pritiskom dirke na tastaturi (strelice) označi da li se smajli nalazi levo ili desno. U trećem bloku se pseudorendomizovano smenjuju zahtevi prvog i drugog bloka, a ispitanik treba tačno da odgovara na tastaturi, uz brzo premeštanje sa jednog zahteva na drugi. Mera premeštanja (RTdiff) se računa oduzimanjem prosečnih vremena reakcije u prva dva bloka zajedno od prosečnih vremena reakcije u trećem bloku, odnosno oduzimanjem proporcije grešaka u prva dva bloka zajedno od proporcije grešaka u trećem bloku (PEdiff). Mera premeštanja su negativni brojevi, a veće vrednosti ukazuju na bolje premeštanje.

Ažuriranje je mereno korišćenjem testa Pamćenje slova, koji je adaptirana verzija istoimenog zadatka Mijakija i saradnika (Miyake et al., 2000). Ispitanicima se sekvencijalno prikazuju nizovi slova (ukupno 20 nizova), a njihov zadatak je da po završetku prikazivanja svakog niza reprodukuju i uz pomoć tastature unesu poslednja dva prikazana slova u svakom od prvih pet nizova, poslednja tri prikazana slova u svakom od narednih deset nizova i poslednja četiri prikazana slova u svakom od poslednjih pet nizova. Kako bi se postiglo vršenje ažuriranja od strane ispitanika, daje im se instrukcija da u svakom trenutku u sebi ponavljaju potreban broj poslednjih slova u nizu (poslednja dva, tri ili četiri slova). Dužina niza varira od 5 do 15 slova, a

u cilju održavanja pažnje ispitanika nizovi različite dužine se smenjuju pseudorendomizovano. Nakon obaveštenja da će zadatak početi, na ekranu se pojavljuje instrukcija koliko poslednjih slova treba pamtiti. Nakon toga se, jedno za drugim, pojavljuju slova između čijeg prikaza se pojavljuje marker za fokusiranje pažnje. Na kraju niza, ispitanik treba na tastaturi da otkuca poslednja dva, tri ili četiri slova datog niza, u zavisnosti od zadatka. Mera ažuriranja je broj nizova u kojima su tačno zapamćena tražena poslednja slova u nizu.

2. Antropometrijske varijable

Visina tela je merena pomoću antropometra i izražena je u centimetrima, sa preciznošću od 0.1 centimetar. *Masa tela* je merena uz pomoć portabl-vage i izražena je u kilogramima, sa preciznošću od 0.1 kilogram. Na osnovu visine i mase tela izračunat je *indeks telesne mase (BMI)*, kao količnik mase tela u kilogramima i kvadrata visine u metrima.

3. Kontrolne varijable

Uticao *inteligencije* na vezu između EF i BMI je kontrolisan, imajući u vidu nalaze o povezanosti inteligencije i EF preadolescenata (Brydges, Reid, Fox, & Anderson, 2012). Inteligencija je testirana korišćenjem kombinacije standardne i napredne verzije Ravenovih progresivnih matrica (Pallier et al., 2002). Test se sastoji od 18 ajtema u kojima se ispitanicima prikazuje 3x3 matrica u kojoj se nalaze određeni simboli, a samo donji desni kvadrat je prazan. Zadatak ispitanika je da od pet ponuđenih odgovora koji su dati ispod matrice izaberu onaj koji logički treba da bude u donjem desnom kvadratu. Zadaci su poređani od lakših ka težim a vreme rada je ograničeno na 6 minuta.

Bavljenje učenika sportom – *sportski staž* je kontrolisan zbog mogućeg uticaja fizičkog vežbanja na EF (Diamond & Lee, 2011) i BMI (Poitras et al., 2016). Roditelji učenika su popunili upitnik u kome su upisali sport/sportove kojima se dete do tada bavilo i trajanje bavljenja sportom. Mera sportskog staža je ukupan broj meseci treniranja sporta/sportova.

Procedure i analiza podataka

Testiranje EF je izvršeno u toku dva dana u istoj radnoj nedelji, u informatičkoj učionici. Učenici su u grupama po osam radili eksperimentalne zadatke na računarima i odgovarali koristeći tastaturu. Inteligencija je testirana tokom časa redovne nastave, a visina i masa tela su izmerene tokom časa fizičkog vaspitanja.

U okviru statističke analize, za zadatke Smajli i Strup na kojima se dobijaju mere vremena reakcije, analizirana su samo vremena reakcije duža od 200ms, i to samo za one stimulse na koje je tačno odgovoreno. U nastavku je primenjena dvostruka procedura trimovanja – između i unutar ispitanika. Na osnovu pregleda raspodela vremena reakcije za sve zadatke, za kritičnu vrednost je određeno ± 3 standardne devijacije od prosečnog vremena reakcije za dati zadatak i sva vremena reakcije koja su bila viša/niša od kritične vrednosti zamenjena su kritičnom vrednošću.

U statističkoj obradi je korišćena deskriptivna statistika i parcijalna korelacija mera EF i BMI, uz kontrolu varijabli Sportski staž i Inteligencija.

Rezultati

U Tabeli 1 su prikazani deskriptivni pokazatelji mera EF, BMI, sportskog staža i inteligencije, odvojeno za poduzorke dečaka i devojčica. Rezultati pokazuju da ne postoji razlika u distribuciji podataka između poduzoraka dečaka i devojčica ni za jednu varijablu, osim za Premeštanje (RTdiff).

Tabela 1. Deskriptivni pokazatelji mera EF, BMI, sportskog staža i inteligencije (N=137)

	Dečaci			Devojčice			K-S(p)
	Min	Max	M (SD)	Min	Max	M (SD)	
Inhibicija (RTdiff)	-477,01	144,03	-64,22 (97,67)	-220,77	184,74	-65,19 (74,45)	,360
Inhibicija (PEdiff)	-0,41	0,11	-0,07 (0,08)	-0,39	0,08	-0,07 (0,08)	,960
Premeštanje (RTdiff)	-598,84	-127,62	-308,24 (95,29)	-1152,79	-122,13	-418,85 (179,63)	,000
Premeštanje (PEdiff)	-0,20	0,05	-0,07 (0,05)	-0,46	0,09	-0,09 (0,07)	,102
Ažuriranje	4,00	20,00	10,52 (3,66)	2,00	17,00	10,49 (3,38)	,980
BMI	14,70	29,00	19,11 (3,24)	12,20	26,50	18,81 (3,10)	,798
Sportski staž	0,00	60,00	33,63 (17,64)	0,00	66,00	25,34 (19,56)	,089
Inteligencija	2,00	17,00	9,61 (2,60)	4,00	16,00	10,76 (2,14)	,380

Legenda: ukupnan broj ispitanika je 137; Min – minimum; Max – maksimum; M – srednja vrednost; SD – standardna devijacija; K-S (p) – nivo značajnosti Kolmogorov-Smirnov testa razlika između distribucija rezultata u poduzorcima dečaka i devojčica, RTdiff – diferencijalni skor za vreme reakcije; PEdiff – diferencijalni skor za proporciju grešaka.

U Tabeli 2 su prikazane razlike između poduzoraka dečaka i devojčica za sve ispitivane varijable u ovom istraživanju. Rezultati t-testa pokazuju da između dečaka i devojčica postoje razlike u merama premeštanja, sportskog staža i inteligencije. Dečaci imaju bolje rezultate u pokazateljima premeštanja i duži sportski staž, a devojčice imaju višu inteligenciju.

Tabela 2. Razlike između dečaka i devojčica za varijable EF, BMI, Sportski staž i Inteligencija

	pol	M	SD	t	p
Inhibicija (RTdiff)	muški	-64,22	97,67	0,06	0,95
	ženski	-65,19	74,45		
Inhibicija (PEdiff)	muški	-0,07	0,08	-0,13	0,90
	ženski	-0,07	0,08		
Premeštanje (RTdiff)	muški	-308,24	95,29	4,53	0,00
	ženski	-418,85	179,63		
Premeštanje (PEdiff)	muški	-0,07	0,05	2,32	0,02
	ženski	-0,09	0,07		
Ažuriranje	muški	10,52	3,66	0,06	0,95
	ženski	10,49	3,38		
BMI	muški	19,11	3,24	0,55	0,58
	ženski	18,81	3,10		
Sportski staž	muški	33,63	17,64	2,60	0,01
	ženski	25,34	19,56		
Inteligencija	muški	9,61	2,60	-2,82	0,01
	ženski	10,76	2,14		

U Tabeli 3 je prikazana korelaciona analiza mera EF i BMI, uz kontrolu mogućeg uticaja sportskog staža i inteligencije na vezu između ovih varijabli. Rezultati korelacione analize pokazuju da je egzekutivna funkcija inhibicije negativno povezana sa BMI kod devojčica, $r = -0.27$, $p < .05$, dok za poduzorak dečaka između ovih varijabli ne postoji povezanost. Ovi nalazi ukazuju da devojčice sa slabijom inhibicijom imaju veći indeks telesne mase. Ostale dve EF – premeštanje i ažuriranje nisu povezane sa BMI ni u jednom poduzorku.

Tabela 3. Korelacija BMI i EF u poduzorcima dečaka i devojčica uz kontrolu sportskog staža i inteligencije

	BMI	
	Dečaci	Devojčice
Inhibicija (RTdiff)	-,12	-,27
Inhibicija (PEdiff)	,11	-,17
Premeštanje (RTdiff)	,07	,15
Premeštanje (PEdiff)	-,05	-,01
Ažuriranje	,06	-,07

Diskusija

U ovom istraživanju je ispitan odnos između EF, kao važnih kognitivnih funkcija u samoregulaciji ponašanja preadolescenata, i BMI, kao mogućeg pokazatelja njihovog ponašanja u vezi sa ishranom. Nalazi pokazuju da se distribucije rezultata dečaka i devojčica ne razlikuju, osim za meru Premeštanja RTdiff. Takođe, rezultati t-testa pokazuju da ne postoje razlike između dečaka i devojčica u BMI i merama EF, osim u pokazateljima premeštanja i u kontrolnim varijablama. Međutim, rezultati parcijalne korelacione analize su ukazali na postojanje razlika među poduzorcima. Za poduzorak devojčica otkrivena je negativna povezanost između inhibicije i BMI. To znači da devojčice sa slabijom inhibicijom imaju veći BMI, odnosno da bi mogle biti u povećanom riziku od gojaznosti.

Ovi nalazi su u skladu sa rezultatima prethodnih istraživanja koji ukazuju na značaj EF inhibicije prilikom odolevanja unosu ukusne, visokokalorične hrane, što posledično može imati uticaj na BMI (Anzman & Birch, 2009; Nederkoorn et al., 2012). Drugi važan faktor održavanja željenog nivoa BMI je fizička aktivnost, čiji je uticaj na vezu između inhibicije i BMI delom kontrolisan kroz sportski staž, odnosno ukupno vreme treniranja nekog sporta/sportova. Rezultati našeg istraživanja pokazuju da se devojčice u proseku manje bave sportom od dečaka, pa bi intervencije usmerene na redukciju mase tela devojčica mogle da obuhvataju kako poboljšanje inhibicije, tako i uključivanje devojčica u sistematske fizičke aktivnosti (na primer sportske aktivnosti).

U nalazima ovog istraživanja nije pronađena veza ostalih EF – premeštanja i ažuriranja, sa BMI ni u jednom poduzorku. Osim zbog specifičnosti malog uzorka ispitanika, može se pretpostaviti da bi razlog ovakvih nalaza mogao biti složenost ispoljavanja ovih egzekutivnih funkcija kada su one pokretači ponašanja u vezi sa ishranom. Naime, EF premeštanja podrazumeva fleksibilno menjanje ponašanja u vezi sa ishranom (Hofmann et al., 2012), što implicira analizu situacije u kojoj bi bilo opravdano promeniti kriterijum u vezi sa izborom vrste hrane, količine ili strategije unosa hrane. Deca uzrasta 9 do 10 godina, bez obzira na svoju sposobnost premeštanja, verovatno neefikasno koriste ovu EF u kontekstu poželjnog ponašanja u vezi sa ishranom.

Ažuriranje je važno za delovanje pojedinca u skladu sa dugoročnim ciljevima i strategijama ishrane (Dohle et al., 2018). Ovo podrazumeva da dete treba da odoleva često ukusnoj hrani i hrani se u skladu sa ponekad apstraktnim predstavama o cilju svog ponašanja u ishrani (na primer: biće zdravije, biće dugovečnije i slično) što je za decu ovog uzrasta veoma složeno i zahtevno, ukoliko se uzme u obzir faza razvoja inteligencije u kojoj se nalaze. Kompleksnost uloge ažuriranja u ovom, poželjnom ponašanju u vezi sa ishranom može biti razlog nepostojanja povezanosti ove EF i BMI u uzorku preadolescenata.

Zaključak

Istraživanje ukazuje na potencijalnu važnost EF inhibicije za održavanje optimalne mase tela devojčica preadolescentnog uzrasta. Utvrđena veza predstavlja osnovu za ispitivanje mogućeg kauzalnog odnosa između ovih varijabli u longitudinalnom istraživanju. Vezu inhibicije i BMI kod dečaka treba proveriti na većem uzorku, imajući na umu nalaze prethodnih istraživanja koji skoro dosledno ukazuju na povezanost inhibicije i BMI kod preadolescenata oba pola.

Odnos premeštanja i ažuriranja sa BMI bi takođe trebalo ispitati na većem uzorku, ali i na različitim uzrastima kako bi se otkrila eventualna vremenska dinamika aktiviranja ovih EF u poželjnim ponašanjima pojedinca u vezi sa ishranom.

U narednim istraživanjima treba koristiti veći broj mera EF, kao i preciznije pokazatelje prekomerne mase tela (određivanje udela masne komponente telesnog sastava).

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DIFFERENCES IN STUDENTS' ATTITUDES ABOUT THE IMPORTANCE AND DEVELOPMENT OF SCHOOL SPORT: A PILOT STUDY

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Introduction

The importance and development of school sport in the past few years has not been only the main focus of research individuals, but also of institutions in Serbia. This research represents only one of many who were aiming to offer answers to certain problems in school sport. It should also respond to the structure of attitudes of students, but also to point to the current understanding of school sports today in Serbia. School sport represents a significant part of the society that directly affects the physical development of individuals, thus directly contributing to the health, prosperity and well-being of one nation. It is desirable that school sport be the part of the educational process. Therefore, the authors point out that school sport has a multidimensional significance and needs to be viewed from several aspects. In one they definitely agree, which is that school sport creates a versatile and educated educational personality. Humanistic concept of sports advocates for the balanced psycho - physical, psycho - social and functional development of each individual, which in the era of modern sports is disappearing and is being suppressed (Havelka & Lazarević, 2011). This paper presents the first empirical findings of the differences in high school students from different backgrounds. Also, this study emphasizes the fact that a student is always in the most important part of school sport, whom we look from the aspect of social sciences, i.e. from the point of the position of the individual in the social environment, but in cooperation with other social factors (Savić, 2014)

So far, research has shown that this area of study is insufficiently investigated and justification and the need for this kind of research is necessary. Authors Koca & Demirhan (2004) investigated the attitudes of high school students towards physical education in relation to gender and degree of participation in sports sections of students aged 15 years and came to the conclusion that there are differences in favor of more positive attitudes towards male students. Also, Bailey (2006) found in his research the effects of physical exercise on motor development of children, as well as on social (social skills and behavior) and cognitive development. Trudeau & Shephard (2005) analyzed the effects of physical education programs in schools on the level of physical activity of students and adults, as well as their attitudes towards physical education. The results of the research have shown that the contents of the physical education programs can significantly contribute to the overall extent of physical activity, and that most children have positive attitudes towards physical exercise. In addition, in order to examine the current problems of school sports, it is important to emphasize that there are differences in the level of physical activity between pupils of elementary and high schools in favor of elementary school students, as well as the existence of differences in the level of physical activity in both age groups in favor of male adolescents (Marković, Šekeljić, Višnjić, & Ilčev, 2013; Radisavljević-Janić, Milanović, & Lazarević, 2012). However, in spite of the fact that the obtained results of the abovementioned research demonstrate a higher level of physical activity of elementary school students, the examination of the attitudes of primary and secondary school students towards school sports determined that, although there are differences in certain claims, especially in the part of the development of school sports in favor of elementary school students, does not mean that high school students do not show positive attitudes towards school sports (Savić, Stojanović, Randelović, & Stojiljković, 2015). On the contrary, the attitudes of high school students are quite positive, and the reasons for reduced physical activity of high

school students should be looked from several aspects. Based on the research of certain authors (Darst, Pangrazi, Sariscsany, & Brusseau, 2006; Sibley & Etnier, 2003), one of the reasons for the reduced participation of high school students in school sports is the stress, which is a result of full maturation.

Based on the above-mentioned the problem of this research was to determine significance and development of school sports in high schools in the cities of Nis and Gracanica. Partially, the problem of this research indirectly refers to the immediate realization of the content of school sports (work in sections and participating in school sports competitions). Therefore, the main goal of this research was to determine the differences in the attitudes of high school students about the importance and development of school sports, as if to determine the structure of attitudes of students from different backgrounds in order to make an adequate consideration of the importance and development of school sports in the population of high school students.

Method

Study design

The survey was conducted in January 2018 during regular school competitions in Nis and Gracanica. The research was conducted by students of the Master studies, as a part of curriculum of the "School Sports" course. Prior to the survey itself, the interviewers gave some necessary instructions to students on how to complete the survey.

The research involved collecting data on the evaluation and development of school sports by students. In a relatively short time, we received data from a large number of respondents (77). The data were collected using the questionnaire (pilot survey, author Savić, Z.), comprised of twenty four (24) items - claims. The claims are clearly, unequivocally and precisely compiled in a certain order. The questionnaire is given in the form of a five-step Likert scale. The answers were expressed in the form of grades from 5 to 1. It was answered by marking one of the offered answers. For the purposes of this pilot study, two variables were applied. They are defined as follows: 1) the first variable is included with the first 10 questions from the survey and is defined as the importance of school sports, 2) the other variables are covered from the other 14 items and is defined as the development of school sports. Using these two variables, an appropriate statistical data processing was made.

Participants

Sample for this research was selected from the population of high school students from Nis and Gracanica. The inclusion criteria was that all the subjects participated in the school sport competitions organized by the School Sport Association in Serbia. The sample of participants consisted of 77 male high school students aged 15-18 years, divided into two subsamples. The first subsample consisted of 34 high school students from the city of Gracanica, while the other one consisted of 43 high school students from the city of Nis, all from the Republic of Serbia. This number of respondents absolutely satisfied the condition for this pilot study, ie quantitative analysis for the given number of variables and the possibility of generalizing the results. This study did not take into account the medical status of students, which certainly did not diminish the significance of this research. Furthermore, the authors collected permissions from the school officials for carrying out the research. Also, each student participated voluntarily and signed a written consent form prior to the onset of participation.

Statistical analysis

The results in this study was based on the use of adequate nonparametric statistics methods that deal with data that are classified by categories, such as scales of attitudes assessment, questionnaire responses, etc., in which distribution deviates from normal (Malacko & Popović, 2001). They are shown in the tables as frequencies and percentages. Mann - Whitney U test is used to determine the significance differences

between the examined subsamples. The obtained data will be compared through the median and we should get a more reliable comparison of the ranking data (Nikolić, 2012). In addition to the above procedures, descriptive method was also used in this study, as well as method of observation and comparative method. We compared the differences between groups of respondents using determined variables.

Results

The selection and application of statistical procedures in the processing of collected data were directly determined by the nature of the pedagogical phenomenon, that is, the subject of this research (Kožuh & Maksimović, 2011). The purpose of the research was based on the importance and development of school sports among high school students from Nis and Gracanica. By examining the significance and development of the school sport of the respondents, we examined the understanding of the given problem by students, their ways of perceiving, evaluating and responding, as well as starting up certain activities. According to the given instructions before the interview, the students filled out the survey. In tables 1. and 2. we presented nonparametric statistics (frequencies and percentages) for these subsamples.

Table 1. Frequencies and percentages of attitudes of high school students from Nis

Claim / degree of agreement		5	4	3	2	1
N=43	Importance of school sport:	Frequencies and Percentages				
1.	Participation in school sports helps me in learning process and everyday life	23(53.5)	15(34.9)	4(9.3)	0(0)	1(2.3)
2.	Engaging in school sports provides me great satisfaction	37(86.0)	5(11.6)	1(2.3)	0(0)	0(0)
3.	Participation in school sports develops positive behaviors	32(74.4)	10(23.3)	1(2.3)	0(0)	0(0)
4.	Engaging in school sports prevents the occurrence of deformities in children and young people	31(72.1)	8(18.6)	4(9.3)	0(0)	0(0)
5.	Participation in school sports affects the proper growth and development of an individual's organism	37(86.0)	4(9.3)	1(2.3)	1(2.3)	0(0)
6.	Engaging in school sports develops discipline	28(63.3)	12(27.9)	2(4.7)	0(0)	1(2.3)
7.	School sport provides me traveling, acquaintances and friendships	24(52.2)	13(20.0)	2(4.7)	2(4.7)	2(4.7)
8.	Engaging in school sports reduces aggression among both male and female students	18(41.9)	15(34.9)	5(11.6)	3(7.0)	2(4.7)
9.	Engaging in school sports develops a collective spirit	33(76.7)	7(16.3)	3(7.0)	0(0)	0(0)
10.	Activities in school sports develop proper hygiene and health habits	18(41.9)	13(30.2)	11(25.6)	1(2.3)	0(0)
Development of school sport:		Frequencies and Percentages				
11.	My school highly values school sport	25(58.1)	11(25.6)	4(9.3)	1(2.3)	2(4.7)
12.	My school have enough sports facilities and playgrounds	6(14.0)	11(25.6)	5(11.6)	7(16.3)	14(32.6)
13.	In my school, sports sections are regularly carried out	20(46.5)	14(32.6)	7(16.3)	1(2.3)	1(2.3)
14.	At my school, students who are engaged at school sports competitions are valued and respected	24(55.8)	6(14.0)	4(9.3)	2(4.7)	7(16.3)
15.	My school regularly organizes school sports competitions	15(34.9)	11(25.6)	10(23.3)	5(11.6)	2(4.7)
16.	My school organizes and participates in municipal competitions	30(69.8)	8(18.6)	4(9.3)	1(2.3)	0(0)

17.	My school also participates in the State competitions	26(60.5)	9(20.9)	5(11.6)	3(7.0)	0(0)
18.	My school has the necessary equipment for school sports competitions	14(32.6)	15(34.9)	10(23.3)	2(4.7)	2(4.7)
19.	Physical education teacher is regularly engaged in school sports	33(76.7)	6(14.0)	2(4.7)	1(2.3)	1(2.3)
20.	Physical education teacher publicly praises the students who attend school competitions	29(67.4)	7(16.3)	5(11.6)	1(2.3)	1(2.3)
21.	Physical education teacher engages students from sports clubs in school sports	34(57.8)	8(22.2)	1(2.3)	0(0)	0(0)
22.	Physical education teacher engages other students. who are not in sports clubs. in school sport	31(72.1)	10(23.3)	2(4.7)	0(0)	0(0)
23.	The class officer supports and encourages students to engage in school sports	22(51.2)	10(23.3)	5(11.6)	1(2.3)	5(11.6)
24.	Other school teachers highly value school sports competitions	17(39.5)	9(20.9)	6(14.0)	5(11.6)	6(14.0)

Legend: 5 – strongly agree; 4 – agree; 3 – neutral; 2 – disagree; 1 – strongly disagree

By general retrospect and analysis of the results in **table 1**. first ten items, i.e. the importance of school sports, we note that the highest number of high school students from Nis were concentrated in the highest grades (5), i.e. positive attitudes ranging from 41.9% to unexpected 86.0%, in the claim that *"Participation in school sports affects the proper growth and development of an individual's organism"*. It is also positive that *"Engaging in school sports provides me great satisfaction"* also 86.0% of the answers. The number of neutral answers is expected to range from 2.3% to 25.6%. There were also those with absolutely negative answers from 2.3% to 4.7%, and to the assertions *"Participation in school sports helps me in learning process and everyday life"* and *"School sport provides me traveling, acquaintances and friendships"*.

By further analysis of the answers on the other 14 claims, that deal with the development of school sports, we could notice similar answers, i.e. the similar statements were made by students. For the most claims the answers are dispersed from grades 1 to 5. Only four claims have no extreme negative pronouncements. In this variable we could notice a higher percentage of positive statements of the students with the highest grade (5), from 34.9% to 76.7%, where the students are unique, agreeing *"Physical education teacher is regularly engaged in school sports"*. The percentage of 32.6% in the claim *"My school have enough sports facilities and playgrounds"* is actually a real picture of the current state. It was expected that 57.8% of students answers were towards the claim that *"Physical education teacher engages students from sports clubs in school sports"*. It is also interesting to say that students attitudes towards claim that *"school highly values school sport"* were scattered at all levels from positive 39.5% to negative of 14.0%. It is also positive that *"Physical education teacher publicly praises the students who attend school competitions"* 67.4%, and that *"The class officer supports and encourages students to engage in school sports"* 57.8%. By contrast, 16.3% of students claim that competitors in the school sports are not respected in the domain expected.

Table 2. Frequencies and percentages of attitudes of high school students from Gračanica

Claim / degree of agreement		5	4	3	2	1
N=34	Importance of school sport:	Frequencies and Percentages				
1.	Participation in school sports helps me in learning process and everyday life	10(29.4)	15(44.1)	5(14.7)	2(5.9)	2(5.9)
2.	Engaging in school sports provides me great satisfaction	22(64.7)	8(23.5)	1(2.9)	1(2.9)	2(5.9)
3.	Participation in school sports develops positive behaviors	15(44.1)	15(44.1)	0(0)	1(2.9)	2(5.9)
4.	Engaging in school sports prevents the occurrence of deformities in children and young people	25(73.5)	5(14.7)	4(11.7)	0(0)	0(0)

5.	Participation in school sports affects the proper growth and development of an individual's organism	20(58.8)	10(29.4)	2(5.9)	2(5.9)	0(0)
6.	Engaging in school sports develops discipline	13(38.2)	11(32.4)	7(20.6)	1(2.9)	2(5.9)
7.	School sport provides me traveling, acquaintances and friendships	12(35.3)	9(26.5)	9(26.5)	2(5.9)	2(5.9)
8.	Engaging in school sports reduces aggression among both male and female students	8(23.5)	10(29.4)	5(14.7)	7(20.6)	4(11.7)
9.	Engaging in school sports develops a collective spirit	16(47.1)	14(41.2)	4(11.7)	0(0)	0(0)
10.	Activities in school sports develop proper hygiene and health habits	8(23.5)	14(41.2)	6(17.6)	3(8.8)	3(8.8)
Development of school sport:		Frequencies and Percentages				
11.	My school highly values school sport	14(41.2)	8(23.5)	7(20.6)	4(11.7)	1(2.9)
12.	My school have enough sports facilities and playgrounds	0(0)	3(8.8)	1(2.9)	12(35.3)	18(52.9)
13.	In my school, sports sections are regularly carried out	7(20.6)	11(32.4)	7(20.6)	7(20.6)	2(5.9)
14.	At my school, students who are engaged at school sports competitions are valued and respected	15(44.1)	8(23.5)	6(17.6)	2(5.9)	3(8.8)
15.	My school regularly organizes school sports competitions	11(32.4)	11(32.4)	8(23.5)	3(8.8)	1(2.9)
16.	My school organizes and participates in municipal competitions	11(32.4)	12(18.6)	8(23.5)	2(5.9)	1(2.9)
17.	My school also participates in the State competitions	9(26.5)	11(32.4)	9(26.5)	2(5.9)	3(8.8)
18.	My school has the necessary equipment for school sports competitions	0(0)	3(11.8)	4(11.7)	17(50.0)	10(29.4)
19.	Physical education teacher is regularly engaged in school sports	29(85.3)	3(8.8)	2(5.9)	0(0)	0(0)
20.	Physical education teacher publicly praises the students who attend school competitions	20(58.8)	10(29.4)	4(11.8)	0(0)	0(0)
21.	Physical education teacher engages students from sports clubs in school sports	14(41.2)	13(38.2)	4(11.8)	2(5.9)	1(2.9)
22.	Physical education teacher engages other students who are not in sports clubs, in school sport	21(61.8)	10(29.4)	3(8.8)	0(0)	0(0)
23.	The class officer supports and encourages students to engage in school sports	13(38.2)	8(23.5)	9(26.5)	4(11.8)	0(0)
24.	Other school teachers highly value school sports competitions	11(32.4)	5(14.7)	5(14.7)	5(14.7)	8(23.5)

Legend: 5 – strongly agree; 4 – agree; 3 – neutral; 2 – disagree; 1 – strongly disagree

In **table 2**. The frequency of responses of high school students from Gracanica is expressed in frequencies and percentages. In the frame of the variable that contains the first 10 items, which expresses the importance of school sports, we can say that students, in the largest percentage, fully agree with the assertions: "Engaging in school sports provides me great satisfaction" 64.7%, "Engaging in school sports prevents the occurrence of deformities in children and young people" 73.5% and that "Participation in school sports affects the proper growth and development of an individual's organism" 58.8%. The highest percentage of negative pronouncements we could notice in the assertion that "Activities in school sports develop proper hygiene and health habits" 8.8%, and positive ones 23.5%. It is also a fact that students believe "school sport does not reduce aggressiveness" 23, 5%, and 11.7% has a negative attitudes to this claim.

When analyzing students' statements on claims that characterize the development of school sports, we noticed only two claims that concern teachers of physical education where students are highly positive (5). These are "Physical education teacher is regularly engaged in school sports" 85.3%, and "Physical education teacher publicly praises the students who attend school competitions" 58.8%. With the statement "My school have enough sports facilities and playgrounds" 52.9% and "My school has the necessary equipment for school sports competitions" 29.4% with absolutely negative estimates indicating the necessary corrections in the future practice are needed.

Table 3. Differences in attitudes of high school students (Mann-Whitney U test)

	Claim	Group 1 (N=43)	Group 2 (N=34)	Group 1 Median	Group 2 Median	U	Z	P level
1.	Participation in school sports helps me in learning process and everyday life	1887.50	1115.50	5	4	520.50	2.16	0.031
2.	Engaging in school sports provides me great satisfaction	1840.50	1162.50	5	5	567.50	1.68	0.094
3.	Participation in school sports develops positive behaviors	1886.00	1117.00	5		522.00	2.14	0.032
4.	Engaging in school sports prevents the occurrence of deformities in children and young people	1672.50	1330.50	5	5	726.50	-0.05	0.963
5.	Participation in school sports affects the proper growth and development of an individual's organism	1874.00	1129.00	5	5	534.00	2.02	0.043
6.	Engaging in school sports develops discipline	1916.00	1087.00	5	4	492.00	2.45	0.014
7.	School sport provides me traveling, acquaintances and friendships	1870.50	1132.50	5	4	537.50	1.98	0.047
8.	Engaging in school sports reduces aggression among both male and female students	1895.00	1108.00	4	4	513.00	2.24	0.025
9.	Engaging in school sports develops a collective spirit	1887.00	1116.00	5	4	521.00	2.15	0.031
10.	Activities in school sports develop proper hygiene and health habits	1836.50	1166.50	4	4	571.50	1.64	0.102
11.	My school highly values school sport	1835.00	1168.00	5	4	573.00	1.62	0.105
12.	My school have enough sports facilities and playgrounds	1954.00	1049.00	3	1	454.00	2.84	0.004
13.	In my school. sports sections are regularly carried out	1951.00	1052.00	4	4	457.00	2.81	0.005
14.	At my school. students who are engaged at school sports competitions are valued and respected	1722.50	1280.50	5	4	685.50	0.47	0.641
15.	My school regularly organizes school sports competitions	1659.50	1343.50	4	4	713.50	-0.18	0.858
16.	My school organizes and participates in municipal competitions	1967.00	1036.00	5	4	441.00	2.97	0.003
17.	My school also participates in the State competitions	1948.00	1055.00	5	4	460.00	2.78	0.005
18.	My school has the necessary equipment for school sports competitions	2246.50	756.50	4	2	161.50	5.84	0.000
19.	Physical education teacher is regularly engaged in school sports	1612.50	1390.50	5	5	666.50	-0.66	0.508
20.	Physical education teacher publicly praises the students who attend school competitions	1715.00	1288.00	5	5	693.00	0.39	0.697
21.	Physical education teacher engages students from sports clubs in school sports	1977.00	1026.00	5	4	431.00	3.08	0.002

22.	Physical education teacher engages other students. who are not in sports clubs. in school sport	1757.50	1245.50	5	5	650.50	0.83	0.409
23.	The class officer supports and encourages students to engage in school sports	1765.50	1237.50	5	4	642.50	0.91	0.364
24.	Other school teachers highly value school sports competitions	1784.50	1218.50	4	3	623.50	1.10	0.270

Legenda: U – U test value; Z – Z score value; P level – the significance of differences ($p < .05$)

Group 1 – high school students from Nis; **Group 2** – high school students from Gracanica.

By inspecting the **table 3**, which shows the differences in the general importance of school sports but also the structure of attitudes in both subsamples, there is a statistically significant difference in assertions **1, 3, 5, 6, 7, 8, and 9**, at the level of significance $p < .05$ for the benefit of students of high schools from the city of Nis with more positive attitudes.

In the part of the table showing the development of school sports, we also notice statistically significant differences in assertions **12, 13, 16, 17, 18, and 21** at the level of significance $p < .05$. All the above claims are more positive in the students of high schools from the city of Nis, and therefore there are statistically significant differences in the individual statements.

Discussion

When it comes to school sports, we must bear in mind: that it is a special segment of sports, it is also a link between two important areas of physical culture (physical education and sports). It contains characteristics of both areas, but definitely have the characteristics of physical education. School sport should be treated as a segment of the education system, in which it teaches "why and how to practice". School sports should include characteristics of the training process, but not in the form of top sports, but its importance is reflected in the desire for mutual competition and that the achieved results are not an objective but an asset, which are the determinants of school sport belonging to the school and the educational process. School sport thus promotes the active participation of students, and this is also the main reason why students decide to participate. Also, an important goal is to form a lasting interest in sports, which can contribute to sports or recreational activities throughout entire life. Bearing in mind the trends of modern life as well as the time in which we live, and the fact that children are not physically active at present, school sports and physical education are of great importance for their development and progress (Savić, 2014). Therefore, some of the future research should be pointed in this direction which could present some new guidelines in practice.

These are just some of the reflections that have determined the authors to explore the importance and development of school sports in two different economic environments. Some research supports the fact that the contents of physical education programs and school sports competitions can significantly contribute to the overall extent of physical activity, and that most students have positive attitudes towards school sports competitions (Trudeau & Shephard, 2005). This research has produced similar results. Students of both entities highly value school sport as a whole and positively refer to school competition.

In one of their previous research, the authors (Savić et al., 2015) investigated the differences in the attitudes of elementary and high school students in Serbia, and proved that they evaluate the development of school sports in different cities, economic environments. They also found that primary school students had more positive answers in some assertions, but the high school students had more developed attitudes towards engagement in physical activity and school sport. This study found differences in the benefit of students from Niš, since there are also economic and social differences in these environments.

The strength and direction of motivation for school sport vary greatly, for some students, physical education is the most favorite part of the school day, and for others it is the main cause of stress and the

reason why students are absent from school (Hagger, Chatzisarantis, & Biddle, 2002; Wang & Biddle, 2001). The cause of the reduced interest can also be the exclusion of a larger number of students from school sports competitions, where athletes mostly have precedence (Shephard, Lavalle, & Larivire, 1978), as well as students' fear of participating in sports competitions (Thompson, Humbert, & Mirwald, 2003).

Physical activity has the roots in the family's upbringing, and should be supplemented by later elementary and high schools (Cvejić, Pejović, & Ostojić, 2013). We should strive for physical activity to be the way of life and work of the school population. This certainly was not the situation with the students from Nis and Gracanica, and therefore there were differences in the part of the attitude towards the positive values of school sports, for the benefit of the students from Nis. During the period of puberty or the period of intense growth and development of the organism, physical activity is an extremely important factor because in this sensible phase it will enable the fulfillment of full biological potential.

Students mostly rated for grades 4 and 5, and the results ranged from 14 to 76.7% for students from Nis high schools and from 0 to 85.3% for Gracanica students. The data that worries where large percentage of students claimed that schools don't have enough sports facilities playgrounds, where the answers disagree and strongly disagree (32.6 % and 16.3% in Nis, and 52.9% and 35.3% in Gracanica) prevailed. Also, the fact that the students from Gračanica claimed that the school doesn't have the necessary equipment for the school sport competitions is alarming. They answers strongly disagree and disagree (29.4% and 50.0%) prevailed. The percentage of pupils who were neutral ranged from 2.3% to 23.3% in the expected range from students from Nis and from 2.9% to 26.5% in students from Gracanica.

The analysis of the results showed that there are significant differences in individual claims between the examined subsamples, in terms of the significance and development of school sport in favor of the students from Nis. When comparing the obtained results, which relate to the importance of school sports, we find that in 7 out of 10 examined claims were statistically significant in favor of students from Nis (**p <.05**). Also, it was established that the population of the students from Nis is more positively related to the development of school sports in 6 out of 14 examined subjects (**p <.05**). Therefore, it was established that the students from Nis had more positive attitudes towards the importance and development of school sports.

All of the abovementioned implies that it is imperative to develop and equally invest in school sports in all environments, all in order to create a healthy and motorically "enriched" population, and thus create positive habits for physical exercise. Therefore, one of the possible solutions for improving the development of children is the early inclusion of free extracurricular sports activities in the school.

Conclusion

The school as an educational institution is the most important environment for the promotion of students' physical activity. Physical education and school sport, directly influence the development of motor skills, primarily allow the increased physical activity of children during physical education and extracurricular sport activities (Bailey, 2006; Sallis et al., 1997). There is evidence that those who developed a strong foundation in basic motor skills, were probably more physically active during their childhood and adolescence, and thus gained positive habits to be engaged in physical activity throughout their lives (Okely, Booth, & Patterson, 2001). On the contrary, children who were unable to get an adequate basis of ability to move, are more likely to not actively participate in organized sports activities and play with their peers due to the lack of basic motor skills and abilities (Ignico, 1990). By analyzing the obtained results, the authors emphasize that there are significant differences in the assertions among the groups, in terms of the significance and development of school sport in favor of the students from Niš. When we look at the obtained results from the aspect of students' attitudes towards the importance of school sports, we found that in 7 out of 10 examined items there were statistically significant differences in the benefit of students from Niš (p

<.05). Also, it was established, that the population of students from Niš is more positively related to the development of school sports in 6 out of 14 examined items ($p < .05$).

We can conclude that the school sport in Nis is more developed and more important for students from Nis than students from Gracanica schools. The reason for the differences can be found in the social context of school sport in the mentioned environments, in the absence of adequate conditions for the organization and realization of school sports competitions. We believe that the limitation of this research can be a small sample of respondents, so in the next research the larger sample should be treated to obtain statistically significant results.

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RAZLIKE U STAVOVIMA UČENIKA O ZNAČAJU I RAZVIJENOSTI ŠKOLSKOG SPORTA: PILOT ISTRAŽIVANJE

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Uvod

Značaj i razvijenost školskog sporta u proteklih nekoliko godina nije bilo u fokusu istraživanja kod pojedinaca, ali i institucija u Srbiji. Ovo istraživanje predstavlja samo jedno od mnogih koja su imale za cilj da ponude odgovore na određene probleme u školskom sportu. Glavni cilj ovog pilot istraživanja je bio da se utvrdi da li postoje razlike u stavovima učenika srednjih škola iz dva različita grada Niša i Gračanice. Takođe, ono treba da odgovore i na strukturu stavova učenika, ali i da ukaže na aktuelno razumevanje školskog sporta danas u Srbiji. Školski sport predstavlja značajan deo društva koji neposredno utiče na fizički razvoj pojedinaca, čime direktno doprinose zdravlju, napretku i blagostanju jednog naroda. Poželjno je da školski sport bude i deo vaspitno – obrazovnog procesa. Zato autori sa pravom ističu da školski sport ima višedimenzionalni značaj i da ga treba posmatrati sa više aspekata. U jednom su svakako saglasni, a to je da školski sport stvara svestranu i obrazovanu vaspitnu ličnost. Humanistic concept of sports advocates for the balanced psycho - physical, psycho - social and functional development of each individual, which in the era of modern sports is disappearing and is being suppressed (Havelka & Lazarević, 2011). Ovaj rad predstavlja prve empirijske nalaze istraživanja razlika kod učenika srednjih škola iz različitih sredina. Takođe, ovo istraživanje ističe i činjenicu da je uvek u centru čovek – učenik, koga sagledavamo sa aspekta društvenih nauka, tj. položaja pojedinca u društvenom okruženju, ali u saradnji sa ostalim društvenim činionicima (Savić, 2014)

Dosadašnjim istraživanjima, ukazuju na nedovoljno istraženo područje i opravdanost i potrebu ovakvog vida istraživanja. Autori Koca & Demirhan (2004) istraživali su stavove srednjoškolaca prema fizičkom vaspitanju u odnosu na pol i stepen učešća u sportskim sekcijama učenika starosti 15 godina i došli do zaključka da postoje razlike u korist pozitivnijih stavova učenika koji se bave školskim sportom. Takođe, Bailey (2006) je u svom istraživanju utvrdio efekte fizičkog vežbanja na motorički razvoj dece tako i na socijalni (socijalne veštine i ponašanje) i kognitivni razvoj. (Trudeau & Shephard, 2005) analizirali su efekte programa fizičkog vaspitanja u školama na nivo fizičkih aktivnosti učenika i odraslih, kao i njihove stavove prema fizičkom vaspitanju. Rezultati istraživanja pokazali su da sadržaji programa fizičkog vaspitanja mogu značajno da doprinesu ukupnom obimu fizičkih aktivnosti, kao i da većina dece ima pozitivne stavove prema fizičkom vežbanju. Pored toga, u cilju sagledavanja aktuelnih problema školskog sporta, važno je naglasiti i da postoje razlike u nivou fizičke aktivnosti između učenika osnovnih i srednjih škola u korist učenika osnovnih škola, kao i postojanje polnih razlika u nivou fizičke aktivnosti u obe uzrasne grupe u korist adolescenata muškog pola (Marković, Šekeljić, Višnjić, & Ilčev, 2013; Radisavljević-Janić, Milanović, & Lazarević, 2012). Međutim, i pored toga što dobijeni rezultati istraživanja navedenih autora dokazuju veći nivo fizičke aktivnosti učenika osnovnih škola, ispitivanjem stavova učenika osnovnih i srednjih škola prema školskom sportu utvrđeno je da, iako postoje razlike u pojedinim tvrdnjama, naročito u delu razvijenosti školskog sporta, u korist učenika osnovnih škola, ne znači da učenici srednjih škola ne iskazuju pozitivne stavove prema školskom sportu (Savić, Stojanović, Randelović, & Stojiljković, 2015). Naprotiv, stavovi učenika srednjih škola su itekako pozitivni, te bi razloge smanjene fizičke aktivnosti srednjoškolaca trebalo detaljnije sagledati. Na osnovu istraživanja (Darst, Pangrazi, Sariscsany, & Brusseau, 2006; Sibley & Etnier, 2003) jedan

od razloga smanjenog učešća srednjoškolaca u školskom sportu je i neposredan stres, koji je posledica polnog sazrevanja.

Na osnovu prethodno navedenog problem ovog istraživanja možemo sagledati u neposrednom značaju, razvijenosti tj. zastupljenosti školskog sporta u srednjim školama u gradovima Nišu i Gračanici. Delom, problem istraživanja indirektno se odnosi i na neposrednu realizaciju sadržaja školskog sporta (rad u sekcijama i odlazak na školska sportska takmičenja). Dakle, osnovni cilj ovog istraživanja bio je da se utvrde razlike u stavovima učenika srednjih škola o značaju i razvijenosti školskog sporta, kao da se utvrdi struktura stavova učenika iz različitih sredina u cilju što adekvatnijeg sagledavanja značaja i razvijenosti školskog sporta kod populacije srednjoškolaca.

Metode

Opis istraživanja: istraživanje je sprovedeno Januara meseca 2018. godine u toku redovnih školskih takmičenja u Nišu i Gračanici. Istraživanje su sproveli studenti Klasičnih master studija u okviru interaktivnosti na predmetu „Školski sport“. Pre samog pristupanja anketiranju, anketari su davali određena neophodna uputstva učenicima o načinu popunjavanja navedene ankete.

Varijable i tehnike istraživanja: istraživanje se bavilo prikupljanjem podataka o vrednovanju i razvijenosti školskog sporta od strane učenika. Za relativno kratko vreme došli smo podataka od većeg broja ispitanika (77). Podaci su prikupljeni primenom Kvestionera (*pilot anketa, autora Savić, Z.*), tj. upitnikom koga čine dvadeset četiri (24) ajtema – tvrdnji. Tvrdnje su jasno, nedvosmisleno i precizno sastavljene po određenom redosledu. Upitnik je dat u obliku petostepene skale *Likertovog tipa*. Odgovori su iskazani u vidu ocena od 5 do 1. Odgovaralo se zaokruživanjem jednog od ponuđenih odgovora. Za potrebe ovog pilot istraživanja primenjene su dve varijable. One su definisane na sledeći način: 1) prva varijabla obuhvaćena je sa prvih 10 ajema iz ankete i definisana je kao **značaj školskog sporta**, 2) druga varijabla obuhvaćena je sa ostalih 14 ajtema i definisana je kao **razvijenost školskog sporta**. Pomoću ove dve varijable urađena je i odgovarajuća statistička obrada podataka.

Uzorak ispitanika ovog istraživanja izabran je iz populacije učenika srednjih škola Niša i Gračanice. Kriterijum uključivanja bio je da su svi ispitanici učestvovali na školskim sportskim takmičenjima u organizaciji Saveza za školski sport Srbije. Uzorak ispitanika sastojao se od 77 srednjoškolaca starosti od 15 do 18 godina, podeljenih u dva subuzorka. Prvi subuzorak sastojao se od 34 srednjoškolaca iz Gračanice, a drugi od 43 srednjoškolaca iz Niša, svi iz Republike Srbije. Ovaj broj ispitanika apsolutno je zadovoljio uslov za ovo pilot istraživanje, tj. kvantitativnu analizu s obzirom na broj varijabli i mogućnost generalizacije rezultata. Ovo istraživanje nije uzimalo u obzir zdravstveni status učenika, što svakako nije umanjilo značaj ovog istraživanja.

Postupak obrade ili **statistička analiza** rezultata u ovom istraživanju bazirala se na korišćenju adekvatnih metoda neparametrijske statistike, koja se bavi podacima koji su razvrstani po kategorijama, kao što su skale procene stavova, odgovori u anketama i slično, tj. kod kojih distribucija odstupa od normale (Malacko & Popović, 2001). Prikazane su u tabelama: frekvencije, procenti i *Mann – Whitney U test*, tj. utvrđena je značajnost razlika između ispitivanih subuzoraka. Dobijeni podaci upoređiće se preko medijana i dobićemo sigurnije upoređenje rangiranih podataka (Nikolić, 2012). Pored navedenih postupaka u radu su korišćene još i *deskriptivna* tj. metoda opservacije i *komparativna metoda*. Njome smo uporedili razlike između grupa ispitanika pomoću utvrđenih varijabli.

Rezultati

Izbor i primena statističkih postupaka u obradi prikupljenih podataka određeni su neposredno prirodom pedagoške pojave koja je predmet ovog istraživanja (Kožuh & Maksimović, 2011). Namera

istraživanja bazirala se na istraživanju značaja i razvijenosti školskog sporta kod učenika srednjih škola iz Niša i Gračanice. Istraživanjem značaja i razvijenosti školskog sporta ispitanika, ispitivali, istraživali smo shvatanje date situacije od strane učenika, njihove načine opažanja, vrednovanje i reagovanja, kao i pokretanje na određene aktivnosti. Prema datim uputstvima pre anketiranja učenici su popunjavali anketu. U tabeli br. 1 prikazana je pouzdanost upitnika, koji je korišćen za potrebe ovog istraživanja. U tabelama br.2 i br.3. predstavili smo deskriptivne parametre neparametrijske statistike (frekvencije i procenti) za navedene subuzorke.

Tabela 1. Questionnaire reliability (Internal Consistency Reliability) for assessment of attitudes about the importance and development of school sport (Reliability/Item analysis)

Upitnik	Cronbach alpha	Standardized alpha	Average inter item corr.
Ukupno	,85	,85	,20
Značaj	,81	,81	,31
Razvijenost	,81	,81	,24

Legenda: Cronbach alpha – Cronbach koeficijent pouzdanosti, Standardized alpha – Standardizovani koeficijent pouzdanosti, Average inter item corr. – Prosečni međuaitemski koeficijent korelacije.

Rezultati u tabeli 1. ukazuju na visoku međuaitemsku korelaciju u svim testiranim varijablama, što se može zaključiti na osnovu vrednosti Cronbach i Standardized koeficijenata korelacije (.81 - .85), kao i zadovoljavajuće prosečne međuaitemske korelacije od .20 do .31 (Swerdlik & Cohen, 2005). Na osnovu dobijenih rezultata može se konstatovati da novokonstruisani upitnik, kao i njegove zasebne celine (Značaj i Razvijenost) imaju zadovoljavajuću pouzdanost.

Tabela 2. Frekvencije i procenti stavova učenika srednjih škola iz Niša

N=43	Tvrdnja / stepen slaganja Značaj školskog sporta:	5	4	3	2	1
		Frekvencije i Procenti				
1.	Učestvovanje u školskom sportu pomaže mi u školskom učenju i svakodnevnom životu	23(53,5)	15(34,9)	4(9,3)	0(0)	1(2,3)
2.	Angažovanje u školskom sportu pričinjava mi veliko zadovoljstvo	37(86,0)	5(11,6)	1(2,3)	0(0)	0(0)
3.	Bavljenje školskim sportom razvija pozitivne oblike ponašanja	32(74,4)	10(23,3)	1(2,3)	0(0)	0(0)
4.	Angažovanje u školskom sportu sprečava pojavu deformiteta kod dece i mladih	31(72,1)	8(18,6)	4(9,3)	0(0)	0(0)
5.	Učestvovanje u školskom sportu utiče na pravilan rast i razvoj organizma pojedinca	37(86,0)	4(9,3)	1(2,3)	1(2,3)	0(0)
6.	Angažovanje u školskom sportu razvija disciplinu	28(63,3)	12(27,9)	2(4,7)	0(0)	1(2,3)
7.	Školski sport omogućava mi nova putovanja, poznanstva i prijateljstva	24(52,2)	13(20,0)	2(4,7)	2(4,7)	2(4,7)
8.	Angažovanje u školskom sportu smanjuje agresivnost kod učenika i učenica	18(41,9)	15(34,9)	5(11,6)	3(7,0)	2(4,7)
9.	Angažovanje u školskom sportu razvija kolektivni duh	33(76,7)	7(16,3)	3(7,0)	0(0)	0(0)
10.	Aktivnosti u školskom sportu razvijaju pravilne higijenske i zdravstvene navike	18(41,9)	13(30,2)	11(25,6)	1(2,3)	0(0)
10.		Frekvencije i Procenti				
11.	Moja škola visoko vrednuje školski sport	25(58,1)	11(25,6)	4(9,3)	1(2,3)	2(4,7)
12.	Moja škola ima dovoljno sportskih terena i sala	6(14,0)	11(25,6)	5(11,6)	7(16,3)	14(32,6)

13.	U mojoj školi se redovno realizuju sportske sekcije	20(46,5)	14(32,6)	7(16,3)	1(2,3)	1(2,3)
14.	U školi se cene i poštuju učenici koji nastupaju za školu na školskim sportskim takmičenjima	24(55,8)	6(14,0)	4(9,3)	2(4,7)	7(16,3)
15.	Škola redovno organizuje odeljenska i školska sportska takmičenja	15(34,9)	11(25,6)	10(23,3)	5(11,6)	2(4,7)
16.	Škola organizuje i uključuje se u opštinska takmičenja	30(69,8)	8(18,6)	4(9,3)	1(2,3)	0(0)
17.	Škola učestvuje i na republičkim takmičenjima	26(60,5)	9(20,9)	5(11,6)	3(7,0)	0(0)
18.	Škola poseduje neophodnu opremu i rekvizite za školska sportska takmičenja	14(32,6)	15(34,9)	10(23,3)	2(4,7)	2(4,7)
19.	Nastavnik fizičkog vaspitanja redovno se angažuje u školskom sportu	33(76,7)	6(14,0)	2(4,7)	1(2,3)	1(2,3)
20.	Nastavnik fiz. vasp. javno pohvaljuje učenike koji nastupaju na školskim takmičenjima	29(67,4)	7(16,3)	5(11,6)	1(2,3)	1(2,3)
21.	Nastavnik fizičkog vaspitanja angažuje učenike iz sportskih klubova u školski sport	34(57,8)	8(22,2)	1(2,3)	0(0)	0(0)
22.	Nastavnik fizičkog angažuje i ostale učenike koji nisu u sportskim klubovima u školski sport	31(72,1)	10(23,3)	2(4,7)	0(0)	0(0)
23.	Razredni starešina podržava i podstiče učenike na angažovanje u školskom sportu	22(51,2)	10(23,3)	5(11,6)	1(2,3)	5(11,6)
24.	Ostali nastavnici u školi visoko vrednuju takmičenja u školskom sportu	17(39,5)	9(20,9)	6(14,0)	5(11,6)	6(14,0)

Legenda: 5 – slažem se u potpunosti; 4 – delimično se slažem; 3 – nemam stav; 2 – delimično se ne slažem; 1 – ne slažem se.

Opštom retrospekcijom i analizom rezultata u tabeli **br. 2** prvih deset ajtema tj. **značaja školskog sporta**, primećujemo da je najveći broj odgovora srednjoškolskih učenika iz Niša skoncentrisan u najvišim ocenama (5), tj. pozitivnim stavovima u rasponu od 41,9% pa do neočekivanih 86,0%, kod tvrdnje da „*školski sport utiče na pravilan rast i razvoj organizma*“. Pozitivno je i to da „*školski sport pričinjava zadovoljstvo učenicima*“ takođe 86,0% odgovora. Broj neopredeljenih je očekivan i kreće se u rasponu od 2,3% pa do 25,6%. Bilo je i onih sa apsolutno negativnim odgovorima i to od 2,3% do 4,7%, i na tvrdnju da „*učestvovanje u školskom sportu pomaže mi u školskom učenju i svakodnevnom životu*“ i „*školski sport mi omogućava nova putovanja, poznanstva i prijateljstva*“.

Daljom analizom odgovora, učenika na ostalih 14 ajtema koji tretiraju **razvijenost školskog sporta**, uočavamo slična opredeljenja, tj. izjašnjavanja učenika na postavljene tvrdnje. I ovde je karakteristično da se kod većini tvrdnji odgovori raspršuju u ocenama od 1 do 5. Samo kod četiri tvrdnji nema krajnje negativnih izjašnjavanja. I od ove varijable imamo veći procenat pozitivnih tvrdnji učenika sa najvišom ocenom (5), od 34,9% do 76,7%, gde su učenici jedinstveni, saglasni „*da se nastavnici fizičkog redovno angažuju u školskom sportu*“. Procenat od 32,6% kod tvrdnje da „*škola nema dovoljno sportskih terena i sala*“, je ustvari realna slika na terenu. Očekivano je izjašnjavanje bilo i na tvrdnju da se u „*školskom sportu angažuju samo sportisti*“ 57,8%. Interesantno je i izjašnjavanje učenika da „*ostali nastavnici u školi visoko vrednuju takmičenja u školskom sportu*“ je raspršenost odgovora u svim nivoima od pozitivnih 39,5 % do negativnih od 14,0%. Pozitivno je i to „*da nastavnik fizičkog vaspitanja javno pohvaljuje svoje takmičare*“ 67,4%, kao i to da „*razredni starešina podržava učenike koji nastupaju na školskim sportskim takmičenjima*“ 57,8%. Nasuprot tome 16,3% učenika tvrdi „*da se u školi ovi takmičari ne poštuju* u domenu koji je potreban.

Tabela 3. Frekvencije i procenti stavova učenika srednjih škola iz Gračanice

N=34		Tvrđnja / stepen slaganja	5	4	3	2	1
		Značaj školskog sporta:	Frekvencije i Procenti				
1.	Učestvovanje u školskom sportu pomaže mi u školskom učenju i svakodnevnom životu		10(29,4)	15(44,1)	5(14,7)	2(5,9)	2(5,9)
2.	Angažovanje u školskom sportu pričinjavami veliko zadovoljstvo		22(64,7)	8(23,5)	1(2,9)	1(2,9)	2(5,9)
3.	Bavljenje školskim sportom razvija pozitivne oblike ponašanja		15(44,1)	15(44,1)	0(0)	1(2,9)	2(5,9)
4.	Angažovanje u školskom sportu sprečava pojavu deformiteta kod dece i mladih		25(73,5)	5(14,7)	4(11,7)	0(0)	0(0)
5.	Učestvovanje u školskom sportu utiče na pravilan rast i razvoj organizma pojedinca		20(58,8)	10(29,4)	2(5,9)	2(5,9)	0(0)
6.	Angažovanje u školskom sportu razvija disciplinu		13(38,2)	11(32,4)	7(20,6)	1(2,9)	2(5,9)
7.	Školski sport mi omogućava nova putovanja, poznanstva i prijateljstva		12(35,3)	9(26,5)	9(26,5)	2(5,9)	2(5,9)
8.	Angažovanje u školskom sportu smanjuje agresivnost kod učenika i učenica		8(23,5)	10(29,4)	5(14,7)	7(20,6)	4(11,7)
9.	Angažovanje u školskom sportu razvija kolektivni duh		16(47,1)	14(41,2)	4(11,7)	0(0)	0(0)
10.	Aktivnosti u školskom sportu razvijaju pravilne higijenske i zdravstvene navike		8(23,5)	14(41,2)	6(17,6)	3(8,8)	3(8,8)
		Razvijenost školskog sporta:	Frekvencije i Procenti				
11.	Moja škola visoko vrednuje školski sport		14(41,2)	8(23,5)	7(20,6)	4(11,7)	1(2,9)
12.	Moja škola ima dovoljno sportskih terena i sala		0(0)	3(8,8)	1(2,9)	12(35,3)	18(52,9)
13.	U mojoj školi se redovno realizuju sportske sekcije		7(20,6)	11(32,4)	7(20,6)	7(20,6)	2(5,9)
14.	U školi se cene i poštuju učenici koji nastupaju za školu na školskim sportskim takmičenjima		15(44,1)	8(23,5)	6(17,6)	2(5,9)	3(8,8)
15.	Škola redovno organizuje odeljenska i školska sportska takmičenja		11(32,4)	11(32,4)	8(23,5)	3(8,8)	1(2,9)
16.	Škola organizuje i uključuje se u opštinska takmičenja		11(32,4)	12(18,6)	8(23,5)	2(5,9)	1(2,9)
17.	Škola učestvuje i na republičkim takmičenjima		9(26,5)	11(32,4)	9(26,5)	2(5,9)	3(8,8)
18.	Škola poseduje neophodnu opremu i rekvizite za školska sportska takmičenja		0(0)	3(11,8)	4(11,7)	17(50,0)	10(29,4)
19.	Nastavnik fizičkog vaspitanja redovno se angažuje u školskom sportu		29(85,3)	3(8,8)	2(5,9)	0(0)	0(0)
20.	Nastavnik fizičkog vaspitanja javno pohvaljuje učenike koji nastupaju na školskim takmičenjima		20(58,8)	10(29,4)	4(11,8)	0(0)	0(0)
21.	Nastavnik fizičkog vaspitanja angažuje učenike iz sportskih klubova u školski sport		14(41,2)	13(38,2)	4(11,8)	2(5,9)	1(2,9)
22.	Nastavnik fizičkog angažuje i ostale učenike koji nisu u sportskim klubovima u školski sport		21(61,8)	10(29,4)	3(8,8)	0(0)	0(0)
23.	Razredni starešina podržava i podstiče učenike na angažovanje u školskom sportu		13(38,2)	8(23,5)	9(26,5)	4(11,8)	0(0)
24.	Ostali nastavnici u školi visoko vrednuju takmičenja u školskom sportu		11(32,4)	5(14,7)	5(14,7)	5(14,7)	8(23,5)

Legenda: 5 – slažem se u potpunosti; 4 – delimično se slažem; 3 – nemam stav; 2 – delimično se ne slažem; 1 – ne slažem se.

U tabeli br. 3. prikazana je učestalost odgovora učenika srednjih škola iz Gračanice izražena frekvencijama i procentima. U okviru prve varijable koja je sadrži prvih 10 ajtema, a kojom se izražava značaj

školskog sporta, možemo da konstatujemo da se učenici u najvećem procentu u potpunosti slažu sa tvrdnjama: „Angažovanje u školskom sportu pričinjavami veliko zadovoljstvo“ 64,7%, „Angažovanje u školskom sportu pričinjavami veliko zadovoljstvo“ 73,5% i da „Učestvovanje u školskom sportu utiče na pravilan rast i razvoj organizma pojedinca“ 58,8%. Najveći procenat negativnih izjašnjenja imamo kod tvrdnje da „Aktivnosti u školskom sportu razvijaju pravilne higijenske i zdravstvene navike“ 8,8%, a pozitivnih 23,5%. Činjenica je i da učenici veruju „da školski sport ne smanjuje agresivnost“ 23,5%, a 11,7% ima negativan stav na ovu tvrdnju.

Kod analize izjašnjenja učenika na tvrdnje koje karakterišu **razvijenost školskog sporta**, uočavamo samo dve tvrdnje na koje se tiču nastavnika fizičkog vaspitanja gde su se učenici izjašnjavaju visoko pozitivno (5). To su „nastavnik fizičkog vaspitanja redovno se angažuje u školskom sportu“ 85,3%, i „nastavnik fizičkog vaspitanja javno pohvaljuje učenike koji nastupaju na školskim takmičenjima“ 58,8%. Kod tvrdnji „moja škola ima dovoljno sportskih terena i sala 52,9% i opremu i rekvizite za školska sportska takmičenja“ 29,4% sa apsolutno negativnim ocenama što ukazuje na buduće neophodne pravce korekcija u praksi.

Tabela 4. Razlike u stavovima učenika srednjih škola (Niša i Gračanice) (Mann-Whitney U test)

	Tvrdnja / stepen slaganja	Grupa 1 (N=43)	Grupa 2 (N=34)	Medijan Grupa 1	Medijan Grupa 2	U	Z	P level
1.	Učestvovanje u šk. sportu pomaže mi u školskom učenju i svakodnevnom životu	1887,50	1115,50	5	4	520,50	2,16	0,031
2.	Angažovanje u školskom sportu pričinjava mi veliko zadovoljstvo	1840,50	1162,50	5	5	567,50	1,68	0,094
3.	Bavljenje školskim sportom razvija pozitivne oblike ponašanja	1886,00	1117,00	5	4	522,00	2,14	0,032
4.	Angažovanje u školskom sportu sprečava pojavu deformiteta kod dece i mladih	1672,50	1330,50	5	5	726,50	-0,05	0,963
5.	Učestvovanje u školskom sportu utiče na pravilan rast i razvoj organizma pojedinca	1874,00	1129,00	5	5	534,00	2,02	0,043
6.	Angažovanje u školskom sportu razvija disciplinu	1916,00	1087,00	5	4	492,00	2,45	0,014
7.	Školski sport mi omogućava nova putovanja, poznanstva i prijateljstva	1870,50	1132,50	5	4	537,50	1,98	0,047
8.	Angažovanje u školskom sportu smanjuje agresivnost kod učenika i učenica	1895,00	1108,00	4	4	513,00	2,24	0,025
9.	Angažovanje u školskom sportu razvija kolektivni duh	1887,00	1116,00	5	4	521,00	2,15	0,031
10.	Aktivnosti u školskom sportu razvijaju pravilne higijenske i zdravstvene navike	1836,50	1166,50	4	4	571,50	1,64	0,102
11.	Moja škola visoko vrednuje školski sport	1835,00	1168,00	5	4	573,00	1,62	0,105
12.	Moja škola ima dovoljno sportskih terena i sala	1954,00	1049,00	3	1	454,00	2,84	0,004
13.	U mojoj školi se redovno realizuju sportske sekcije	1951,00	1052,00	4	4	457,00	2,81	0,005
14.	U školi se cene i poštuju učenici koji nastupaju za školu na školskim sportskim takmičenjima	1722,50	1280,50	5	4	685,50	0,47	0,641
15.	Škola redovno organizuje odeljenska i školska sportska takmičenja	1659,50	1343,50	4	4	713,50	-0,18	0,858
16.	Škola organizuje i uključuje se u opštinska takmičenja	1967,00	1036,00	5	4	441,00	2,97	0,003
17.	Škola učestvuje i na republičkim takmičenjima	1948,00	1055,00	5	4	460,00	2,78	0,005
18.	Škola poseduje neophodnu opremu i rekvizite za školska sportska takmičenja	2246,50	756,50	4	2	161,50	5,84	0,000

19.	Nastavnik fizičkog vaspitanja redovno se angažuje u školskom sportu	1612,50	1390,50	5	5	666,50	-0,66	0,508
20.	Nastavnik fiz. vasp. javno pohvaljuje učenike koji nastupaju na šk. takmičenjima	1715,00	1288,00	5	5	693,00	0,39	0,697
21.	Nastavni fiz. vasp. angažuje učenike iz sportskih klubova u školski sport	1977,00	1026,00	5	4	431,00	3,08	0,002
22.	Nastavnik fiz. angažuje i ostale učenike koji nisu u sportskim klubovima u školski sport	1757,50	1245,50	5	5	650,50	0,83	0,409
23.	Razredni starešina podržava i podstiče učenike na angažovanje u školskom sportu	1765,50	1237,50	5	4	642,50	0,91	0,364
24.	Ostali nastavnici u školi visoko vrednuju takmičenja u školskom sportu	1784,50	1218,50	4	3	623,50	1,10	0,270

Legenda: U – vrednost U testa; Z – vrednost Z skora; P level – značajnost razlika na nivou $p < ,05$

Grupa 1 – učenici srednjih škola iz Niša; Grupa 2 – učenici srednjih škola iz Gračanice,

Inspekcijom tabele **br. 4** koja prikazuje razlike kod opšteg **značaja školskog sporta** ali i strukturu stavova kod oba subuzorka uočava se statistički **značajna razlika** u tvrdnjama **br.1, 3, 5, 6, 7, 8, 9**, na nivou značajnosti $p < .05$ u korist učenika niških srednjih škola koji imaju pozitivnije stavove.

U delu tabele koji prikazuje **razvijenost školskog sporta** takođe uočavamo statistički **značajne razlike** u tvrdnjama **br. 12, 13, 16, 17, 18 i 21**, na nivou značajnosti $p < .05$. Sve navedene tvrdnje su pozitivnije kod učenika niških srednjih škola, pa se zato i javljaju statistički značajne razlike u pojedinim izjašnjanjima na date tvrdnje.

Diskusija

Kada govorimo o školskom sportu, moramo da imamo u vidu: da je on poseban segment sporta, takođe je istovremeno spona između dva bitna područja fizičke kulture (fizičkog vaspitanja i sporta). On sadrži karakteristike oba područja, ali svakako prioritet imaju karakteristike fizičkog vaspitanja. Školski sport treba tretirati kao segment obrazovnog sistema, u kome se uči „*zašto i kako vežbati*“. Školski sport treba da sadrži karakteristike trenažnog procesa, ali ne u formi vrhunskog sporta, već se njegov značaj ogleda u želji za međusobnim nadmetanjem i da postignuti rezultati nisu cilj već sredstvo, što su odrednice školskog sporta koji pripada školi i edukativnom procesu. Školski sport tako promovise aktivno učestvovanje učenika, jer je to i osnovni razlog zbog kojeg se učenici za njega i opredeljuju. Takođe, važan cilj tiče se formiranja trajnog interesovanja za bavljenje sportom, što može doprineti bavljenju sportskim ili rekreativnim aktivnostima tokom celog života. Imajući u vidu trendove modernog života kao i vreme u kome živimo, te činjenicu da su deca u sadašnjosti nedovoljno fizički aktivna, školski sport i nastava fizičkog vaspitanja su od velikog značaja za njihov razvoj i napredak (Savić, 2014). Zato neka od narednih istraživanja treba usmeravati u tom pravcu i doći do odgovora koji će predstavljati neke nove smernice u praksi.

Ovo su samo neka od razmišljanja koja su i opredelila autore da istražuju značaj i razvijenost školskog sporta i dve različite ekonomske sredine. Pojedina istraživanja govore u prilog činjenici da sadržaji programa fizičkog vaspitanja i školskih sportskih takmičenja mogu značajno da doprinesu ukupnom obimu fizičke aktivnosti, kao i da većina učenika ima pozitivne stavove prema školskim sportskim takmičenjima (Trudeau & Shephard, 2005). Ovo istraživanje došlo je sličnih rezultata. Učenici oba entiteta visoko vrednuju školski sport u celini i pozitivno se odnose prema školskim sportskim takmičenjima.

U jednom od svojih predhodnih istraživanja autori (Savić et al., 2015) istraživali su razlike u stavovima učenika osnovnih i srednjih škola u Srbiji, i dokazali su da one postoje kod vrednovanja razvijenosti školskog sporta u različitim gradovima, tj. ekonomskim sredinama. Takođe utvrdili su da učenici srednjih škola imaju više pozitivnih tvrdnji, tj. zrelije se izjašnjavaju od učenika osnovnih škola. U ovom

istraživanju nađene su razlike u korist učenika iz Niša, s obzirom da postoje i ekonomske i društvene razlike u navedenim sredinama.

Snaga i smer motivacije za školski sport jako variraju, za neke učenike je fizičko vaspitanje najomiljeniji deo nastavnog dana, a za druge predstavlja glavni uzrok stresa i povod da učenici izostaju iz škole (Hagger, Chatzisarantis, & Biddle, 2002; Wang & Biddle, 2001). Uzrok smanjenog interesovanja može biti i isključivanje većeg broja učenika iz školskih sportskih takmičenja, gde privilegiju imaju uglavnom sportisti (Shephard, Lavallo, & Larivire, 1978), kao i strah učenika od učešća na sportskim takmičenjima (Thompson, Humbert, & Mirwald, 2003).

Fizička aktivnost ima korene u porodičnom vaspitanju deteta, a treba kasnijim osnovnoškolskim i srednjoškolskim biti dopunjeno (Cvejić, Pejović, & Ostojić, 2013). Trebamo težiti da fizička aktivnost bude način života i rada školske populacije. Ovo svakako nije bila i situacija sa učenicima iz Niša i Gračanice pa su se stoga i javile razlike u delu odnosa prema pozitivnim vrednostima školskog sporta, u korist učenika iz Niša. Tokom perioda puberteta odnosno perioda intezivnog rasta i razvoja organizma, fizička aktivnost predstavlja izuzetno bitan faktor jer bi u ovoj senzibilnoj fazi omogućila ispunjenje punog biološkog potencijala.

Učenici su se uglavnom opredeljivali za ocene 4 i 5, a rezultati su se kretali u rasponu od 14 do 76.7% kod učenika iz niških srednjih škola i od 0 do 85.3% kod učenika iz Gračanice. Podatak koji zabrinjava je, da se veliki procenat učenika na tvrdnju „škola ima dovoljno sportskih terena i sala“ izjašnjavao ocenom 1 i 2 (32.6 i 16.3% u Nišu, i 52.9 i 35.3% u Gračanici). Takođe, alarmantan je i podatak da su učenici iz Gračanice tvrdnju „škola poseduje neophodnu opremu i rekvizite za školska sportska takmičenja“, u velikom procentu ocenili ocenom 1 i 2 (29,4% i 50,0%). Procenat učenika koji su neopredeljeni kretao se u očekivanom rasponu od 2,3% do 23,3% kod učenika iz Niša i od 2,9% do 26,5% kod učenika iz Gračanice.

Analiza rezultata pokazala je da postoje značajne razlike u individualnim tvrdnjama između ispitivanih subuzoraka, u smislu značaja i razvijenosti školskog sporta u korist subuzorka iz Niša. Kada uporedimo dobijene rezultate, koji se odnose na značaj školskog sporta, uviđamo da u 7 od 10 ispitivanih ajtema postoje statistički značajne razlike u korist učenika iz Niša ($p < .05$). Takođe, utvrđeno je i da se populacija učenika iz Niša pozitivnije odnosi prema razvijenosti školskog sporta u 6 od 14 ispitivanih ajtema ($p < .05$). Dakle, utvrđeno je da su učenici iz Niša imali pozitivnije stavove prema razvijenosti školskog sporta.

Sve prethodno navedeno implicira, da je neophodno podjednako razvijati i ulagati u školski sport u svim sredinama, a sve u cilju stvaranja zdrave i motorički „oplemenjene“ populacije i na taj način stvoriti pozitivne navike prema fizičkom vežbanju. Dakle, jedno od mogućih rešenja za unapređenje razvoja dece jeste što ranije uključivanje u besplatne vannastavne sportske aktivnosti u školi.

Zaključak

Škola kao vaspitno-obrazovna ustanova predstavlja najbitnije okruženje za promociju fizičke aktivnosti učenika. Fizičko vaspitanje i školski sport, pored toga što neposredno utiču na razvoj motoričkih sposobnosti, pre svega omogućavaju povećanu fizičku aktivnost dece u toku nastave fizičkog vaspitanja i vannastavnih školskih aktivnosti (Bailey, 2006; Sallis et al., 1997). Postoje dokazi da su oni koji su razvili jaku osnovu u bazičnim veštinama, verovatno u toku detinjstva i adolescencije bili aktivni, i na taj način stekli pozitivne navike za upražnjavanjem fizičke aktivnosti tokom celog života (Okely, Booth, & Patterson, 2001). Nasuprot tome, deca koja nisu bila u stanju da dobiju adekvatnu bazu sposobnosti kretanja, vrlo verovatno se neće aktivno uključivati u organizovanim sportskim aktivnostima i igri sa svojim vršnjacima zbog nedostatka osnovnih motoričkih sposobnosti i veština (Ignico, 1990). Analizom dobijenih rezultata naglašavamo da postoje značajne razlike u tvrdnjama između ispitivanih grupa učenika, u smislu značaja i razvijenosti

školskog sporta u korist subuzorka iz Niša. Kada dobijene rezultate sagledamo sa aspekta značaja školskog sporta, uviđamo da u 7 od 10 ispitivanih ajtema postoje statistički značajne razlike u korist učenika iz Niša ($p < .05$). Takođe, utvrđeno je i da se populacija učenika iz Niša pozitivnije odnosi prema razvijenosti školskog sporta u 6 od 14 ispitivanih ajtema ($p < .05$).

Možemo zaključiti da je školski sport u Nišu razvijeniji i značajniji za učenike iz niških škola u odnosu na učenike škola iz Gračanice. Razlog u dobijenim razlikama možemo tražiti u društvenom kontekstu školskog sporta u navedenim sredinama, tj. u nedostatku adekvatnih uslova za organizaciju i realizaciju školskih sportskih takmičenja. Mišljenja smo da ograničenje ovog istraživanja može biti mali uzorak ispitanika, tako da bi u narednim istraživanjima trebalo tretirati veći uzorak ispitanika radi dobijanja statistički značajnijih rezultata.

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Social-humanistic aspects of physical education, sport and recreation

Društveno humanistički
aspekti fizičkog vaspitanja,
sporta i rekreacije

SOCIOLOGICAL ASPECTS OF APPLYING PHYSICAL ACTIVITIES THROUGH THE CONTRIBUTION OF SPORT TOURISM AND SMALL-SCALE SPORTS EVENTS

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Introduction

The application of physical activities is a leisure behavior that leads to a healthy lifestyle and contributes to the formation of sustainable societies. The trend towards a healthy life, exercise and seeking for experiences is constantly increasing, becoming a global phenomenon that motivates tourists and travelers to either plan their travels based on a particular sporting event or to seek activities at their holiday destination (Bouchoris, Agapitou and Didaskalou, 2017). Nowadays, the abovementioned phenomenon is widely known as sport tourism and is one of the fastest growing special forms of tourism worldwide (Alexandris and Kaplanidou, 2014). According to Loukatou (2017, p. 43) *"The increased emphasis on health and fitness and increased use of sport events by cities to attract tourists made sport tourism one of the fastest growing sectors in the tourism industry"*. Similarly, Moira, Mylonopoulos and Papagrigoriou (2017, p. 47) claimed that *"Tourism and Sports are considered significant industries as they attract large groups of people moving for tourist or physical activities"*. Gibson (1998) distinguished sport tourism into three major categories: attending a sport event, visiting a sport event and actively participating in a sport event. Nogawa, Yamaguchi and Yumiko (1996) described the sport tourist as a person who is engaged in physical activities during a trip, attending sport events or participating in sport events, such as a marathon. The aforementioned approaches advocate the view of sport tourism as a comprehensive tourist experience where sport events are the focus of interest and lead to the distinction of "active" (professional athletes or amateurs, such as marathon runners or cyclists) and "passive" (simply spectators of a sport event) sports tourists. Sport tourism has become increasingly popular as it has been established, documented and promoted through major world-class sport events (Bhatiz, 1991), such as Olympic Games, World Cups, Marathons and other sport events. Consequently, sport competitions and events constitute a special section of sport tourism and consists a strategy for local, regional and national tourism development. As stated by Alexandris (2017, p. 19) sports events are categorized by their size into: (a) *Mega events*, which involve large financial investments and are organized or co-organized by state governments (eg. Olympic Games, EURO Football Championship, etc.), (b) *Major International sports events*, which do not have accordingly the international recognition of mega events (eg. USA Open etc.) and (c) *Small-scale sport events*, which organized at local level and can get international extensions (eg. Olympus Marathon, Eco Trail de Paris, Zagori Mountain Running, Metsovo Race)".

Small-Scale sports Events and Sociological Dimensions of Sport Tourism and Physical Activities

Small-scale sports events include city and mountain marathons, low range international sport events, mainly of non-widespread sports, competitions for veteran athletes' and people with disabilities (Higham, 1999). A small-scale sport event involves the active participation of locals in the organization of the competition and accompanying events and contributes to the promotion of the unique characteristics of the hosting area (Alexandris, 2017). In Greece, the birthplace of Marathon Races and the cradle of the Olympic

Games, throughout the year are hosted a plethora of running races in different cities and regions, which as small-scale sport events are used as a basic promotion tool to attract native and foreign visitors in several destinations and support all-year-round tourism season. In fact, the positive impressions created by the participation in a small-scale sport event lead more and more visitors- participants to a future visit to the destination. Nowadays, taking into consideration that during the last year (September 2017 to September 2018) Greece hosted 38 small-scale sports events in 24 different destinations (Running Greece, 2018), and with the assumption that a large part of tourists who visited Greece at the same period was potential sport tourists, it is obvious that sport tourism offers significant development prospects for Greece and its regions. For instance, in Europe, the participants in cities Marathon races are 50 million and economic revenue of physical activities amounts almost 10 billion Euros (Scheerder and Beeveld, 2015). Sport tourism is an economic, social and cultural phenomenon created by the unique interaction of physical activity, people and destination (Weed and Bull, 2004). The relation between sport and tourism has the effect of understanding different cultures and lifestyles, contributes to promoting and maintaining peace and developing interpersonal relationships (Huescar, 2001). Similarly, Kurtzman et al. (1993) mentioned the importance of tourism and sports in promoting local, national and international friendship and apprehension of countries, communities, groups, and individuals. The social effects of a small-scale sport event is related to increased the local pride, the strengthening of social cohesion, the involvement of the local society in the organization of sport event and the interaction with other cultures (Polatidou, 2015).

Aims and Objectives

The main objectives of the present analysis are a) to explore the demographic characteristics and motivations of the participants in a small-scale sport event and to emphasize the social aspects of applying physical activities to those sport events, b) to examine the level of involvement of the participants in both physical activities of the sport event and from a range broader physical activities and c) to assess the contribution of small-scale sports events to attracting native and foreign visitors to the destination. The key contribution of this work is that approach the social impact of applying physical activities through the organization of a small-scale sport event and offer significant benefits for the definition of the motives of the participants in such sport event. This has been discussed by a great number of authors in literature. For instance, a number of authors have recognized the motives for training and competing among participants in a half-marathon race (Tjelta, Kvale and Shalfawi, 2017; Moira, Mylonopoulos and Papagrigoriou, 2017; Vernadou, et al. 2012), or have analyzed the motives of the participation on outdoor physical activities (Ntakouris, et al. 2014), while some authors have driven the further development of the relationship among leisure involvement and psychological commitment for individuals who had participated in a Marathon event (Ridinger, et al. 2012). In fact, previous researches can only be considered a first step towards a more profound understanding of the social effects of applying physical activities.

Method

As a research field, Skyros Island in Greece was selected and as a small-scale sport event was defined the Skyros Half-Marathon, which took place on September 15th, 2018. For the purposes of the survey, a quantitative research was conducted and a structured questionnaire was distributed in a random sample of 120 participating athletes. From this point forward the distribution and completion of the questionnaires which took place on the day of the Half- Marathon from the 09:00 to 21:00, a total number of 104 questionnaires were successfully answered and collected, while 16 were canceled from the final analysis due to lack on responses. It is worth noting that the questionnaire was drafted in Greek and English, and all of the questions used were closed-ended and scale (5-point Likert). More specifically, in the first section of the

questionnaire participants-athletes were asked to indicate their level of involvement with physical activities generally. Section B covered the social dimensions of physical activities, the reasons for respondents choosing the run as a basic physical activity and the motives for participating in the Half-Marathon of Skyros. Section C explored the level of satisfaction of visitors-participants from the organization and participation in the Half-Marathon and the final section covered the demographic characteristics of the respondents. Information gathered includes gender, age, educational level, job status and their training age. Those final variables were used in forming the following six hypotheses of the current survey:

H1: Participants-athletes with higher education evaluate higher each variable of “Social Aspects of Applying Physical Activities” than participants-athletes with lower education.

H2: Younger participants-athletes evaluate higher each variable of “Social Aspects of Applying Physical Activities” than older participants-athletes.

H3: Participants-athletes with a high level of involvement in a plethora of Physical Activities during last year evaluate higher each reason for choosing the run as a basic Physical Activity than participants-athletes with a low level of involvement.

H4: Participants-athletes with seven years and over of training age evaluate higher each reason for choosing the run as a basic Physical Activity than participants who trained from one to six years.

H5: Younger participants-athletes evaluate higher each reason for participating in Skyros Half Marathon than older participants-athletes.

H6: Females evaluate more positive each variable for the evaluation of the level of satisfaction from the organization and participation in Skyros Half Marathon than Males.

The data collected were based on descriptive and inductive statistics analyzed by SPSS v.24. A descriptive analysis was used to examine the demographic profile of the respondents and the inductive analysis focused on an Independent Sample t-test to compare means of two different samples for a variable, in order to explore whether a difference between the mean scores of a variables’ statement is statistically significant or not at the statistical significance level of $p < 0.05$. A reliability analysis of internal consistency was also conducted, which mainly concerns Likert-type scale questions, and the Cronbach’s coefficient alpha (0.78) indicate a high level of reliability (over 0.70).

Results and Discussion

Subjects

The total number of participants-athletes presented in the current survey was 104 and the majority of them are male (66.3%), while 33.7% are females. Regarding age, participants-athletes aged from 36-50 are the largest group accounting the 42.3% of the sample and within the participants-athletes aged from 18-35 (34.6% of the sample size) consist the youngest category of the sample accounting 76.9%, while the category of older participants-athletes were 23.1%. In reference to the educational level of the participants-athletes it is observed that 53.9% of them have from none to completed secondary education, while 46.1% of them have university education. Regarding job status, private employees are the largest group accounting the 37.5% of the sample, followed by freelancers (21.2%) and public servants (19.2%). As for the training age, the majority of the participants-athletes were exercised from seven years and over (60.6%), while 39.4% of them were exercised up to six years.

Table 1. Descriptive Statistics for Demographic Profile of the participants-athletes (N=104)

		%		%	
Gender	Female	33.7	Nationality	Greek	94.2
	Male	66.3		Foreigner	5.8
Age	18-35	34.6	Training Age	Up to 3years	10.6
	36-50	42.3		4-6 years	28.8
	51-65	20.2		7-9 years	27.9
	66 +	2.9		From 10 years	32.7
	None	2.9		Public Servant	19.2
Education	Primary	7.7	Job Status	Private Employee	37.5
	Secondary	43.3		Freelancer	21.2
	University	32.7		Pensioner	3.8
	Master	11.5		University Student	5.8
	Doctoral Degree	1.9		Unemployed	12.5

Hypothesis Testing

Aiming to test the hypothesis formed in the theoretical section, a number of Independent Samples t-test were conducted for exploring if there are significant differences in participants-athletes' responses regarding the social dimensions of physical activities. From the responses presented in Table 2 it can be noticed that the respondents considered that applying of physical activities can strengthen identity and the spirit of society as locals join together to promote their culture (31.3%) and mitigate social differences and contrasts (22.6%). It is worth mentioning that those perceptions of the respondents seems to support the opinion of Polatidou (2015) that a small-scale sport event leads to the strengthening of social cohesion, the involvement of the local society in the organization of sport event and the interaction with other cultures. Examining the first and second hypothesis of the study, the results of t-test showed that none of the variables of "Social Aspects of Applying Physical Activities" revealed significant differences between the two groups of Age and Educational level. Consequently, Hypothesis 1 and 2 were fully rejected. Exception is only the variable "Applying of Physical Activities reduce the feelings of racism, xenophobia and alienation" which presented differences between the different levels of age ($p = .033$).

Table 2. Social Dimensions of Physical Activities

Variables: Applying of Physical Activities	Percent (%)	p-value*	
		Age	Education
Can strengthen identity and the spirit of society as locals join together to promote their culture	31.3	.052	.279
Mitigate social differences and contrasts	22.6	.389	.916
Reflect an equal society for all	21	.491	.504
Reduce the feelings of racism, xenophobia and alienation	17.4	.033	.403
Reduce the gender discrimination	5.1	.810	.639
Reduce religious prejudices	2.6	.362	.559

*Statistically significant at .05 or less

In order to define the level of involvement with several physical activities, the participants-athletes mentioned the number of times they did each physical activity during the last twelve months (Table 3). The percentage of low involvement related to the application of physical activities in monthly basis (None to 3 times a month or more) and the high level of involvement concerned a frequent application of physical

activities in a weekly basis (One to 2 times a week to 3 times a week or more). The high involvement of the respondents with jogging and running activities it is also visible through their strong participation in 5.5km road race running (61.5%) and their participation in 21km Half-Marathon of Skyros (38.5%).

Table 3. Level of Involvement with Physical Activities during 2017

Physical Activities (N=104)	None	One to 2 times a month	3 times a month or more	One to 2	3 times a
				times a week	week or more
				%	
Walking	-	6.7	17.3	58.5	17.5
Jogging and Running	-	18.3	19.2	49	13.5
Aerobics – Floor (Yoga, push-ups etc.) and Weight Exercises	15.4	18.3	16.3	45.2	4.8
Cycling	24	28.8	12.5	31.7	2.9
Swimming	-	1.9	11.5	52.9	33.7
Collective Sports (Football, Basketball, Volleyball, etc.)	45.2	16.3	12.5	22.1	3.8
Individual Sports (Tennis, Golf, Boxing, Wrestling, etc.)	49	21.2	11.5	14.5	3.8
Sea Sports (Yachting, Rowing, Wind-Surfing etc.)	87.5	3.8	1.0	7.7	-

In terms of the reasons for the participants-athletes choosing the run as a basic physical activity the perception that running constitutes a daily habit account the 15.3% of the sample size, followed by the perception that running forms a significant socialization mean and improves the physical and psychological health (13.6% for each category) (Table 4). Those findings are identified with the findings of Tjelata, Kvale and Shalfawi (2017), who highlighted that running as activity is important for maintaining physical and psychological health, but also improves other health issues. A similar pattern of those results was collected by Ntakouris et.al (2014), who claimed that the participation in running activities is the way of participants-athletes to talk and come in contact with new people. From this standpoint, the third Hypothesis required an examination of differences between the participants-athletes with low involvement in physical activities and those who presented a high level of involvement. The t-test has not demonstrated differences ($p > .05$) in respondents' perceptions about the reasons for choosing the run as physical activity, comparing to the high and low involvement with physical activities during 2017. Consequently, third Hypothesis is mainly rejected. Exceptions are the variables "Running forms a significant socialization mean" which presented differences between the different levels of involvement with Walking ($p = .013$) and Jogging- Running ($p = .001$), the "Running improves my performance in other sports" and the "Running reflects the aspects of my personality" which showed differences between the two levels of involvement with Sea sports ($p = .012$) and ($p < .001$), respectively, but, also the "Running reduces weight and improves a plethora of health issues" which demonstrated differences between the dissimilar levels of involvement with Aerobics and floor exercises ($p = .013$), and the "Running is pleasurable" which presented differences between the different levels of involvement with Jogging- Running ($p = .044$). In the same context, the fourth Hypothesis explored differences between the participants-athletes with seven years and over of training age and those who trained from one to six years. The results of t-test presented in Table 4 depict that those with seven years and over of training age did not have statistically different perceptions in any variable than those who trained from one to six years. Consequently, the fourth Hypothesis was fully rejected.

Table 4. Reasons for Choosing the Run as a Basic Physical Activity

Variables	Percent (%)	p-value*								
		Training Age	Level of Involvement with Physical Activity							
			Walking	Jogging Running	Aerobics	Cycling	Swimming	Collective sports	Individual sports	Sea sports
Running constitutes a daily habit	15.3	.456	.629	.129	.435	.705	.912	.980	.838	.257
Running forms a significant socialization mean	13.6	.456	.013	.001	.163	.451	.148	.872	.444	.909
Running improves my physical and psychological health	13.6	.248	.691	.325	.072	.736	.113	.872	.794	.529
Running improves my performance in other sports	12	.173	.182	.283	.415	.818	.491	.531	.200	.012
Running reduces weight and improves a plethora of health issues	12	.360	.132	.292	.013	.843	.237	.096	.453	.556
Running is pleasurable	11.6	.932	.213	.044	.538	.062	.271	.968	.834	.813
Running reflects the aspects of my personality	11.6	.738	.446	.109	.304	.960	.862	.370	.170	.000
Running leads to a healthier lifestyle	10	.440	.786	.784	.525	.069	.914	.981	.854	.760

*Statistically significant at .05 or less

The main reasons for participants-athletes to participate in the Half-Marathon of Skyros were to live the experience of the sport event (31.4%) and feel the pleasure of the participation (29.9%), but also to explore the prestige of the Classical Route (27.5%) (Table 5). These findings are consistent with the research of Moira, Mylonopoulos and Papagrigoriou (2017) showing that participants-athletes who participated in Classical Marathon of Athens had similar motives. A series of t-test were undertaken in order to identify any differences about the reasons for participating in Skyros Half-Marathon between the younger and older participants-athletes. The results presented in Table 5 depict that younger participants-athletes have not statistically different perceptions from older participants-athletes. Consequently, fifth Hypothesis cannot be accepted.

Table 5. Reasons for Participating in Skyros Half-Marathon

Variables	Percent (%)	p-value*
		Age
For the Experience	31.4	.913
For the Pleasure	29.9	.149
For the Prestige of the Classical Route	27.5	.336
For the Competition and Measuring my Running Abilities	8.8	.926
For the Medal and the Personal Challenge	2.5	.869

*Statistically significant at .05 or less

In order to examine the level of satisfaction from the organization and participation in Skyros Half-Marathon, the participants-athletes were asked to indicate the positive and negative impressions for each statement and their responses were measured on a 5-point rating scale ranging from "Very Dissatisfied" (1 point) to "Very Satisfied" (5 point), with 3 signifying a neutral feeling. The mean scores of the variables for the level of satisfaction of participants-athletes from Skyros Half-Marathon, as formulated by their responses, ranged from 3.71 to 4.21 (Table 6). In particular, the variable with the largest mean (4.21) concerned the

Organization of the sport event, followed by the Hospitality and local people behavior (4.04). For easier interpretation the mean scores of others variables are presented in a descending order. The penultimate row of Table 6 presents the result of the reliability test conducted in order to explore the internal consistency of the attachment scale. The Cronbach alpha value .78 indicates a high level of reliability (over .70). In this section, the results of mean scores are in line with the ideas of Moira, Mylonopoulos and Papagrighoriou (2017) who mentioned a high level of satisfaction of runners for the organization of Classical Athens Marathon, the information about the sport event, but also for the other events which took place during the Classic Marathon. The t-test results presented in Table 6 were not significant, suggested that there are no significant differences in participants-athletes responses that can be attributed to their gender. Exception was only that females evaluated more positive the variable "Organization of a sport event" than males participants-athletes ($p = .008$). Consequently, the sixth Hypothesis was rejected.

Table 6. Level of Satisfaction from Skyros Half-Marathon

Variables	Mean	p-value*
		Gender
Organization of a Sport Event	4.21	.008
Hospitality & Local people Behavior	4.04	.364
Information for Skyros Half Marathon	3.97	.551
Other Events	3.92	.636
Support for Athletes - Participants	3.90	.769
Information about the Destination	3.71	.120
Cronbach's Alpha		0.78

*Statistically significant at .05 or less

Extensive results of the current survey showed that the 87.5% of the participants-athletes had participated in similar sport events at the past, indicating a systematic involvement with physical activities. Also, the 97.1% of the participants-athletes claimed that intent to participate again in the same sport event at the future. In fact, the positive impression that participants-athletes gain from both participation in a small-scale sport event and the hosting area itself contributes to the repetition of the visit to the destination and the participation in the same sport event. So, this is not a new trend, as the 83.7% of the runners said that intent to take part again in the Athens Marathon (Moira, Mylonopoulos and Papagrighoriou, 2017) and almost one to two foreign visitors expressed their desire to visit Thessaloniki due to the World Maxi Basketball and the World Rowing Championship, while visitors from Greece expressed a strong desire (92%) to visit Metsovo due to the Metsovo Race (Alexandris, 2017). Finally, the 100% of the participants-athletes will recommend the Skyros Half-Marathon to their friends and relatives.

Conclusion

The present findings confirm that the demographic profile of the participants-athletes is characterized by young ages, high level of education and high level of involvement with several physical activities. Regarding the motives, the findings of the survey are consistent with similar researches showing that participants-athletes of a small-scale sport event participate mainly, for the experience and pleasure of the participation and less about competition, preserving the principles and the ideals of Olympic Games and good sportsmanship. Sport and Tourism, two global phenomena and significant industries have an important impact on the peoples' socio-cultural life worldwide. The sociological aspect of the research, taking into consideration the homogeneity of the participants-athletes' responses in accordance to the conduction of Independent sample t-test, suggested that the applying of physical activities enhance the identity and the

spirit of the local society and contributes to the promotion of local culture, but also reflects an equal society for all without social differences and contrasts. Ideally, these lines should be replicated in a study where local people will estimate the social impact of the contribution of small-scale sports events into the local communities. The high level of participants-athletes' involvement with physical activities in a yearly basis and their strong preference for walking, running and jogging activities declares staunch supporters of running events, with specific motivations, and creates target groups which have the desire to participate regularly to such small-scale sports events, which is in the interest of local communities. This may be considered a further validation of the positive impression that participants gained from the organization of Skyros Half-Marathon and the hosting area, which lists only 2.994 resident citizens, and expresses their desire for the repetition of the visit to the destination and the participation in the same sport event. Future studies could fruitfully explore more the social effects of the applying of physical activities through the contribution of small-scale sports events, while future investigations are necessary to validate or not the kinds of conclusion that can be drawn from this survey. In addition, future research about the exploration of the motivations of the locals and foreigner participants-athletes of a small-scale sport event is warranted. The aim is twofold: on the one hand, the possibility of attracting these groups (sports tourists, athletes, amateurs) and the design of suitable tourist packages for the successful promotion of sports events in the future and, on the other hand, the implementation of mild physical activities, through the organization of small-scale sports events which are friendly to local societies, in the direction of sustain the social cohesion and the constant mitigation of social differences and contrasts. The dynamic role of Sport tourism and small-scale sports events can also promote sustainability and transform the younger and older athletes to responsible people and travelers, who adopting a healthy lifestyle which improves physical and psychological health will respect other humans, societies and cultures.

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SYNDICAL ORGANISATION IN SPORT – EUROLEAGUE BASKETBALL PLAYERS SELECTED AS AN EXAMPLE

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Introduction

Labour is ingrained in both human individual and social existence (Bolčić, 2003). In his work, Marx points to the fact that the labour itself is a possession of exchange between humans and nature, a process that makes the exchange of material with nature possible for people. Man is driven by a natural force of his body through the endeavours to tailor the natural material according to its acceptable shape (Bolčić, 2003). Apart from labour, man is accustomed to "entertainment", "play" and "celebration" as well, which are all meanings of the word "sport" (Giulianotti, 2008).

Numerous sociologists have dealt with sport, regarding it as one significant social phenomenon., so today sociology of sport is a new discipline which deals with contest and social conditioning of sport (Radenović, 2017). Dunkheim's sociology highlights a function of sport that promotes social betterment on both systematical and everyday level. Marxist theories deal with conflicts rooted in the sport of modern capitalism. They claim that sport reproduces the mark of great injustice of industrial capitalism, such as exploitation of sportsmen and manipulation of viewers (Giulianotti, 2008). Progress of sport and its wide commercialisation have now become a social institution where experiencing certain quality achievement, as well as release of massive effects and emotions towards the actors and observers themselves, who represent social labour and progress, are immanent. Today's sport has taken on the role of adjusting to capitalist society, as a result of which a certain bond between contemporary capitalism and sport has been established (Filipović, 1985). With the growth of sport's popularity and commercialisation, the capital invested via media companies grows as well (Coakley, Pike, 2009). This is how sport becomes a capitalist organisation with its main goal being yielding profit, and sport is given a hyperslave status (Giulianotti, 2008).

The uprising of the capitalist system in the XIX and XX led to the increased exploitation of workers in factories. In order to protect themselves, the workers organised working syndicates whose foundations were the protection and advancement of employees' economic and social interests (Stoiljković, 1995). Syndicates are organised with freewill membership and workers access them if it's of any service to them, since it requires paying a membership fee. The most important function of these syndicates is indeed their negotiation power which they use to force employers to pay for work services. Syndicates negotiate all aspect of of work contract: wages, working hours, premiums, non-cash compensations, job safety, safety and health at work (Arandarenko, 2010). In a contemporary age, all across the European Union, syndicates are going through a tough period. Social status they once had is now undermined by globalisation and non-liberalism. The rate of syndicalism (the percentage of employed workers who are members of syndicates, to be exact) has been fluctuating greatly and it moves in the range from 8 to 80 percent (Bernaciak; Grumbrell-McCormick; Hyman, 2014).

However, over the last years the significance of syndicates of sport has risen. Since sport clubs get the characteristics of capitalist organisations, players in such organisations receive an employee status. Some of the problems players face are: although highly paid, they aren't necessarily protected; flexible working hours prevent them from moving freely during seasons; they are strictly limited by format rules, the breaking of which causes suspension; high chances of injury make the job harmful to their health and can even lead to

incapability for any further work. In addition, one of the main points is that their careers end relatively early and it can sometimes make it difficult for the players to be once again included in the society. The role and importance of these syndicates lies in helping players with solving the above-mentioned problems during their careers, but also when they are over.

The first players' syndicate was formed in the NBA League (*National Basketball Player Association – NBPA*) in 1954, while in Europe the first UBE syndicate was established much later, in 2017 (*Union des Basketteurs Europeens*), though it was shown to be unsuccessful. The first EuroLeague players' syndicate (*EuroLeague Players Association – ELPA*) was founded on May 19, 2018 at the final EuroLeague tournament. Before this one, there hadn't been any syndicate that included international leagues such as the EuroLeague, FIBA, EuroCup, Champions League. While the American players are, through their syndicates, involved in the changes that occur in their league, in Europe the formats of competing have been changed without the players' consent over the last years, which has made it more difficult for the players to adapt to these conditions. Also, NBA has limited the number of games per season to 82, while in Europe, certain players who play in the EuroLeague, their national leagues and FIBA representative competitions may play over 100 games per season, since the number of games per season doesn't have a defined limit. Another difference are the working conditions in the European and American clubs. In America, each club provides its players with the best conditions necessary for work, where only a few such clubs exist in Europe.

The European players who play at the highest professional level are exposed to greater violation of human, civil and labour rights. League representatives take the competitions to higher and higher levels in order to increase capital, while at the same time they are ignorant of the way it reflects on the players and they don't pose the question whether such a league is really taken to a higher level if its players have to make an absence for the half or the whole of the season because of injuries. One of the main indicators of the forming of the syndicates in Europe is the current clash between the EuroLeague and FIBA, since this conflict has pointed to the burning question of the players' human, civil and labour rights violation. The main goal is to determine all circumstances which lead to the forming of the European syndicates, as well as the motives behind the players' forming a syndicate.

Contextual framework

Basketball was developed in the USA around the year 1891-1892, at the University of Springfield, known as YMCA Training School. This sport was an immediate success and its popularity crossed the boards of the United States of America and Canada, thus becoming popular in China, India, France and England in 1895. Basketball appeared across Europe with the organisation of the International Basketball Federation (*Federation Internationale de Basketball – FIBA*) in 1932 in Geneva. European basketball has gone through the same stages as the American, in its technical, tactical and strategic development, only with significant delay (Primo, 1975).

Basketball popularity has risen pronouncedly on a global scale during the last years. The data published in 2017 at the "Statistic Brain Research Institute"² concerning the world's most popular sports show that basketball, with around two and seven hundred and fifty trillion supporters, scored third, right after cricket with three trillion and football with three and a half trillion supporters. There has been a significant rise of basketball popularity in Europe, much like the one on a global scale, so today's European basketball takes the third place, right after tennis and football, according to listverse.info³. Because of its great popularity, the European countries organise national basketball leagues, and international ones, where some of the best teams from national leagues perform, are organised as well. Because of its overwhelming

² Taken from <https://www.statisticbrain.com/most-popular-sports-worldwide/>

³ Taken from <http://www.listverse.info/top-sports-played-in-europe/>

popularisation and commercialisation, modern sport turns players into workers of big sports organisations who, despite having big economic capital, still share the need to unite in order to protect their human and civil rights. Scovill points out that players' associations in sport are almost as old as professional sports themselves (Aydin, 2009).

The first basketball syndicate was established in the USA in 1954, called the National basketball syndicate of NBPA players. NBPA has the protection of the NBA players and the provision of the best possible conditions for work and development as their main goal, so that each player can optimise their capabilities and goals, on the court and outside of it. It doesn't matter whether the topic of discussion is a collective contract, a complaint on the players' behaviour, or a players consultation, the members of NBPA work for the best of the NBA players' interests⁴. Before the establishment of this syndicate, the NBA players didn't have the privilege and protection they do today. They didn't use to have a pension plan, minimum wage, or any health benefits. When the NBA All-Star team (the best players proclaimed by the NBA league) gave a warning that they wouldn't play the first All-Star game on television in 1964, the players made their first victory over the NBA leaders. The NBA owners recognised the determination of the players and leaders such as Bob Cousy, Tom Heinsohn and Oscar Robertson, and therefore they officially granted NBPA the status of an exclusive syndicate of all NBA players. NBA allows the players to take part in syndical activities in a great number of aspects, some of which are an executive leading role, team's representative position, as well as participation in global initiatives such as the Community Outreach and more, so that each NBA player has a chance to be involved in democratic institutions established for their needs⁵. The development of the European basketball shall be presented in the further portion of this text, as well as the key conflict between the two organisations, which is one of the main reasons why there is now a syndical organisation in Europe.

Different basketball leagues where clubs compete at an international level began to appear across Europe. The first international competition organised by FIBA was the European Champions Cup which lasted from 1958 to 1987. Winners of the European national leagues played with the winners of the European Champions Cup of that time. The system of competing defined it as a tournament where competitors play against each other and the finale is played for two victories. Later on, from around 1987-88 to around 1990-91, FIBA changed the format according to which the champions of the European national leagues competed against each other. For the first time the finale was organised in the format of today's Final Four, where the best four teams play and there is only one victory. FIBA changed the name of the competition to the EuroLeague ⁶ in 1996/97.

FIBA international competition gained great popularity during this period, which secured monopoly over the European basketball for the FIBA organisation and subsequently caused a decrease in significance and quality of national basketball leagues. With the aim of improving the position of the European national leagues, on June 25, 1991 in Rome, national basketball unions of Italy, France and Spain set up a meeting and founded an independent organisation ULEB (*Union of European Basketball Leagues*). More national unions joined shortly after and their total number today is 11. With the increase of popularity and growth of commercialisation, ULEB has become a strong organisation with a big economic capital. They met with important clubs from Europe on July 9, 2000 in Sitges, Catalonia, with the aim of organising another international competition which wouldn't be under FIBA's supervision⁷. Because of the frequent changes in the format and rules of games, a certain number of clubs expressed their support for ULEB, which led to great changes on a global scale. Two separate leagues were organised: the Super League, which was organised by

⁴ Taken from <https://nbpa.com/about/>

⁵ Taken from <https://nbpa.com/about/>

⁶ Taken from https://en.wikipedia.org/wiki/EuroLeague#Title_sponsorship

⁷ Taken from <http://www.uleb.com/history1.htm>

the FIBA organisation, and the EuroLeague, organised by ULEB. FIBA had never protected the EuroLeague's title, so ULEB simply appropriated the title, so FIBA was obliged to find another one for its championships, since it didn't possess any legal acts to return the original title. Teams that were the most successful were divided into two leagues, so Europe had two continental champions in May, 2001. The problem of having two champions led to the leaders of both organisations arranging talks about a singular competition. After only one year of being established, the EuroLeague had more media coverage and had therefore gained bigger economic capital, so they managed to convince FIBA to agree with their conditions. As a result, all European club competitions were wholly integrated into the EuroLeague. Teams which had competed in FIBA Super League during the 2000-01 season joined the EuroLeague, while FIBA was still in charge of organising international competitions on different continents⁸.

Since 2009 ULEB has organised the EuroLeague and ULEB Cup, known today as the EuroCup. It was founded in 2002 and in 2008, after some alternations in the format, it changed its title to EuroCup. The EuroCup is a competition organised by the same organisation of the EuroLeague. The winner of the EuroCup qualifies to play in the next season of the EuroLeague. Both competitions were taken in 2009 by ECA (*Euroleague Commercial Assets*), a private organisation made out of 11 European clubs with the highest economic capital.

Because of their loss of control over the European basketball scene and the predominance of ECA, both FIBA and FIBA Europe tried to again take hold of the European competitions. With the FIBA Europe's full support, in 2015 FIBA organised another international league, the Basketball Champions League, hoping to regain its dominance over the European basketball⁹. The EuroLeague's response to FIBA's actions was a total transformation of the season 2016-17, so the tournament system was turned into a league system, modelled upon the NBA league, where there are 82 games and 30 teams play against each other during the regular season. Teams are ranked on the boards according to the conferences. There are two conferences, Eastern and Western Conference, and each has around 15 teams. The best team from each conference plays in the finale. According to this format of competition, the EuroLeague lowered the number of teams allowed to perform from 24 to 16. Starting from the 2009-10 season, as stated by ULEB ranking list, 11 first ranked teams from Europe got their A licence, which secured their perennial performance in the EuroLeague, despite of their success at international competitions. Teams from different national (Spain, Russian, German league) and international leagues (ABA (Adriatic League) league winners and EuroCup winners) compete for the remaining five spots. The format of competition includes 30 games in the regular season, where each team plays with the other, followed by the playoff portion played by the 8 first ranked on the list. There they compete for the progress to the next round with three victories. The only characteristic kept from the previous EuroLeague formats is the Final four tournament, where 4 best teams play two games each¹⁰.

The conflict between FIBA and the EuroLeague transitioned in time from a basketball court to a judicial level. FIBA Europe exerted pressure on basketball unions to forbid the clubs to compete in the leagues organised by ECA (EuroLeague and EuroCup), threatening to deny them the right to compete at the EuroBasket in 2017. FIBA publicly supported the FIBA Europe's decision. The EuroLeague filed a complaint against FIBA Europe in February because of their threatening messages to the national leagues, while FIBA Europe sent a complaint in April because of the EuroLeague's supremacy. FIBA's Executive Board decided to fully support FIBA Europe¹¹.

⁸ Taken from https://en.wikipedia.org/wiki/EuroLeague#Title_sponsorship

⁹ Taken from <http://www.asser.nl/SportsLaw/Blog/post/fiba-euroleague-basketball-s-eu-competition-law-champions-league-first-leg-in-the-landgericht-munchen-by-marine-montejo>

¹⁰ Taken from euroleague.net/rs/89rc6t9mc63fbgqt/84bd1f8d-134d-42a0-a8ee-cd688d29aaa2/562/filename/201718taebylaws.pdf

¹¹ Taken from <http://www.asser.nl/SportsLaw/Blog/post/fiba-euroleague-basketball-s-eu-competition-law-champions-league-first-leg-in-the-landgericht-munchen-by-marine-montejo>

The clash deepened and FIBA decided to change the format of international competitions, which in no way overlapped with the schedule of the EuroLeague and NBA games, so the players couldn't participate in their national teams. The new EuroLeague format, intense conflict between these two organisations, as well as a sequence of other problems during the season, caused the players to organise the first official ELPA syndicate at the EuroLeague final tournament on May 19, 2018 in order to protect their human and civil rights¹².

Method

The method used in this work shall be the analysis of media content, which in this work involves the content available online. The analysis of content is a sociological research method used for the sorting of data and with the help of which systematic recordings of social communication experiential records are built (Manić, 2012). Content analysis primarily refers to the content of a message. Based on the analysis of content, conclusions on understanding, attitudes, values, transmitter's intentions, as well as on their relations with other social groups, organisations, social units within certain community and within a broader international frame are reached (Milić, 1996). Quantitative and qualitative analyses are the two methods that can be distinguished when it comes to content analysis. Qualitative analysis is used in this work because it studies the text as a whole, as well as the overall experiential records content in order to establish important categories of analysis and thereby provide the understanding of the studied changes, taking into account the context of their occurrence (Manić, 2017). Hsieh and Shannon differentiate three basic types of qualitative analysis: conventional, directional and summative (Hsieh; Shannon, 2005 according to Manić, 2017). This work shall use conventional analysis since it is used when the aim of a research is a description of a studied problem, i.e. then the empirical knowledge concerning the subject of interest is limited, and a relevant theory does not exist or is not developed enough. Since the content of available data is incomplete, constructing categories beforehand should be avoided and they should be constructed based on the material itself instead, by reading it for a few times in order to get the glimpse of its essence and holistic character (Manić, 2017).

Sample

This work will use non-probability sampling because of its available resources and the format of content analysis that is to be used. Qualitative analysis doesn't insist on a representative sample (Manić, 2017).

In order to determine the problems the players face, two internet portals which broadcast news about basketball events daily are chosen as a sample in this research of the syndical organisation of the European basketball players. By intentional sampling, the following were selected: Eurohoops.net and TalkBasket.net. These two portals were chosen because they are up-to-date when it comes to broadcasting news concerning events from the world of basketball. Both of them are EuroLeague's official partners, which makes their content reliable. When the first announcements that a players' syndicate could be formed appeared, both of these websites published them immediately, which goes to prove just how representative they are as a source for using information for content analysis.

The pieces of news which are analysed here were published during the period from June 12, 2017 to September 12, 2018. On the basis of the criteria that they should refer to the problems EuroLeague players face or should contain the word "syndicate" (player union/ association), 23 pieces of news have been selected by intentional sampling.

¹² Taken from <https://www.eurohoops.net/en/euroleague/679066/euroleague-players-association-was-presented-in-belgrade/>

Research unit and research questions

As a context unit, this work uses the whole text analysed from the context of the published pieces of news regarding syndicates. Since the main goal of this work is to determine the problems Euroleague players who can be included in the business of a syndicate have, special attention is paid to the research questions which stem from the main aim:

- Which problems are most frequently taken as causes of dissatisfaction among the EuroLeague basketball players?
- Is it possible to single out collective problems for the EuroLeague basketball players?
- How can relations between the players and their leaders be characterised?
- What are the major differences in treatment between Euroleague and US players (NBA)?
- Can the main reasons which served as a motive for the organisation of the European ELPA syndicate be recognised?

Results with a discussion

In this work has been used qualitative content analysis of the selected online news refers to the syndical organisation of the EuroLeague basketball players. Criteria for choosed news refer to the problems EuroLeague players face or should contain the word "syndicate" (player union/ association)

It has been estimated that one of the main changes that occurred was the alternation of the format of competing in the EuroLeague in the 2015/16 season. The format was changed according to the NBA model in order to take the competition to a higher level and improve its rating. Because of this change, once the season was over, the players took action via social media, mainly Twitter, expressing the problems they were facing. By using this analysis, the following results which represent the answers to the research questions have been estimated:

Which problems are most frequently taken as causes of dissatisfaction among the EuroLeague basketball players? The problems that have been identified refer to the overwhelming number of games and trainings, the changes in competing format which are always followed by the change of rules regarding such changes, the lack of free time for rest and rehabilitation, frequent test dopings, non-existence of official bodies which players could consult in order to find solutions to their problems.

Is it possible to single out collective problems for the EuroLeague basketball players? Two main problems shared by all European basketball players can be distilled on the basis of the analysed news: no time for rest and the players' need to be directly involved in the making of the decisions that concern them. The European players start training two times a day from an early age and they play for national teams in summer. The main problem which arises is that young players compete in two or three official FIBA tournaments in their national jorneys during only one summer. A 20-year-old player can perform both in a junior and senior selection. Also, there are two tournaments for players of 18 and 20 years of age, where one player may play three tournaments over summer and finish with only a few days of repose. Even if a player doesn't play for a senior team, club practice is held by the end of summer. Because of their duration, all seasons require a higher number of games and trainings and therefore shortened recovery time, both the general one and the one needed for players' rehabilitaion. The players are more prone to injury due to shortened recovery time, which can lead to premature retirement or an absolute and of their careers. The lack of free time makes the players less able to spend time with their families, friends, or to rest. The European players are overburdened with trainings, sometimes held two times a day, while they have around two games per week and only one break.

How can relations between the players and their leaders be characterised? Another current problem is the non-existence of official bodies players can address, which, in essence, deprives them of their right to

vote. This provokes revolt seen in statements such as "basketball belongs to players and without them it would cease to exist", or "we need to be involved". Such pronouncements clearly point out to the players' need to be directly involved in the organising and making of decisions that concern them. The lack of real communication tells us a lot about the relationship between the players and their leaders. The only way the European players could express their opinions was through the media and/ or social networks, while decisions were made by the leaders who hadn't taken the players' beliefs and needs into account. This situation has already shown the reason for the tendency to organise a syndicate.

What are the major differences in treatment between Euroleague and US players(NBA)? As can be concluded from the analysis of news, apart from having better working conditions, NBA players have a syndicate (NBPA) which gives them right to vote and enables them to be involved in the making of any changes. In NBA, all newly introduced changes have to be adjusted to players, not vice versa, which is not the case in Europe. The NBA players focus primarily on adequate rest and have succeeded in fighting not only for better working conditions, but financial stability as well, which still represents a problem for the European players.

Can the main reasons which served as a motive for the organisation of the European ELPA syndicate be recognised? Primarily noticed reasons that served as motives for the founding of the European ELPA syndicate are, apart from the above-mentioned problems the players face, the inability of the European EuroLeague players to play in their national teams. The conflict between FIBA and EuroLeague (where their leaders were the main actors) was actually the main reason why the players were prevented from playing for their national teams. This is at the same time one of the leading motives which served as an initiative for the self-organisation of the players.

Conclusion

Even before the analysis began, it was clear that the number of problems which follows this sport was increasing, as seen in the newest reports from the world of basketball. It should be also mentioned that certain attempts (the foundation of UBE in 2017) did not bring about desired results. The players' need to self-organise and take action together had been growing until it was finally realised through syndical organisation.

The aim of ELPA is to protect professional basketball players' rights who compete in the EuroLeague via collective discussions with the EuroLeague leaders, as well as with the EuroLeague clubs. Individual and collective players' rights are protected by constant efforts to improve working conditions, economic benefits, and work safety for all members. The founders believe that the syndicate will in time turn into an organisation with financial, educational and marketing activities, which should in return additionally improve economic stability and security of the members of the syndicate. What also shows the importance of the ELPA syndicate is the fact that a partnership between NBPA and this syndicate was formed shortly after it had been established. This partnership is significant not only for the support on the global basketball level which this partnership offers, but also for the great experience and knowledge NBPA gives to ELPA as a role model.

Syndical organisation of basketball players in Europe is interesting in many aspects. The first one is that the initiative for the ELPA syndicate organisation came from social media, primarily Twitter. On Twitter players were able to directly and clearly express their opinions, dissatisfaction, and were able to connect more easily. On the other hand, portals serving as media for wider population published ongoing and timely pieces of news in the right time. Another reason why the organisation of this syndicate is interesting is the way it portrays self-organisation, not an organisation initiated by an institution, although syndical organisation in basketball isn't a novelty, since the American syndicate is over sixty years old. The third reason which is

exceptionally interesting is that the syndicate was formed by “sportsmen millionaires”. This fact shows that requests for more humane working conditions and rights to vote aren’t only for the existentially threatened. It has been proven that reaching independence from a financial status obviously isn’t the only and sufficient condition for happiness.

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SINDIKALNO ORGANIZOVANJE U SPORTU – PRIMER KOŠARKAŠA EVROLIGE

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Uvod

Rad je ljudima u korenu njihove individualnosti i društvene egzistencije (Bolčić, 2003). Marks u svojim delima ističe kako je upravo rad proces razmene čoveka i prirode, proces koji čoveku omogućava razmenu materije sa prirodom. Čoveka pokreće prirodna snaga njegovog tela u nastojanju da prirodnu materiju prilagodi sebi prihvatljivom obliku (Bolčić, 2003). Pored rada čoveku je svojstvena i "zabava", "igra", "veselje", što su sve zapravo značenja reči "sport" (Đulijanoti, 2008).

Mnogi sociolozi su se bavili sportom kao jednim bitnim društvenim fenomenom tako da danas Sociologija sporta predstavlja mladu disciplinu koja se bavi pitanjima konteksta i društvene uslovljenosti sporta (Radenović, 2017). Dirkemovska sociologija ističe funkciju sporta koja promoviše društveni poredak na sistemskom i na svakodnevnom nivou. Marksističke teorije bave se konfliktima koji su u osnovi sporta u modernom kapitalizmu. Oni smatraju da sport reprodukuje obeležje velike nepravde industrijskog kapitalizma, kao što je eksploatacija radnika/sportista i manipulacija potrošačima/gledaocima (Đulijanoti, 2008). Progres sporta i njegova široka komercijalizacija postali su danas društvena institucija kojoj je imanentno doživljavanje određenih dostignuća vrednosti, a ujedno i oslobađanje masovnih efekata i emocija samih aktera i posmatrača, ljudi nosilaca društvenog rada i progressa. Sport je danas preuzeo ulogu prilagođavanja kapitalističkom društvu, čime je stvorena neka vrsta zajednice interesa između savremenog kapitalizma i sporta (Filipović, 1985). Sa rastom popularnosti i komercijalizacije sporta, raste i kapital koji se ulaže preko medijskih korporacija (Coakley, Pike, 2009). Na ovaj način sport postaje kapitalistička organizacija čiji je najvažniji cilj sticanje profita, a sport dobija hiperrobni status (Đulijanoti, 2008).

Razvoj kapitalističkog sistema u 19. i 20. veku dovodi do porasta eksploatacije radnika u fabrikama. Da bi se zaštitili, radnici se organizuju u radničke sindikate čija je osnovna funkcija zaštita i unapređenje ekonomsko-socijalnih interesa zaposlenih (Stoiljković, 1995). Sindikati su organizacija sa dobrovoljnim članstvom, u koju radnici pristupaju ako imaju od nje koristi, pošto iziskuje plaćanje članarine. Najvažnija funkcija sindikata je upravo njegova pregovaračka moć, kojom uspevaju da prisile poslodavce da plate radne usluge. Sindikati pregovaraju o svim aspektima ugovora o radu: zaradama, radnom vremenu, premijama, nenovčanim naknadama, sigurnosti posla, bezbednosti i zdravlju na radu (Arandarenko, 2010). U savremenom dobu, širom Evropske unije, sindikati prolaze kroz težak period. Društveni status koji su nekada uživali, podriven je globalizacijom i neo-liberalizmom. Stopa sindikalizovanosti (odnosno procenat zaposlenih radnika učlanjenih u sindikate) značajno varira u poslednje tri decenije i kreće se u rasponu od 8 do 80 procenata (Bernaciak; Grumbrell-Mccormick; Hyman, 2014).

Međutim, u sportu značaj sindikata poslednjih godina povećava. Pošto sportski klubovi dobijaju odlike kapitalističke organizacije, igrači u tim organizacijama dobijaju status radnika. Neki od problema sa kojima se suočavaju sportisti su: da iako imaju visoka primanja, nisu nužno i zaštićeni; fleksibilno radno vreme im onemogućava da se slobodno kreću u toku sezone; striktno su ograničeni formalnim pravilima čije kršenje donosi suspenziju; velike šanse od povreda čine posao rizičnim po zdravlje, a može dovesti i do nesposobnosti za dalji rad. Takođe, jedna od značajnih stavki jeste ta da se njihove karijere relativno rano završavaju, usled čega igrači često imaju problem sa ponovnim uključenjem u društvo. Uloga i značaj

sindikata je upravo u tome da pomogne igračima u rešavanju ovih problema u toku njihove karijere, ali i posle nje.

U košarci se prvi sindikat igrača formira u NBA ligi (*National Basketball Player Association –NBPA*) 1954. godine, dok se u Evropi tek od 2017. godine organizovanjem, kako se pokazalo, neuspešnog UBE (*Union des Basketteurs Europeens – UBE*) sindikata. Prvi sindikat igrača Evrolige (*EuroLeague Players Association – ELPA*) organizuje se 19. 05. 2018. godine, na završnom turniru Evrolige. Pre ovoga u Evropi nije postojao nijedan sindikat igrača koji bi obuhvatio internacionalne lige kao što su EuroLeague, FIBA, Evrocup, Liga Šampiona. Dok su američki igrači preko svog sindikata uključeni u promene koje se dešavaju u njihovoj ligi, u Evropi se poslednjih godina, bez saglasnosti igrača, često menjaju formati takmičenja i igračima postaje sve teže da se prilagode takvim uslovima. Takođe je u NBA-u broj utakmica ograničen na 82 po sezoni, dok u Evropi, pojedinim igračima koji učestvuju u Evroligi, svojim nacionalnim ligama i u reprezentativnim takmičenjima FIBE, broj odigranih utakmica po sezoni nije ograničen, pa može da premaši čak 100 utakmica po sezoni. Dodatno se razlikuju uslovi za rad u evropskim i američkim klubovima. U Americi svaki klub obezbeđuje svojim igračima najbolje uslove potrebne za rad, dok u Evropi takvih klubova ima samo nekoliko.

Danas su u Evropi igrači koji igraju na najvišem profesionalnom nivou izloženi pojačanom ugrožavanju ljudskih, građanskih i radničkih prava. Predstavnici liga podižu takmičenja na sve više nivoe kako bi uvećavali kapital, pritom ne vodeći računa o tome kako se to odražava na igrače i ne razmišljajući o tome koliko je liga uopšte podignuta na viši nivo kada zbog povreda najbolji igrači izostaju po pola ili celu sezonu. Jedan od glavnih pokretača inicijative organizovanja sindikata u Evropi je aktuelni sukob između Evrolige i FIBE, zato što je ovaj sukob ukazao na goruća pitanja ugrožavanja ljudskih, građanskih i radničkih prava igrača. Osnovni cilj rada je utvrđivanje okolnosti koje dovode do formiranja evropskih sindikata kao i motiva košarkaša za sindikalnim organizovanjem.

Kontekstualni okvir

Košarka je nastala u SAD 1891-1892. godine na Univerzitetu Springfield, poznatom kao YMCA trenerska škola. Ovaj sport odmah postiže veliki uspeh i popularnost ne samo da se širi u Sjedinjenim Američkim Državama i Kanadi, već ga i od 1895. godine popularizuju Kina, Indija, Francuska i Engleska. Košarka se javlja širom Evrope sa organizovanjem Međunarodne košarkaške federacije (*Federation Internationale de Basketball – FIBA*), osnovanom 1932. godine u Ženevi. U svom tehničkom, taktičkom i strategijskom razvoju evropska košarka prošla je kroz iste etape kao i američka, ali uz značajno zakašnjenje (Primo, 1975).

Poslednjih godina se na globalnom nivou popularnost košarke izrazito uvećala. Podaci objavljeni 2017. godina na „Statistic Brain Research Institute“¹³ o najpopularnijim sportovima na svetu pokazuju da se košarka sa oko dva i sedamsto pedeset biliona navijača nalazi na trećem mestu odmah posle kriketa sa tri biliona i fudbala sa tri i po biliona navijača. Kako na svetskom nivou tako dolazi do značajnog rasta popularnosti košarke u Evropi, tako da se danas evropska košarka nalazi na trećem mestu po popularnosti, odmah posle tenisa i fudbala kako navodi listverse.info¹⁴. Zbog masovne popularizacije košarke evropske zemlje organizuju nacionalne lige, ali pored njih se organizuju i internacionalne, u kojima nastupaju najbolje ekipe iz nacionalnih liga. Zbog prevelike popularizacije i komercijalizacije, savremeni sport igrače pretvara u radnike velikih sportskih organizacija koji, iako poseduju veliki ekonomski kapital, i dalje imaju potrebu da se ujedine kako bi zaštitili svoja ljudska i građanska prava. Skovil ističe da su udruženja igrača u sportu stara skoro kao i profesionalni sportovi (Aydin, 2009).

¹³ Preuzeto sa <https://www.statisticbrain.com/most-popular-sports-worldwide/>

¹⁴ Preuzeto sa <http://www.listverse.info/top-sports-played-in-europe/>

Prvi košarkaški sindikat je organizovan u SAD-u 1954. godine pod nazivom nacionalni košarkaški sindikat igrača NBPA od strane NBA igrača. Cilj NBPA je da zaštiti prava NBA igrača i omogući im bolje uslove za rad i razvoj, tako da svaki igrač može da optimizuje svoje mogućnosti i ciljeve, kako na terenu tako i van njega. Bez obzira da li je tema pregovora kolektivni ugovor, žalba u ime igrača ili savetovanje igrača članovi NBPA rade u najboljem interesu svih NBA igrača¹⁵. Pre nastanka ovog sindikata, NBA igrači nisu imali privilegije i zaštite koje postoje danas. Nisu imali penzioni plan, dnevnice, minimalnu platu, nikakve zdravstvene beneficije. Kada je u NBA All Star tim (najbolji igrači proglašeni od strane NBA lige) 1964. godine zapretio da neće igrati tokom prvog televizijskog All-Star Game, igrači su izborili svoju prvu pobjedu nad čelnicima NBA. Vlasnici NBA-a su prepoznali odlučnost igrača i lidera kao što su Bob Cousi, Tom Heinsohn i Oskar Robertson i zvanično priznali NBPA kao ekskluzivni sindikat svih NBA igrača. NBPA omogućava igračima da učestvuju u sindikalnim aktivnostima u velikom broju aspekata, kao što su izvršne vodeće uloge, timske reprezentativne pozicije, da učestvuju u globalnim inicijativama kao što je Community Outreach i više, tako da svaki NBA igrač ima priliku da se uključi u demokratske institucije stvorene za njihove potrebe¹⁶. U daljem delu teksta biće prikazan razvoj evropske košarke kao i ključni sukob između dve organizacije koji je jedan o glavnih razloga zašto sada dolazi do sindikalnog organizovanja u Evropi.

U Evropi nastaju različite košarkaške lige u kojima se takmiče klubovi na međunarodnom nivou. Prvo međunarodno takmičenje koje je organizovano od strane FIBA jeste Kup evropskih šampiona koji je trajao od 1958-1987. godine. Kup su igrali pobednici evropskih nacionalnih liga sa aktuelnim pobednikom kupa evropskih šampiona. Sistem takmičenja je turnir u kome se klubovi takmiče jedni protiv drugih, a finale se igra na dve pobjede. Zatim 1987-88. do 1990-91. FIBA menja format u kome se šampioni evropskih nacionalnih domaćih liga takmiče jedni protiv drugih. Prvi put se finale organizuje u formatu današnjeg Final four-a gde se takmiče četiri najbolje ekipe, i igra se na jednu dobijenu utakmicu. FIBA 1996-97. godine menja naziv takmičenja u Evroliga ¹⁷.

FIBA međunarodno takmičenje tokom ovog vremenskog perioda dostiže veliku popularnost koja omogućava FIBA organizaciji monopol nad Evropskom košarkom, što uzrokuje smanjene značaja i kvaliteta nacionalnih košarkaških saveza. Sa ciljem poboljšanja položaja evropskih nacionalnih saveza, nacionalni košarkaški savezi Italije, Francuske i Španije, sastaju se 25. juna 1991. godine u Rimu i osnivaju samostalnu organizaciju ULEB (*Union of European Basketball Leagues*). Ubrzo im se pridružuje još nacionalnih košarkaških saveza, tako da ih danas ima jedanaest. Sa povećanjem popularnosti i rastom komercijalizacije ULEB postaje snažna organizacija sa velikim ekonomskim kapitalom. ULEB se sastaje sa velikim klubovima iz Evrope 09. 07. 2000. godine u Sitges, Kataloniji sa namerom da organizuje još jedno međunarodno takmičenje koje nije pod nadzorom FIBA¹⁸. Zbog čestih promena formata i pravila igre u takmičenju, jedan deo klubova daje podršku ULEB-u, što je dovelo do velikih promena na međunarodnom nivou. Organizuju se dve odvojene lige: Super liga, organizovana od strane FIBA organizacije i Evroliga koju organizuje ULEB. FIBA nikada nije zaštitila naziv Evrolige, tako da je ULEB jednostavno prisvojio ime, a FIBA nije imala pravni akt kojim bi povratila ime, pa je bila primorana da nađe novo ime za svoja prvenstva. Najbolji klubovi su bili podeljeni između dve lige tako da je u maju 2001. godine Evropa imala dva kontinentalna šampiona. Problem postojanja dva šampiona doveo je do toga da su čelnici obe organizacije morali da stupe u pregovore o jedinstvenom takmičenju. Evroliga je, posle samo godinu dana postojanja, bila bolje medijski propraćena i time je stekla veći ekonomski kapital, te uspeva da prisili FIBA da pristane na njene uslove. Kao rezultat toga, evropsko klupsko takmičenje je u potpunosti integrisano u Evroligi. Timovi koji su se takmičili u FIBA

¹⁵ Preuzeto sa <https://nbpa.com/about/>

¹⁶ Preuzeto sa <https://nbpa.com/about/>

¹⁷ Preuzeto sa https://en.wikipedia.org/wiki/EuroLeague#Title_sponsorship

¹⁸ Preuzeto sa <http://www.uleb.com/history1.htm>

Superligi tokom 2000-01 sezone su pristupili Evroligi, a FIBA je i dalje ostala zadužena za internacionalna takmičenja koja se organizuju na različitim kontinentima¹⁹.

Do 2009. godine ULEB je organizovao Evroligu i ULEB Kup, koji je danas poznat pod nazivom Evrokup. ULEB Kup je osnovan 2002. godine, a nakon promena u formatu promenio je ime 2008. godine u Evrokup. Evrokup je takmičenje koje organizuje ista organizacija koja organizuje i Evroligu. Pobjednik Evrokupa se kvalifikuje da nastupa u sledećoj sezoni u Evroligi. Oba takmičenja 2009. godine preuzima ECA (*Euroleague Commercial Assets*) privatna organizaciju sačinjena od jedanaest Evropskih klubova sa najvećim ekonomskim kapitalom.

FIBA i FIBA Evrope zbog gubitka kontrole nad evropskom košarkaškom scenom i prevlasti ECA pokušavaju da opet preuzmu kontrolu nad evropskim takmičenjima. FIBA Evrope je, uz potpunu podršku FIBA 2015. godine, organizovala još jednu međunarodnu ligu, tj. Ligu Šampiona (*the Basketball Champions League*), sa ciljem da vrati svoju prevlast nad evropskom košarkom²⁰. Odgovor Evrolige na tu FIBA akciju je bila totalna transformacija sezone 2016-17, tako što je sistema takmičenja iz sistema turnira prebačen u sistem lige, po ugledu na NBA. U NBA ligi održavaju se 82 utakmice. U regularnom delu 30 ekipa igra međusobno. Ekipe se na tabeli rangiraju po konferencijama. Postoje dve konferencije, a to su Istok i Zapad i u svakoj ima po 15 timova. U finalu se nalaze najbolje ekipe iz obe konferencije. Evroliga po ugledu na ovakav format takmičenja smanjuje broj timova koji mogu da se takmiče sa 24 na 16. Prema ULEB-ovoj rang listi počev od 2009-10 sezone 11 prvoplasiranih timova iz Evrope dobija A licencu koja omogućava višegodišnje nastupe u Evroligi nezavisno od uspeha u nacionalnim takmičenjima. Za ostalih 5 mesta se bore timovi iz različitih nacionalnih (Španska, Ruska i Nemačka liga) i internacionalnih liga (pobednici ABA (*Adriatic League*) lige i Evokupa). Format takmičenja se sastoji od 30 utakmica u regularnom delu, gde svaki tim igra sa svakim, zatim 8 prvo plasiranih na tabeli odlazi u playoff u kome se timovi takmiče za dalji prolaz u 3 dobijene utakmice. Jedino što je zadržano od prethodnih formata Evrolige jeste da se održava Final four turnir u kome se takmiče četiri najbolje ekipe igrajući još po 2 utakmice²¹.

Vremenom se sukob između FIBA i Evrolige udaljava od košarkaškog terena i prenosi na pravni nivo. FIBA Evropa je izvršila pritisak na nacionalne košarkaške saveze da zabrane klubovima da se takmiče u ligama organizovanim od strane ECA (Evroligi i Evrokupu) preteći im uskraćivanjem prava na takmičenje na Evrobasketu 2017. godine. FIBA je javno podržala odluku FIBA Evrope. Evroliga je u februaru podnela žalbu protiv FIBA Evrope zbog njene preteće poruke nacionalnim savezima, dok je FIBA Evrope u aprilu poslala žalbu zbog nadmoći Evrolige. Izvršni odbor FIBA je odlučio da u potpunosti podrži FIBA Evropu²². Sukob se dalje produbljuje i FIBA menja format međunarodnih takmičenja, koji se nikako ne poklapa sa rasporedom Evroligaških i NBA utakmica, tako da igrači ne mogu da učestvuju u svojim nacionalnim timovima. Novi format u Evroligi, žestoki sukobi između ove dve organizacije, kao i niz drugih problema tokom sezone, naveli su igrače da se na završnom turniru Evrolige final four 19. 05. 2018. godine organizuju u prvi zvanični sindikat igrača ELPA kako bi se zaštitili svoja ljudska i građanska prava²³.

Metod

Metod koji će u radu biti korišćen je analiza medijskog sadržaja u koji, u ovom radu spadaju sadržaji dostupni na internetu. Analiza sadržaja je sociološki istraživački postupak putem kojeg se sređuju podaci kojima se nastoji izgraditi sistemska iskustvena evidencija o društvenoj komunikaciji (Manić, 2012). Analiza

¹⁹ Preuzeto sa https://en.wikipedia.org/wiki/EuroLeague#Title_sponsorship

²⁰ Preuzeto sa <http://www.asser.nl/SportsLaw/Blog/post/fiba-euroleague-basketball-s-eu-competition-law-champions-league-first-leg-in-the-landgericht-munchen-by-marine-montejo>

²¹ Preuzeto sa euroleague.net/rs/89rc6t9mc63fbgqt/84bd1f8d-134d-42a0-a8ee-cd688d29aaa2/562/filename/201718taebylaws.pdf

²² Preuzeto sa <http://www.asser.nl/SportsLaw/Blog/post/fiba-euroleague-basketball-s-eu-competition-law-champions-league-first-leg-in-the-landgericht-munchen-by-marine-montejo>

²³ Preuzeto sa <https://www.eurohoops.net/en/euroleague/679066/euroleague-players-association-was-presented-in-belgrade/>

sadržaja se pre svega odnosi na sadržaj poruka. Na osnovu proučavanja sadržaja, izvode se zaključci o shvatanjima, stavovima, vrednostima, namerama odašiljača poruke, o njihovim odnosima s drugim društvenim grupama, organizacijama, društvenim jedinicama unutar nekog društva i u širem međunarodnom okviru (Milić, 1996). U analizi sadržaja mogu se razlikovati dve vrste metoda kvantitativna i kvalitativna analiza. U radu se koristiti kvalitativna analiza kojom se proučava tekst kao celina, celokupan sadržaj iskustvenog materijala radi utvrđivanja bitnih kategorija analize, a time se obezbeđuje razumevanje proučavanih promena uzimajući njihov kontekst nastanka (Manić, 2017). Hsieh i Shannon razlikuju tri osnovne vrste kvalitativne analize: konvencionalnu, usmerenu i sumativnu (Hsieh; Shannon, 2005 prema Manić, 2017). Rad će koristiti konvencionalnu analizu jer se ona koristi kada je cilj istraživanja opisivanje proučavanog problema, tj. kada su empirijska saznanja o predmetu interesovanja ograničena, a relevantna teorija ne postoji ili nije dovoljno razvijena. Zbog sadržinske nepotpunosti raspoloživih podataka izbegava se konstruisanje kategorija unapred već se one konstruišu na osnovu same građe, iščitavanjem više puta kako bi se proniklo kroz njenu suštinu i holistički karakter (Manić, 2017).

Uzorak

U radu će biti korišćen neprobabilistički uzorak zbog raspoloživih resursa ali i oblika analize sadržaja koji se koristi. Kvalitativna analize ne insistira na reprezentativnom uzorku (Manić, 2017).

U istraživanju sindikalnog organizovanja košarkaša u Evropi sa ciljem da se utvrde problemi sa kojim se susreću igrači kao uzorak su korišćena dva internet portala koja svakodnevno izbacuju vesti o košarkaškim dešavanjima. Namernim uzorkovanjem su izabrani: *Eurohoops.net* i *TalkBasket.net*. Ova dva portala su izabrana zbog njihove ažurnosti u objavljivanju vesti o dešavanjima iz sveta košarke. Oba sajta su zvanični partneri sa Evroligom, što čini njihove informacije pouzdanim. Prve objave o mogućem nastanku sindikata igrača su oba sajta objavila odmah, što potvrđuje njihovu reprezentativnost kao izvora za korišćenje informacija za analizu sadržaja.

Vesti koje će se analizirati su objavljene u vremenskom periodu od 12. 06. 2017. godine pa do 12. 09. 2018. godine. Namernim uzorkovanjem izabrane su 23 vesti, na osnovu kriterijuma da se odnose na probleme koje iznose igrači Evrope ili da sadrže reč „sindikata“ (player union/ association).

Jedinica analize i istraživačka pitanja

U radu je kao jedinica konteksta uzet ceo tekst posmatran u kontekstu objavljenih vesti o sindikatu. Kako je osnovni cilj rada utvrđivanje problema evropskih košarkaša koji mogu biti obuhvaćeni radom sindikata, istraživačka pitanja kojima će biti posvećena pažnja, a proizilaze iz osnovnog cilja su:

- Koji problemi se najčešće navode kao izraz nezadovoljstva evroligaških igrača?
- Da li je moguće izdvojiti zajedničke probleme za evroligaške igrače?
- Kako se mogu okarakterisati odnosi između igrača i njihovih čelnika?
- Koje su glavne razlike u tretmanu evroligaških igrača u poređenju sa američkim igračima (NBA)?
- Mogu li se prepoznati ključni razlozi koji su poslužili kao motiv za stvaranje evropskog ELPA sindikata?

Rezultati sa diskusijom

Kvalitativnom analizom sadržaja izdvojenih vesti praćene su internet vesti koje se odnose na sindikalno organizovanje košarkaša Evrolige. Kriterijum za odabir je bio da se vesti odnose na probleme koje iznose igrači Evrope ili da sadrže reč „sindikata“ (player union/ association).

Analizom je utvrđeno da je jedan od glavnih uzorka problema promena formata takmičenja u Evroligi u sezoni 2016/17. Format je promenjen po ugledu na NBA da bi se takmičenje podiglo na veći nivo i poboljšala

gledanost. Zbog ove promene, nakon završene sezone igrači se aktiviraju preko društvenih mreža, pre svega preko twitter-a, iznoseći probleme sa kojima su se suočili.

Analizom sadržaja odabranih vesti utvrđeni su sledeći rezultati koji predstavljaju odgovore na istraživačka pitanja:

Koji problemi se najčešće navode kao izraz nezadovoljstva evroligaških košarkaša? Uočeni problemi se odnose na preopterećenost utakmicama i treninzima, promenu formata takmičenja koju prati konstantno menjanje pravila u okviru tih formata, nedostatak slobodnog vremena za odmor i rehabilitaciju, učestalost doping testova, nepostojanje zvaničnih organa kojim bi mogli da se obrate za rešenja problema.

Da li je moguće izdvojiti zajedničke probleme za evroligaške igrače košarke? Na osnovu analiziranih vesti, mogu se izdvojiti dva glavna problema zajednička za evropske igrače košarke: *nedostatak odmora* i *potreba igrača da direktno učestvuju u odlukama koje se tiču njih samih*. Evropski igrači još u ranim godinama treniraju po dva puna dnevno, a tokom leta igraju za nacionalne timove. Glavni problem koji se javlja je taj da mladi igrači tokom leta odigraju po dva ili tri zvanična FIBA turnira u nacionalnom dresu. Igrač koji ima 20 godina može da igra i u juniorskoj i seniorskoj selekciji. Takođe, postoje dva turnira za igrače sa 18 i 20 godina, gde jedan igrač može da odigra 3 turnira preko leta i da završi sa samo par dana odmora. Čak i ako igrač ne igra u seniorskom timu, krajem leta se organizuju pripreme sa klubom. Sve sezone zbog svoje dužine trajanja dovode do povećanja broja utakmica i treninga umanjuju slobodno vreme, kako uopšte, tako i za potrebnu rehabilitaciju igrača. Igrači su usled nedostatka odmora u većoj meri skloni povredama, što može da dovede do preranog penzionisanja ili do potpunog prekida karijere. Nedostatak slobodnog vremena igračima umanjuje i mogućnost da to vreme provedu sa porodicom, prijateljima i uopšte uzev za oporavak. U Evropi su igrači preopterećeni treninzima koje imaju nekad i po dva puta dnevno, dok u toku sedmice imaju po dve utakmice i samo jedan pauze.

Kako se mogu okarakterisati odnosi između igrača i njihovih čelnika? Kao drugi problem se izdvaja nepostojanje zvaničnih organa kojima bi igrači mogli da se obrate, što im u suštini oduzima pravo glasa. Time se javlja revolt koji se ogleda u izjavama poput „košarka pripada igračima i bez igrača ne bi ni postojala“ ili „potrebno je da budemo uključeni“. Ove i slične izjave jasno ukazuju na potrebu igrača da se direktno uključe u organizaciju i u donošenje odluka koje se prvenstveno tiču njih samih. Nepostojanje prave komunikacije je problem koji dosta govori i o odnosu igrača i njihovih čelnika. Jedina mogućnost da evropski košarkaši iskažu svoje mišljenje bila je putem medija i/ili društvenih mreža, dok su odluke donosili čelnici ne uzimajući u obzir mišljenje i potrebe igrača. Ovakva situacija je jasno ukazala na razloge za pojavu težnje za sindikalnim organizovanjem

Koje su glavne razlike u tretmanu evroligaških u poređenju sa američkim igračima (NBA)? Kako se iz analize vesti može zaključiti, pokazuje se da osim što imaju daleko bolje uslove za rad, NBA igrači imaju i sindikat (NBPA) koji im omogućava pravo glasa i daje mogućnost da učestvuju u odlučivanju o bilo kakvoj promeni. U NBA sve promene koje se uvode su prilagođene igračima, a ne obrnuto, kao što je slučaj u Evropi. Igrači NBA stavljaju akcenat na što adekvatniji odmor i uspeali su da se izbore ne samo za bolje uslove za rad nego i za finansijsku stabilnost, što i dalje predstavlja problem evropskim košarkašima.

Mogu li se prepoznati ključni razlozi koji su poslužili kao motiv za stvaranje evropskog ELPA sindikata? Glavni uočeni razlozi koji su poslužili kao motiv za stvaranje evropskog ELPA sindikata su, pored već pomenutih problema sa kojima se igrači suočavaju, i nemogućnost učestvovanja evroligaških igrača u svojim nacionalnim timovima. Sukob FIBE i Evrolige (u kojem su glavni akteri čelnici ovih organizacija) zapravo je glavni razlog zbog koga su igrači onemogućeni da igraju u svojim nacionalnim timovima. To je ujedno i jedan od glavnih motiva koji je poslužio kao inicijativa ka samoorganizovanju igrača.

Zaključak

Još pre nego što se započelo sa analizom, na osnovu aktuelnih vesti iz sveta košarke bilo je jasno da se poslednjih godina broj problema koji prati ovaj sport povećava. Pri tome određeni pokušaji (osnivanje UBE, 2017. godine) nisu dali zadovoljavajuće rezultate. Potreba igrača za organizovanim i zajedničkim delovanjem je rasla dok konačno nije našla svoje ostvarenje u vidu sindikalnog organizovanja.

Cilj sindikata ELPA je da zaštiti prava profesionalnih košarkaša koji se takmiče u Evroligi putem kolektivnih pregovora sa čelnicima Evrolige, ali i sa evroligaškim klubovima. Individualna i kolektivna prava igrača se štite tako što se nastoji da se poboljšavaju uslovi rada, ekonomske beneficije, ali i sigurnost posla za sve članove. Osnivači smatraju da će sindikat vremenom prerasti u organizaciju sa finansijskim, edukativnim i marketinškim aktivnostima što bi trebalo dodatno da poboljša ekonomsku stabilnost i sigurnost članova sindikata. Koliko je važna uloga ELPA sindikata pokazuje i to što je nakon njegovog osnivanja sklopljeno partnerstvo između ovog sindikata i NBPA. Ovo partnerstvo značajno je ne samo zbog podrške na svetskom košarkaškom planu koje tako partnerstvo nudi, već i zbog velikog iskustva i znanja koje NBPA kao uzor donosi ELPA.

Sindikalno organizovanje evropskih košarkaša je interesantno iz više razloga. Prvi razlog je to što je inicijativa za organizovanje ELPA sindikata potekla sa društvenih mreža, pre svega twitter-a. Na twitter-u košarkaši imaju mogućnost da direktno i jasno iskažu svoje mišljenje, nezadovoljstvo i ujedno priliku da se lakše povežu. Sa druge strane, portali kao mediji namenjeni široj populaciji omogućili su aktuelne, pravovremene vesti na odgovarajuće teme. Drugi razlog zbog čega je organizovanje ovakvog sindikata zanimljivo je to što predstavlja samoorganizovanje, a ne organizovanje od strane institucija, iako sindikalno organizovanje u košarci nije novo, budući da američki sindikat postoji već više od šezdeset godina. Treći razlog koji je ujedno i posebno zanimljiv je to što je sindikat oformljen od strane „milionera-sportista“. Ova činjenica upućuje na to da zahtevi za humanijim uslovima za rad i pravom glasa nisu samo za one koji su egzistencijalno ugroženi. Pokazuje se da dostizanje nezavisnosti od finansijskog statusa očigledno nije jedini i dovoljan uslov za zadovoljstvo.

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Elektronski izvori

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W. J. MORGAN AND A. MACINTYRE – THE ROOTS OF INTERNALISM IN SPORT

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Introduction

During last two decades, the debate on normative theories of sport somehow mark the period in the development of the philosophy of sport, and especially the ethics of sport. In the ongoing debate are included, with their contributions, the most prominent scholars in the field, like Robert L. Simon (2000, 2004a, 2004b, 2010, 2015a, 2015b), Scott Kretchmar (2015, 2016), William J. Morgan (1987, 1994, 2004, 2012, 2015, 2016, 2018), John S. Russell (1999, 2004, 2007, 2018), and Javier Lopez Frias (2014, 2018), among many others. Two concepts dominated the debate - R. L. Simon's concept of *broad internalism* or *interpretivism*, and W. J. Morgan's *historicistic conventionalism* and *deep conventions*.

On one hand, in distinction from the *narrow internalism* or *formalism*, stands R. L. Simon's "critically reflective" (Simon, 2000, 14) conception of *broad internalism* (ibid, 6) as a "basis for a critical evaluation of sporting practice" and "for an ethic of an athletic competition" (ibid, 15). Simon is relying upon rationally extracted internal values of sport, general principles of the nature and purpose of sport such as striving for excellence, as a guidance in hard normative cases and dilemmas in sport. Simon claims that "there are underlying principles that may be embedded in overall theories or accounts on the sport as practice" (Simon, 2000, 7). In other words, he presented a normative account of the sport, that is based on the rational principles of nature and the purpose of sport. These internal principles are "standards that have a rational basis independent of the cultural, linguistics, or pragmatic considerations" (Simon, 2004, 125). As maybe the most important, we can point out the so-called *mutualism* or voluntary "mutual quest for excellence", which at the same time, keeps the integrity of sport intact and enables reaching human individual flourishing.

On the other hand, W. J. Morgan in his *historicistic conventionalism* critique is pointing out that the rational base of the *broad internalism* is too general and abstract, and not situated in social context and conventions developed in the history of the sporting practice. Moreover, Morgan is showing how striving for excellence is perceived completely differently in amateur, professional and scientific sport. Thus, Morgan is proposing socializing and historicizing every rationalization of the purpose and the essence of the sport.

Despite the fact that Simon sees *conventionalism* to be only a form of the *externalism*, and find it not important in any essential way, in my opinion, two concepts doesn't oppose each other, in fact they are complementary. Historicizing and socializing of *broad internalism* can and should be seen as an addition. Because, it seems quite obvious that Morgan is right, and that *broad internalism* is abstract! But not just that, it is not rationally accessible, and, it is unclear what it is. Furthermore, Simon is using, as well as Morgan, formulations like "striving for excellence" and "internal goods and values", without clearly showing what it is. Probably the best example is Morgan's triple division of sport, and triple understanding and meaning of the "striving for excellence" in amateur (leisure, love for the game), professional (winning, strategy, training methods) and scientific understanding of sport (improving athletes). (Morgan, 2012)

However, three articles published in the *Journal of the Philosophy of Sport* stands out, as the ones that marked and shaped the future debate: Russel's article "Are Rules All an Umpire Has to Work With?" (Russell, 1999), Simon's "Internalism and Internal Values in Sport" (Simon, 2000) and Morgan's „Broad Internalism, Deep Conventions, Moral Entrepreneurs, and Sport" (Morgan, 2012). The last has caused a sort of disquietude among sports-philosophers and provoked different criticizing reactions from several scholars

(Lopez Frias, 2014; Moore, 2018; Russell, 2018). Namely, in the article Morgan has presented his critics of the broad internalism for being too abstract, out of the social context and sports history, and proposed his conventionalist view leaning on deep conventions and Andrei Marmor's book *Social Conventions. From Language to Law* (Marmor, 2009). What Morgan is trying to do is not to show that *broad internalism* is wrong, but that it isn't good enough for obvious reasons. What he is trying to do is to build an *conventionalist internalism*.

However, in this paper, I will take a look back, in order to find out where the origins and the roots of internalism are. Namely, while most of the scholars, when speaking about the internalism, starts with the R. L. Simon's and J. S. Russell's, I propose to go back a little further into Morgan's work to find the starting point, its context and origin, just to be able to fully understand the ongoing disputes on internalism and normativity. Three things most of all: first, that Morgan is internalist; second, that he is not conventionalist; and third, that for him there is no (proper or valid) internalism without conventions.

Method

Research was conducted by the application of the bibliographical method for data collection. Critical analysis, comparative critical review method and comparative historical research method were used for detection of the relevant books and collections of essays.

Results

William John Morgan is the „father“ of internalism.

In his 1987. article „The Logical Incompatibility Thesis and Rules: A Reconsideration of Formalism as an Account of Games“ (Morgan, 1987), he has introduced A. MacIntyre's *After Virtue: a Study in Moral Theory* (1981) to the philosophy of sport, in order to solve the problem of a logical logjam in the formalists account of sport, called "incompatibility thesis": Namely, if someone is intentionally or deliberately breaking the rules, the moment (s)he brakes the rule, (s)he is not playing a game anymore, and thus (s)he can not win. So, to save formalism, he brought MacIntyre's distinction between sports practice and sports institutions, as well as internal and external values connected with the first distinction.

MacIntyre's distinctions

To make the distinction more obvious, MacIntyre is using the example of chess, in which „two kinds of good possibly [can] be gained by playing chess. On the one hand there are those goods externally and contingently attached to chess-playing and to other practices by the accidents of social circumstance —[...] prestige, status and money“ (MacIntyre, 1984, 188), which can be achieved through other ways also. „On the other hand there are the goods internal to the practice [...] for two reasons: first, [...] because we can only specify them in terms of chess [...], and secondly because they can only be identified and recognized by the experience of participating in the practice in question. Those who lack the relevant experience are incompetent thereby as judges of interna] goods.“ (MacIntyre, 1984, 189) MacIntyre concludes, that this is the case with all the social practices, sports included. His definition of social practice Morgan introduced and incorporated in the philosophy of sport:

„By a 'practice' I am going to mean any coherent and complex form of socially established cooperative human activity through which goods internal to that form of activity are realized in the course of trying to achieve those standards of excellence which are appropriate to, and partially definitive of, that form of activity, with the result that human powers to achieve excellence, and human conceptions of the ends and goods involved, are systematically extended.“ (MacIntyre, 1984, 187)

Institutions are dealing only with the external values, the instrumental, providing the economical and other external necessities for the practice. "Sports is a (social) practice, a joint project in which goods internal to the project are realized in the course of trying to achieve the standards of excellence that characterized it." (Morgan, 1987,17) Practices so defined have a little if anything to do with the instrumental activities, but are made of standards of excellence that are ment to increase our capacity for understanding and self mastery. Key notion in the definition of the practice is - internal goods – the ones that can be achieved and experienced only through engaging in the practice. Thus, the only way to reach the internal goods of sport is involving yourself in sports practice - playing sport!

In other words, Morgan is internalist, moreover "he do[es] not believe that there is a defensible externalist theory of anything" (Morgan, 2015, 299). In a constructivist moral theory like his, all normative principles are created "intramurally" (Morgan, 2012, 76) by the members of specific communities and practices. "Sport is an intrinsic perfectionist pursuit that should be pursued for the love of the game itself, rather than any tangible instrumental benefits it might provide." (Morgan, 2016, JPS, 31)

If one would want to describe Morgan's position in sports-philosophy or sports-ethics through key notions, in my opinion, it would look like this: *gratuitous-ethnocentric-historicistic-conventionalist-internalist*. With the emphasis - there is no essence of sport, there are only internal goods and values essential to the sport, combined with the specific ethos, build through history of practice in the specific social context. It seems to me that we can say that Morgan is an internalist with the conventionalist twist.

Morgan's internalist account of sport

Based on the grounds of three elements taken from MacIntyre, namely: 1) distinction between internalistic and externalistic values; 2) distinction between social practice and social institutions as a carriers of the values; 3) the pursuance towards achieving excellence, in the 1995 book *Leftist Theories of sport. A Critique and Reconstruction*, Morgan has futher developed the concept of internalistic account of sport with the four central elements:

- *gratuitous logic of sport*
- *sports practice communities*
- *striving for excellence*
- *social context and history.*

Morgan's internal theory understands sport as a social practice in MacIntyre's terms, and accepts its specificities: inherent goods and values, internal "gratuitous logic", characteristics and principles, non-instrumental ""inside" rational deliberations of its practice-community" (ibid., 253), and Suits unnecessary obstacles present in constitutive rules (Suits, 1978, 41) which ensure permanent "advancement of human excellence." (Morgan, 1995, 45)

Gratuitous logic of sport

Famous expression, "gratuitous logic of sport" Morgan borrowed from Suits, who has used it only one time in the *Grasshopper*: „gratuitous introduction of unnecessary obstacles to the achievement of an end is regarded as a decidedly irrational thing to do, whereas in games it appears to be an absolutely essential thing to do.“ (Suits, 1978, 39) However, Morgan define it differently: "the gratuitous logic of sport is a socially grounded, contingent logic that it cannot claim to be universal, transcultural logic." (Morgan, 1994, 215) It is common to all sporting practices as the intrinsic universal core and a contingent universal condition of the practice of sport. (ibid., 215) It is present only when there is a practice of sport actualized within the sport practice communities. If there is no practice, there is no (its) gratuitous logic. Moreover, S. Loland finds three

elements of the „gratuitous logic of sport“: overcoming unnecessary obstacles; an ethos of Fair –play; and sporting human excellence. (Loland, 2018)

Sports practice communities and deliberation process

In the final chapter of *Leftist Theories of Sport* - “Practice-communities as Deliberative Bodies”, Morgan states that the sport-practice communities (SPC) are “an internal good of sporting practices” which “can only be procured by directly involving oneself in the practice of sport.” Further, while „it is always difficult to handle on just who belongs and doesn't belong“ to the SPC, Morgan is making a distinction between *primary* agents of practice community or the athletes or practitioners per se; and *secondary* agents: coaches, game officials, spectators, journalists, researchers, critics, scholars – the ones with the vital role in sustaining the vitality of the SPC, and preserving the forms of life instantiated in sport. (Morgan, 1994, 236) Finally, as the only „salient sign of the membership“ to the SPC is if someone „thoughtfully reflects on its (proposed reform measure) likely effect on the good of the game“. (Morgan, 1994, 237)

Furthermore, in his book *Why Sports Morally Matter* (Morgan, 2006) Morgan states that the hope for the (by market economy corrupted and commodified) sport arises in the intersubjective pragmatic internalistic sphere (Morgan, 2006, 73) of the sport "practice communities", which is the only place where true nature of sport is preserved. SPC's are the carrier of the spirit of the sport, a place where sport exists in fundamental form. Therefore, SPC's are a key solution to all the problems of sport, thus also normative, as well as a healthy foundation to build upon. Within such a community of practitioners, sport is still "the world unto itself, that stands apart from the affairs of everyday life" (Morgan, 1976, 90); a space in which ideals of fairness and equality of opportunity reveals itself in a pure form; "the realm of freedom" (Morgan, 2006, 187) opposite to human labor that provides the necessities; "indispensable to leading a good, meaningful, and, therefore, full life" (ibid., 204).

In Morgan's opinion, all the (ethical) problems of sports will be solved in SPC through the deliberation process. Deliberation process Morgan describes in *Leftist Theories of Sport* very similar to what and how discussion is taking place in the sports-philosophy community from the beginning (Morgan, 1994, 245), and quite different from Habermas. He is giving „concrete presuppositions“ while Habermas is giving „idealizing“ ones - „the ideal speech“ situation that set out transcendental criteria of reasoned discourse“ (Morgan, 1994, 242) On the other hand, Morgans deliberation process is specifically framed with presuppositions of taking into account internal logic of sport, goods, values, virtues, ethnocentric features. Furthermore, normative inquiry must, per necessity, start with a particular conception of sport held by the members of a particular athletic community at a specific time and place. (Morgan, 2016, 35) For Morgan, deliberation should be taking place in „athletic forum armed only with their arguments, leaving behind all titles, goods, and vantage points that derive from their standing in other spheres.“ (ibid., 242) Unlike Habermasian deliberation process, in Morgans there is no democracy, especially not the direct democracy, and there are the privileged ones. Morgan explains that it is „master-apprentice“ kind a way of doing the deliberation, with the linear hierarchy between participants. In Morgans vision of the actual deliberation discourse process „recognized rational authorities of the game“ of sport should have a privileged role. (Morgan, 1994, 244) Moreover, „rational authorities“ are the ones with „the highest standards of reason realized thus far regarding the character, scope, and proper context of sporting practices.“ They produced the best interpretations of sport and „of the good of the kinds of life embodied in sporting practices“ so far, interpretations that „survive historical dialectic of vindication and justification.“ (Morgan, 1994, 245)

Discussion

In my opinion, there are three hammerstones to be able to understand Morgan:

1. dismissal of all „universal“ ethical principles
2. ethnocentric perspective
3. intramural principle

Firstly, Morgan is dismissing all the „universal“ principles as the ones non-applicable to sports (ethics), on the grounds of being too abstract. Thus, in his view, John Rawls *veil of ignorance* is blocking the ethnocentrism, Thomas Nagels *view from nowhere* is getting us nowhere in moral considerations of sport, while Habermas's *discourse ethics* is just too universalistic. Morgan is against every, in Habermas terms, „abstraction by essentialization“ of sport and pursuit for finding the universal principles that can apply on everyone, but actually no one in particular. (Morgan, 1994, 188). Abstraction starts the moment we are going away from the social and historical instances in sport, as its core to understand it at all. In other words, sport is its history in social and cultural context with the ethos, values, goods and virtues that were developed within its practice community. “The more abstract the account of sport [is], the greater the level of generality it aspires to, the less substance it possesses...thus, the stepping back from practices like sport, dissociating ourselves from all of their cultural particulars...is a way of consigning ourselves to a superficial understanding of them.” (Morgan, 1994, 185)

This is why Morgan is building an immanent theory of sport all of his life, starting from the *Leftist Theorie of Sport* onward. The epistemic principles that one need in that regard are, what Habermas refers to as, its „unshakeable facticity“ that derives from its concrete forms of life“. (Morgan 1987, 1994) In Morgan's view, in order to build any normative and/or critical theory of sport, one should „concentrates its search for epistemic principles on the local social arrangements and traditions that frame sporting practices. It begins with the ethnocentric starting points per necessity; these are literally the only conceptual materials it has at its disposal, and, fortunately, the only one it needs“ (Morgan, 1994, 189).

For Morgan, our job as a sports philosophers, and even more, as a sports ethicists is quite simple- it is not going in abstractions and looking for an essence, rather „to make explicit the normative standards we already implicitly use in the course of sporting lives, and then to bring those standards to bear on the actual conduct of those lives.“ (ibid. 189)

Secondly, Morgan is having an ethnocentric perspective in building normative accounts on sport, which means taking into account: social context, history of sport, developed conventions or ethos, intrinsic values, goods and virtues. If someone doubts that, just remember how, for example, football or soccer looked like 30 years ago, or 20, or 10. Further you go, less it looks like the same sport that it is today. It is extremely different – the intensity of play, the way of playing the game and hitting the ball, the tactics and strategies, the athletes bodies, stadiums...

Thirdly, all normative principles should be created *intramural* or within the practice, among and by the members of specific practice communities. That's why he has built an immanent method in approaching and considering or reflecting sports. His immanent critic is an ethnocentrically based, using „conceptual resources that already exist, and they don't need to be either invented or discovered“, and traditions from which can be drawn „historically extended“ and „socially embodied arguments.“ (MacIntyre, 1984, 222)

Conclusions

This article has clearly pointed out and made obvious three insights. First, W. J. Morgan is the “father of internalism” in the philosophy of sport. Second, by introducing MacIntyre, Morgan has created one of the turning points in the history of the development of the discipline, where sport is perceived as a specific social practice with its internal values and goods, gratuitous logic, and pursuit for excellence. And third, by doing that, he has largely influenced, shaped and directed the later global sports-philosophy, but even more sports-ethics, especially the field of normativity.

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HISTORY OF TEACHING OF SOCIOLOGY OF SPORT AT THE FACULTY OF SPORT AND PHYSICAL EDUCATION UNIVERSITY OF BELGRADE

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Introduction

The founding of sociology as a general social science through the emergence of basic sociological approaches is related to the XIX century and thought of the classical sociologists. In the first decades of the twentieth century, it became clear that the subject of sociology is very broad and complex, so that the process of differentiation of sociology and formation of special sociological disciplines can be perceived, such as: sociology of law, sociology of morality, sociology of family, sociology of politics, sociology of religion, sociology of culture, urban sociology, sociology of work, sociology of leisure time, sociology of medicine, sociology of inter ethnic relationships, sociology of education, and later sociology of sport, sociology of the body, sociology of bioethics, etc. As Koković points out (Koković, 2007), sociology of sports deals with the issues of context and social conditionality of sport. The development of sociology of sport as a theoretical and empirical discipline is not only a simple consequence of the development of contemporary sociology and its spreading to newer and more recent phenomena, but this sociological discipline points to a close interdependence between the development of sports and the development of certain areas of social life, certain phenomena in culture and civilization (Koković, 2007: 567). The first publications about the social problems of sports are related to the beginning of the 20th century and they have had wide echo in public, academic and sports world (Handbook of Sports Studies, 2000). One of the first attempts to consider the essence of sport from a sociological point of view is the work of Günter Riese, under the title "Sociology of Sport" (1921). In this paper the author considers sport as a reaction to the entire system that turns man into a machine. Let's also mention that the book "Sport and Culture" (1910) by Heinrich Steinitzer in which the author discusses the relation between sport and culture and summarizes the criticism of professional sport of that time, is considered as the first publication on the subject of social problems of sport. This publication have had wide echo in the public and sports world at the beginning of the 20th century (Koković, 2007: 567-568). Contemporary research in sociology of sports considers sport as a form of culture, sport in everyday life, commercialization of sports, sport as a spectacle. The field of sociology of sport as a special sociological discipline includes the following issues: sport as a factor and product of society and social development, the role of sport in the whole social life, the social position of participants in sport, the attitude of the wider community towards sports, social relations within sports, etc. (Koković, 2007). An important field of the practical study of sports sociologists today concerns the social microstructure of sports, in fact, the formal and informal structure of sports collectives such as clubs, sports groups – very important in team sports, amateur groups, dominant groups, influence groups – pressure groups. It can be noticed that the proper and efficient functioning of sport as an institution and the realization of the goals set by this institution depends very much on the study of these microstructures. An unavoidable example of this study is the influence of formal or informal structure on the flow and effects of sport training, as well as on the achievement of results (Koković, 2007). As a specific sociological discipline, sociology of sport has its own "sociotechnical" function, so in that sense research topics are life preoccupations, behavior patterns, value system and personalities of dominantly athletes (participants of sports events) as well as intermediaries of sports events (coaches,

judges, journalists, sponsors...) and audience (particularly psychology of mass audience) (Koković, 2007). Minding the fact that the sociology of sport takes interest in whole sociability as a primary goal of its researches is sports event that is consisted from players (actors), intermediaries and fans. Sport sociologists usually consider that sociology of sport regards sport so that society as a whole could be better understood, so in that sense researches insist on mutual relation between sport and society as a basis of researches in modern sociology of sport (Koković, 2007, Radenović, 2017). Adding to this, sport is interdisciplinary phenomena and as such demands interdisciplinary approach, where sociology of sport is one of necessary sciences for its analysis and understanding. When it comes to researches in sociology of sport, this sociological discipline gets its place in academic circles through process of institutionalisation in the world as well as Serbia (Radenović, Savović, 2018). As this paper considers history and the significance of researching sociology of sport at Faculty of sport and physical education University of Belgrade from its founding in 1938 up until today, let us mention firstly why is it important to research sociology of sport for future professors of P.E. and coaches. It is necessary to bring to mind that in the sociology of sport following topics are represented: sport as a factor and product of society and social development, role of sport in whole social life, social position of participant (actors) in sport, relation of broader social community towards sport, social relations within sport. That practically means that sociology of sport tries to give answers to following and similar question: Why is sport taking ever more significant and more influential place in global society today? What are the connections between sport and different segment of culture and every day life? What is the relations between amateur, professional and elite sport? Why today is often present discourses that sport as an authentic game is being lost? What is the relation between sport and physical culture? etc. Very important topic that sociology of sport regards, and which is significant for future professors of P.E. and coaches, as well as professionals in sport and physical culture, is relations teacher-student, and coach-athlete (practitioner). From the quality of this relations depends complete relation of the student himself towards physical culture, and athlete towards sport as a whole bearing in mind sociological, psychological, ethical, medicinal, legal aspects and no matter if it is about recreational, professional or elite sport. It is because of these topics the syllabus of program of sociology of sport that is general educational subject, but as well as specific sociological discipline can also be the only applied discipline that offers its own type of education of future professors of P.E. and coaches (Radenović, 2017).

Method

The historical method and method of content analysis were used in the research. The content of the curricula of the Faculty of Sport and Physical Education University of Belgrade has been analyzed from 1946 to nowadays to determine the presence and importance of sociology of sports as a teaching subject.

Results

Firstly, let us mention that Faculty of Sport and Physical Education University of Belgrade from 1946 up until 1953 was known by the name National Institute for Physical education (hence the popular abbreviation DIF, or NIPE in English, that is used still), from 1953 to 1956 as an Institute for physical culture, in years 1956-1963 as High school for Physical Education, in 1963 the faculty was accepted in Belgrade University, from 1978-1988 faculty was known as Faculty for Physical Education, from 1988-2000 as Faculty of Physical Culture and finally from the years 2000 changes name to today's – Faculty of Sport and Physical Education.²⁴

As a specific sociological discipline, sociology of sport had been researched under teaching program from the foundation of the Faculty of Physical Education University of Belgrade up until today, under

²⁴ <http://www.dif.bg.ac.rs/%D1%81%D1%80/o-fakultetu/istorijat>, access 05.12.2018, 23:54.

different names. Socialist government insisted on Marxist approach in science and formed new subjects on the University that had had “ideological-political educational role” (Bondžić, 2004). Consequently, after foundation NIPE complied to building of socialism, first Rule book defined the goal of this new institution: “preparing highly qualified personnel who will master advanced science and armed with expertise knowledge will be awake keepers of heritage of peoples-liberation struggle”, while as its goal it defined that “ideologically-politically educate students and teachers in the spirit of progressive democratic principles, heritages of peoples-liberations and the Constitution of FNRJ” (Mijatov, 2016). According to state’s policy sociology changed: from 1946 in NIPE sociology was researched with the subject Basics of social science (Statute of High School for Physical Education, 1958; Kreačić, 1950), from 1964 by the name Basics of society science (Statute of High School for Physical Education, 1964), and from 1973 within the subject Basics of Marxism (Syllabus for generation inscribed 1973/74, 1973). From 1987 thematic units connected to sociology of sport are being researched with the subject Sociology of physical culture (Syllabus for generation inscribed 1987/88, 1987), while from 1990 up until 2000 within syllabuses stand out General sociology and Sociology of physical culture (Syllabus for generation inscribed 1990/91 until 1994/1995, 1990; Syllabus for generation inscribed 1994/95 until 1999/2000, 1994). During academic year 2000/2001 and 2001/2002 in syllabuses we find subjects Sociology and Sociology of sport (Syllabus for generation inscribed 2000/2001 until 2001/2002, 2000) while from 2002 to 2008 besides Sociology of sport Sociology of physical culture was also being researched (Syllabus for generation inscribed 2002/2003, 2002; Syllabus for generation inscribed 2003/2004, 2003; Syllabus for generation inscribed 2004/2005, 2004; Syllabus for generation inscribed 2005/2006, 2005; Syllabus for postgraduate studies of physical education for generation inscribed 2006/2007 and 2007/2008, 2006; Syllabus for study program sport of basic four-year studies for generation inscribed 2006/2007 and 2007/2008, 2006). From 2008/2009 sociology was researched and from 2009/2010 Sociology with the sociology of sport (Syllabus for generation inscribed 2008/2009, 2008; Syllabus for generation inscribed 2009/2010, 2009)

Discussion

Along with the change of name of the faculty which corresponded with the expand of syllabuses, it is clear that the name of subject had also changed, so, as mentioned before, from 1946 up until today stand out: Basics of social science, Basics of society science, Basics of Marxism, Sociology of physical culture, General sociology, Sociology, Sociology of sport and finally Sociology with the sociology of sport. As it is stated (Bondžić, 2010) in press, analysis and teachers congresses mainly social science faculties in mid 50-ties of the XX century, which considered conception of subject Basics of social sciences and Basics of society science, they came to conclusion that this subject should be taken in the first two semesters with two classes for week and that by its content should cover general phenomena and tendencies in society and social development. Along with that, as a basis of this content Marxism was recognized with results from other social sciences. It was the reason why after the names Basics of social sciences and Basics of society science, sociology was researched within the subject Basics of Marxism. During the 90-ties of XX century with the war in Yugoslavia and the abandonment of socialism, Basics of Marxism are being expelled from syllabuses and are being replaced with sociology as a subject of general education. Soon, sociology of sport stand out as an specific sociological discipline and subject of general education within syllabuses of Faculty of sport and physical education University of Belgrade. On bachelor studies and basic professional studies within mandatory subject Sociology with sociology of sport and Sociology of sport that are being researched at the Faculty of sport and physical education University of Belgrade, in syllabus following topics are represented: 1. Introduction to sociology and sociology of sport; 2. Culture, society, religion; 3. Globalization, population and ecological crisis; 4. Social interaction; 4. Gender and sexuality; 6. Sociology of body; 7. Modern organizations;

Mass media and communication, significance of sport journalism; 9. Sociological definition of sport and sport event; 10. Sport and related terms; 11. Classification of sport; 12. Social dimensions of sport, national identity and sport; 13. Phenomenon of sport spectators; spectators and similar terms; 14. Violence of sport spectators, hooliganism and vandalism; 15. Ethics in sport, stadium racism.²⁵

Based on conducted researches (Radenović, Savović, 2018), sociology of sport is within programs of faculty of sport and physical education and similar faculties in Republic of Serbia and in some surrounding countries, mandatory subject with planned number of classes that span from the lowest – 30 (Faculty of Sport and Physical Education University of Nikšić) up to highest – 90 (Faculty of Sport and Physical Education University of Novi Sad). Within the program of the Faculty of Sport and Physical Education University of Belgrade, sociology of sport is present with number of 45 classes.²⁶ Minding the fact that sociology of sport is being researched as a mandatory subject within the programs of higher educational institutions in Serbia and in some surrounding countries, it is clear that sociology of sport as a specific sociological discipline is recognized as highly significant for reflecting the complex relation between sport and society and with the goal of improving the education of future P.E. professors and trainers. This specific sociological discipline is being researched within programs of faculties of sport and physical education and similar faculties, but not main faculties for the sociology itself. According to available data, only Faculty of Philosophy University of Novi Sad (Department of Sociology) as a main faculty, stand out with non-mandatory subject known as *Sociology of free time and sport* which is offered within the program of bachelor studies. Hence, we can see that main faculties still do not recognize the significance of sociology of sport as a specific sociological discipline that considers complex relation between sport and society and sport as multidimensional social, cultural and historical phenomenon (Radenović, Savović, 2018: 687-688). One of the possible explanations of unrecognizing the significance of research of sociology of sport within syllabuses of the main faculties is connected to the trend of the late constitution of some sociological disciplines in domestic academic space. Late constitution of the sociology of education, sociology of every day life and sociology of sport as the academic disciplines had contributed that numerous theoretical and practical questions had remained outside sociological considerations (Koković, 2012: 930). In that sense we can agree with the constatation that sport as social phenomenon was not up until today subject of serious research and still is, not just colloquial, considered as something that is understandable by itself (Koković, 2012: 939). Let us bring into mind generally accepted understanding of football as a most important secondary thing in the world. Still, we can see that more and more ideas for constitution of sociology of sport because sport as a mass phenomenon is more and more influencing the life and behavior of huge number of people (Koković, 2012: 939).

Conclusion

The history of teaching of sociology of sport at the Faculty of Sport and Physical Education University of Belgrade since its founding in 1938 until today, indicates that, as in European and world academic space, this special sociological discipline was recognized as very important for analyzing the complex relationship between the sport and the society in order to improve education of future teachers of physical education and trainers. It can be noticed that academic interest in sports has increased in recent decades due to the expansion of professional and commercial sports in the second half of the 20th century. Thus opens the possibility of allocating new sociological disciplines such as "sociology of physical culture", "sociology of physical education", "sociology of recreation", "sociology of sports training" and "sociology of football"

²⁵ http://www.dif.bg.ac.rs/mat/2014_15/oas1_sociologija_soc_sp.pdf, http://www.dif.bg.ac.rs/mat/2014_15/oss2_sociologija_sp.pdf, access 08.12.2018, 13:41.

²⁶ <http://www.dif.bg.ac.rs/%D1%81%D1%80/studije-od-2014-15/osnovne-akademske-studije/prva-godina>, <http://www.dif.bg.ac.rs/%D1%81%D1%80/studije-od-2014-15/strukovne-studije-sporta/druga-godina>, access 08.12.2018, 13:42.

(Milovanović, Radenović, 2018). Regarding the fact that sport as an interdisciplinary phenomenon requires interdisciplinary studies, it can be assumed that the further development of the institutionalization of sociology of sports will follow the European and world tendencies regarding the establishment of new special sociological disciplines related to the sociology of sports.

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ISTORIJAT IZUČAVANJA SOCIOLOGIJE SPORTA NA FAKULTETU SPORTA I FIZIČKOG VASPITANJA UNIVERZITETA U BEOGRADU

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Uvod

Zasnivanje sociologije kao opšte društvene nauke kroz nastanak osnovnih socioloških pristupa vezuje se za XIX vek i dela klasika sociološke misli. Već prvih decenija XX veka postaje jasno da je predmet sociologije veoma širok i kompleksan, tako da se može uočiti proces diferencijacije sociologije i formiranja posebnih socioloških disciplina kao što su: najpre sociologija prava, sociologija morala, sociologija porodice, sociologija politike, sociologija religije, sociologija kulture, sociologija grada, sociologija rada, sociologija slobodnog vremena, sociologija medicine, sociologija međuetničkih odnosa, sociologija obrazovanja, a nešto kasnije sociologija sporta, sociologija tela, sociologija bioetike itd. Kako upućuje Koković (Koković, 2007), sociologija sporta se bavi pitanjima konteksta i društvene uslovljenosti sporta. Sām razvoj sociologije sporta kao teorijske i empirijske discipline, nije samo prosta posledica razvoja savremene sociologije, tačnije, njenog rasprostiranja na sve novije i novije pojave, već ova sociološka disciplina ukazuje na usku međuzavisnost između razvoja sporta i razvoja određenih oblasti društvenog života, određenih pojava u kulturi i civilizaciji (Koković, 2007: 567). Prve publikacije na temu društvenih problema sporta vezuju se za početak XX veka i nailaze na širok odjek u javnosti, akademskom i sportskom svetu (Handbook of Sports Studies, 2000). Jednim od prvih pokušaja razmatranja suštine sporta sa sociološkog aspekta smatra se rad Gintera Rizea (*Günter Riese*) pod nazivom „Sociologija sporta“ (1921). U ovom radu autor smatra da je sport reakcija na celokupan sistem koji čoveka preobraća u mašinu. Pomenimo i to da se knjiga Hajnriha Štajnicera (*Heinrich Steinitzer*) „Sport i kultura“ (1910) u kojoj autor raspravlja o odnosu sporta prema kulturi i iznosi kritiku vrhunskog sporta tog vremena smatra prvom publikacijom na temu društvenih problema sporta. Ova publikacija je naišla na širok odjek u javnosti i sportskom svetu početkom XX veka (Koković, 2007: 567-568). Savremena istraživanja u sociologiji sporta posmatraju sport kao oblik kulture, sport u svakodnevnom životu, komercijalizaciju sporta, sport kao spektakl. Delokrug sociologije sporta kao posebne sociološke discipline obuhvata prevashodno sledeća pitanja: sport kao činilac i proizvod društva i društvenog razvoja, uloga sporta u celokupnom društvenom životu, društveni položaj učesnika u sportu, odnos šire društvene zajednice prema sportu, društveni odnosi unutar sporta itd. (Koković, 2007). Važna oblast praktičnog proučavanja sociologa sporta danas tiče se društvene mikrostrukture sporta, odnosno formalne i neformalne strukture sportskih kolektiva poput klubova, sportskih grupa – veoma važne u timskim sportovima, stihijskih amaterskih grupa, dominantnih grupa, grupa koje vrše uticaj – grupe za pritisak itd. Može se primetiti da od proučavanja ovih mikrostrukture u značajnoj meri zavisi i pravilno i efikasno funkcionisanje sporta kao institucije i realizacija ciljeva koje ova institucija postavlja. Nezaobilazan primer takvog proučavanja jeste uticaj formalne ili neformalne strukture na tok i efekte sportskog treninga, kao i na ostvarivanje rezultata (Koković, 2007). Kao posebna sociološka disciplina, sociologija sporta ima i svojevrsnu „sociotehničku“ funkciju, pa se u tom smislu imaju na umu istraživanja životnih preokupacija, obrazaca ponašanja, interesovanja, sistema vrednosti i ličnosti prevashodno sportista (aktera sportskog događaja), ali i posrednika sportskog događaja (treneri, sudije, novinari, sponzori...) i publike (ima se u vidu psihologija sportske publike) (Koković, 2007). S obzirom na činjenicu da sociologiju sporta zanima celina društvenosti, u

prvom planu njenih istraživanja nalazi se sportski događaj koga čine igrači (akteri), posrednici i navijači. Sociolozi sporta mahom smatraju da sociologija sporta istražuje sport da bi što više saznala o društvu, te u tom smislu istraživači insistiraju na uzajamnom odnosu sporta i društva kao okosnici istraživanja u savremenoj sociologiji sporta (Koković, 2007, Radenović, 2017). Ovome treba dodati i da je sport interdisciplinarni fenomen i da kao takav zahteva interdisciplinarni pristup, gde je sociologija sporta jedna od neophodnih nauka za njegovo sagledavanje i razumevanje. Kada je reč o izučavanju sociologije sporta, ova sociološka disciplina dobija svoje mesto u akademskim krugovima kroz proces instutucionalizacije u svetu i kod nas (Radenović, Savović, 2018). Kako se u ovom radu razmatra istorijat i značaj izučavanja sociologije sporta na Fakultetu sporta i fizičkog vaspitanja Univerziteta u Beogradu od osnivanja 1938. godine do danas, navedimo najpre zbog čega je važno izučavanje sociologije sporta za buduće nastavnike fizičkog vaspitanja i trenere. Podsetimo da delokrug sociologije sporta obuhvata pomenuta pitanja: sport kao činilac i proizvod društva i društvenog razvoja, uloga sporta u celokupnom društvenom životu, društveni položaj učesnika (aktera) u sportu, odnos šire društvene zajednice prema sportu, društveni odnosi unutar sporta. To praktično znači da sociologija sporta pokušava da odgovori na sledeća i slična pitanja: Zbog čega sport zauzima sve značajnije i uticajnije mesto u globalnom društvu danas? Kakve su veze između sporta i različitih segmenata kulture i svakodnevnog života? Kakav je odnos između amaterskog i profesionalnog, vrhunskog sporta? Zbog čega se danas često govori o uništavanju sporta kao vida autentične igre? Koji je odnos sporta i fizičke kulture? Itd. Veoma važna tema kojom se bavi sociologija sporta, a koja je značajna za buduće nastavnike fizičkog vaspitanja i trenere, kao profesionalce u oblasti sporta i fizičke kulture, jeste odnos *nastavnik –učenik*, odnosno *trener – sportista(vežbač)*. Od kvaliteta ovog odnosa zavisi kompletan odnos samog učenika prema fizičkoj kuturi, odnosno sportiste prema sportu u celini imajući na umu sociološke, psihološke, etičke, medicinske, pravne aspekte, i bez obzira da li je reč o rekreativnom, ili profesionalnom, vrhunskom sportu. Zbog toga sve pobrojane teme čine sadržaj programa sociologije sporta koja jeste opšteobrazovni predmet, ali kao posebna sociološka disciplina može biti i jedna primenjena disciplina koja nudi i svojevrsan tip pripreme za buduće nastavnike fizičkog vaspitanja i trenere (Radenović, 2017).

Metod

U istraživanju su primenjeni istorijski metod i metod analize sadržaja. Analiziran je sadržaj nastavnih programa Fakulteta sporta i fizičkog vaspitanja Univerziteta u Beogradu od 1946. godine do danas kako bi se utvrdilo prisustvo i značaj sociologije sporta kao nastavnog predmeta.

Rezultati

Najpre pomenimo da Fakultet sporta i fizičkog vaspitanja Univerziteta u Beogradu od 1946. do 1953. godine radi pod nazivom Državni institut za fiskulturu (odatile i popularno ime DIF, koje se zadržalo do današnjih dana), od 1953. do 1956. godine kao Institut za fizičku kulturu, u periodu od 1956. do 1963. godine kao Visoka škola za fizičko vaspitanje, 1963. godine fakultet je primljen u Beogradski univerzitet, od 1978. do 1988. godine fakultet radi po nazivom Fakultet za fizičko vaspitanje, od 1988. do 2000. godine kao Fakultet fizičke kulture i od 2000. godine ime menja u današnje – Fakultet sporta i fizičkog vaspitanja²⁷.

Kao posebna sociološka disciplina, sociologija sporta se u okviru nastavnih programa od osnivanja Fakulteta sporta i fizičkog vaspitanja Univerziteta u Beogradu do danas, izučavala pod različitim nazivima. Socijalistička vlast je insistirala na markističkom pristupu u nauci i formirala nove predmete na Univerzitetu koji su imali "ideološko-političku vaspitnu ulogu" (Bondžić, 2004). Posledično, po osnivanju DIF se povinovao izgradnji socijalizma, prvi Pravilnik je definisao cilj nove instutucije: „spremanje visoko kvalifikovanih kadrova koji ce savladati naprednu nauku i naoružani stručnim znanjem biti budni čuvari tekovina narodno-

²⁷ <http://www.dif.bg.ac.rs/%D1%81%D1%80/o-fakultetu/istorijat>, pristup 05.12.2018. u 23:54.

oslobodilačke borbe“, dok je kao zadatak definisano da „idejno – politički vaspitava studente i nastavnike u duhu naprednih demokratskih načela, tekovina narodno – oslobodilačke borbe i Ustava FNRJ“ (Mijatov, 2016). Prema državnoj politici prilagođavala se i sociologija: od 1946. godine na DIF-u sociologija se izučava u okviru predmeta Osnovi društvenih nauka (Statut Visoke škole za fizičko vaspitanje, 1958; Kreačić, 1950), od 1964. godine pod nazivom Osnovi nauke o društvu (Statut Visoke škole za fizičko vaspitanje, 1964), a od 1973. godine u okviru predmeta Osnovi marksizma (Nastavni plan za generaciju upisanu školske 1973/74. godine, 1973). Od 1987. godine, tematske jedinice vezane za sociologiju sporta se izučavaju u okviru predmeta Sociologija fizičke kulture (Nastavni plan za generaciju upisanu školske 1987/88. godine, 1987), dok se od 1990. do 2000. godine u okviru nastavnih programa izdvajaju Opšta sociologija i Sociologija fizičke kulture (Nastavni plan za generacije upisane od školske 1990/91. do 1994/1995. godine, 1990; Nastavni plan za generacije upisane od školske 1994/95. do 1999/2000. godine, 1994). Tokom akademske 2000/2001. i 2001/2002. godine u nastavnim programima su navedeni predmeti: Sociologija i Sociologija sporta (Nastavni plan za generacije upisane od školske 2000/2001. do 2001/2002. godine, 2000) dok se od 2002. do 2008. godine pored Sociologije sporta, izučava i Sociologija fizičke kulture (Nastavni plan fakulteta za generacije upisane školske 2002/2003. godine, 2002; Nastavni plan fakulteta za generacije upisane školske 2003/2004. godine, 2003; Nastavni plan fakulteta za generacije upisane 2004/2005. školske godine, 2004; Nastavni plan fakulteta za generacije upisane 2005/2006. školske godine, 2005; Nastavni plan studijskog programa dodiplomskih studija na odseku fizičko vaspitanje za generacije upisane školske 2006/2007. i 2007/2008. godine, 2006; Nastavni plan studijskog programa sport osnovnih četvorogodišnjih studija za generacije upisane školske 2006/2007. i 2007/2008. godine, 2006). Od 2008/2009. godine izučava se sociologija, a od 2009/2010. godine Sociologija sa sociologijom sporta (Nastavni plan školske 2008/2009. godine, 2008; Nastavni plan školske 2009/2010. godine, 2009).

Diskusija

Uporedo sa promenom imena fakulteta koje korespondira sa uslozňjavanjem nastavnih programa fakulteta, može se uočiti i menjanje naziva predmeta, tako da se, kako je pomenuto, od 1946. godine do danas, izdvajaju: Osnovi društvenih nauka, Osnovi nauke o društvu, Osnovi marksizma, Sociologija fizičke kulture, Opšta sociologija, Sociologija, Sociologija sporta i najzad, Sociologija sa sociologijom sporta. Kako se navodi (Bondžić, 2010), u štampi, analizama kao i na skupovima nastavnika prevashodno društvenih fakulteta sredinom 50-ih godina XX veka koji su razmatrali koncepciju predmeta Osnovi društvenih nauka, odnosno, Osnovi nauke o društvu, došlo se do zaključka da bi ovaj predmet trebalo izučavati u prva dva semestra po dva časa nedeljno, a da sadržajno predmet pokriva opšte pojave i zakonitosti društva i društvenog kretanja. Pri tom, kao okosnica sadržaja bio je predviđen marksizam uz rezultate drugih društvenih nauka. Otuda se posle naziva Osnovi društvenih nauka, odnosno Osnovi nauke o društvu, sociologija izučava u okviru predmeta Osnovi marksizma. Tokom 90-ih godina XX veka uporedo sa raspadom SFRJ i napuštanjem socijalizma, Osnovi marksizma se izbacuju iz nastavnih programa i bivaju zamenjeni sociologijom kao opšteobrazovnim predmetom. Nedugo zatim se izdvaja sociologija sporta kao posebna sociološka disciplina i opšteobrazovni predmet u nastavnim programima Fakulteta sporta i fizičkog vaspitanja Univerziteta u Beogradu. Na osnovnim akademskim i osnovnim strukovnim studijama u okviru obaveznih predmeta Sociologija sa sociologijom sporta i Sociologija sporta koji se izučavaju na Fakultetu sporta i fizičkog vaspitanja Univerziteta u Beogradu, nastavnim programom su predviđene sledeće tematske oblasti: 1. Uvod u sociologiju i sociologiju sporta; 2. Kultura, društvo, religija; 3. Globalizacija, stanovništvo i ekološka kriza; 4. Društvena interakcija; 5. Rod i seksualnost; 6. Sociologija tela; 7. Moderne organizacije; 8. Masovni mediji i komunikacije, značaj sportskog novinarstva; 9. Sociološko određenje sporta i sportski događaj; 10. Sport i srodni pojmovi; 11. Klasifikacija sporta; 12. Društvene dimenzije sporta, nacionalni

identitet i sport; 13. Fenomen sportske publike; publika i srodni pojmovi; 14. Nasilje sportske publike, huliganizam i vandalizam; 15. Etika u sportu, tribinski rasizam²⁸. Na osnovu dosadašnjih istraživanja (Radenović, Savović, 2018), sociologija sporta je u okviru programa fakultetā sporta i fizičkog vaspitanja i srodnih fakulteta u Republici Srbiji i nekim zemljama okruženja obavezan predmet sa predviđenim fondom časova koji se kreće u opsegu od najmanje 30 časova (Fakultet za sport i fizičko vaspitanje Univerziteta u Nikšiću) do najviše 90 časova (Fakultet sporta i fizičkog vaspitanja Univerziteta u Novom Sadu). U okviru programa Fakulteta sporta i fizičkog vaspitanja Univerziteta u Beogradu, sociologija sporta je prisutna sa fondom od 45 časova²⁹. S obzirom na to da se sociologija sporta izučava kao obavezan predmet u okviru programa visokoškolskih ustanova u Srbiji i nekim zemljama okruženja, može se zaključiti da je sociologija sporta kao posebna sociološka disciplina prepoznata kao veoma značajna za reflektovanje kompleksnog odnosa sporta i društva i to u cilju unapređenja obrazovanja budućih nastavnika fizičkog vaspitanja i trenera. Ova posebna sociološka disciplina se izučava u okviru programa fakultetā sporta i fizičkog vaspitanja i srodnih fakulteta, ali nematičnih fakulteta za samu sociologiju. Prema dostupnim podacima, jedino se Filozofski fakultet Univerziteta u Novom Sadu (Odsek za sociologiju) kao matični fakultet, može pohvaliti izbornim predmetom pod nazivom *Sociologija slobodnog vremena i sporta* koji je ponuđen u okviru programa osnovnih akademskih studija. Otuda možemo primetiti da matični fakulteti još ne prepoznaju značaj sociologije sporta kao posebne sociološke discipline koja izučava kompleksan odnos sporta i društva i uopšte sport kao višedimenzionalan društveni, kulturni i istorijski fenomen (Radenović, Savović, 2018: 687-688). Jedno od mogućih tumačenja neprepoznavanja značaja izučavanja sociologije sporta u okviru nastavnih programa matičnih fakulteta tiče se trenda kašnjenja u konstituisanju nekih socioloških disciplina u domaćem akademskom prostoru. Kašnjenja u konstituisanju sociologije obrazovanja, sociologije svakodnevnog života i sociologije sporta kao akademskih disciplina kod nas doprinela su tome da su brojna teorijska i praktična pitanja ostala izvan socioloških razmatranja (Koković, 2012: 930). U tom smislu se možemo složiti sa konstatacijom da sport kao socijalna pojava do sada nije ozbiljno proučavan i da se i dalje, ne samo kolokvijalno, smatra kao nešto što se samo po sebi razume (Koković, 2012: 939). Podsetimo na opšteprihvaćeno shvatanje fudbala kao najvažnije sporedne stvari na svetu. Ipak, može se primetiti sve više ideja za konstituisanje sociologije sporta jer sport kao masovna pojava sve više utiče na način života i ponašanje velikog broja ljudi (Koković, 2012: 939).

Zaključak

Istorijat izučavanja sociologije sporta na Fakultetu sporta i fizičkog vaspitanja Univerziteta u Beogradu od osnivanja 1938. godine do danas upućuje na činjenicu da je kao i u evropskom i svetskom akademskom prostoru, ova posebna sociološka disciplina prepoznata kao veoma značajna za analizu kompleksnog odnosa sporta i društva radi unapređenja obrazovanja budućih nastavnika fizičkog vaspitanja i trenera. Može se primetiti da je akademsko interesovanje za sport u porastu poslednjih decenija usled ekspanzije profesionalno-komercijalnog sporta u drugoj polovini XX veka. Otuda se otvara mogućnost izdvajanja novih socioloških disciplina poput „sociologije fizičke kulture“, „sociologije fizičkog vaspitanja“, „sociologije rekreacije“, „sociologije sportskog treninga“, te „sociologije fudbala“ (Milovanović, Radenović, 2018). S obzirom na činjenicu da sport kao interdisciplinarni fenomen zahteva interdisciplinarnu studiju, može se pretpostaviti da će i dalji razvoj institucionalizacije sociologije sporta pratiti evropske i svetske tendencije kada je reč o zasnivanju novih posebnih socioloških disciplina srodnih sociologiji sporta.

²⁸ http://www.dif.bg.ac.rs/mat/2014_15/oas1_sociologija_soc_sp.pdf,

http://www.dif.bg.ac.rs/mat/2014_15/osss2_sociologija_sp.pdf, pristup 08.12.2018. u 13:41.

²⁹ <http://www.dif.bg.ac.rs/%D1%81%D1%80/studije-od-2014-15/osnovne-akademske-studije/prva-godina>, <http://www.dif.bg.ac.rs/%D1%81%D1%80/studije-od-2014-15/strukovne-studije-sporta/druga-godina>, pristup 08.12.2018. u 13:42.

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**Methodical aspects of the
effects of physical activity
application in preschool
children**

Metodički aspekti primene
fizičke aktivnosti kod
predškolskog uzrasta

THE ROLE OF PRE-SCHOOL TEACHERS IN DEVELOPING THE HABITS OF SPORTS ACTIVITIES IN PRE-SCHOOL CHILDREN

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Introduction

Motor skills in younger children have an impact on the general health status and on different abilities, either as a positive correlation (self-esteem, cardio-respiratory endurance, cognition development) or a negative correlation, such as obesity.

There are numerous studies dealing with the influence of physical activity on the morphological and motor development of children. One of the recent studies, by Zang and associates (Zang et al., 2017), is based on the analysis of the research on the effects of programs of various physical activities on the development of pre-school children. Thus, ten studies dealing with the effects of physical activity on motor skills and 5 studies dealing with the impact on cognitive development were selected.³⁰ In 8 of the studies, significant positive changes in the development of motor skills and abilities were noted, while one study had mixed findings, only significant improvements were observed in equilibrium exercise and in the muscular arm strength, but not in other measurements (walking speed, mobility, rising speed from a sitting position, climbing and going down the stairs, walking test for two minutes). One of the possible explanations of the fact that the differences did not show up in other measurements as well, is that there was not sufficient amount of physical activity provided.

When it comes to the effects of physical activity on cognitive development, four studies indicate significant changes in the learning of language, attention, and cognitive functions.

One of them is the study of Tumpaniori and associates (Toumpaniori et al., 2015; Mavilidi et al., 2017: 5-6), which points out the positive effects of combined physical and cognitive activities in learning foreign words at the age of 4-5.³¹

Mavilides and associates (Mavilidi et al., 2017) designed their program, intended for children of pre-school age. The survey conducted in Australia included 87 children from 8 pre-school institutions, randomly selected. Children have learned the names of continents and one animal typical of each continent.³² A map of the world which was on the floor and animal toys made of soft material were used. During the program, learning sessions lasted for three days (Monday, Wednesday and Monday). The sample was divided into three groups. The first group was taught in such a way that physical activity was integrated with the content. The children "travelled" from one continent to another imitating the movement of animals. In the second group, where the children also had physical activity which were not integrated into the content, the children would take one of the animals and then run around the map and then put the animal on the starting position, until having used with all the animals. In the control group, the children stood in front of the map and

³⁰The criteria for selection of papers were, among others, that they were published in English from January 2000 to July 2017 as per-reviewed empirical research with children aged 4 to 6 years. Among 632 papers, 15 met the set requirements.

³¹Children were shown flash cards with written animal names, in two one-hour sessions, during 4 weeks. The child should have shown the physical activity characteristic of that animal (how it moves, sounds, stands, or how to sit like that animal). Learning a foreign language with the help of physical activities has resulted in the best outcomes and is also a way of learning which children enjoyed the most.

³²Australia - kangaroo, Europe - fox, Asia - panda, Africa - giraffe, America - bear, Antarctica - penguin.

watched and the researcher showed the continents and their animals, standing next to the child. Continents and animals were shown all in the same sequence. Testing was carried out immediately after the completion of the program and repeated after 5 weeks.

The first hypothesis that children would be more successful in terms of physical activity in comparison with the control group, was confirmed in both tests. However, the second hypothesis that children who studied under integrated conditions would be more successful, was not confirmed. It turned out that the children in the second group were more successful and the authors explained this by the level of physical activity. The third hypothesis that the integrated learning approach would be most appropriate for children was confirmed because the children in the first group were most satisfied with the way they worked and showed the greatest interest in the future learning as well.

Recent research on the impact of physical activities on the morphological and motor status of preschool children, carried out in our country (Pelemiš, 2016; Savičević, Suzović and Dragić, 2012) also point to the positive effects of the applied programs.

In a survey conducted at the Preschool Institution in Sremska Mitrovica, on the sample of 128 children attending preparatory preschool program, the authors assumed that the specific curriculum of physical activities would lead to positive transformational effects of motor abilities of children of pre-school age (Savičević, Suzović and Dragić, 2012). The nine-month program of physical activities was realized five times a week in both groups, experimental and control, but every organizational form of physical education in the experimental group was realized in 30% longer duration (morning exercise five times a week in duration of 10 to 15 minutes; directed motor activity twice a week, 40-45 minutes; recreational break 5 times a week, 10-15 minutes). A statistically significant difference ($F = 436.35$, $p < 0.01$, $\eta^2 = 6.67$) was found in the developmental level of motor abilities of both groups of children. Among the groups, a statistically significant difference (at the significance level $p \leq 0.05$) was found in variables that define force, explosive, repetitive force and velocity elements in favour of the experimental group. The developmental level of motor abilities of children enrolled in experimental treatment is statistically significantly different from the achieved new motor skills of children covered by the regular curriculum of physical education in the kindergarten (Ibid. 2012: 119).

Research on the impact of the additional physical exercise program on the morphological and motoric status of children (Pelemiš, 2016) was carried out in three kindergartens of the Preschool Institution "Čukarica" in Belgrade, during 2014/15 school year, on a sample of 211 children, divided into three groups. Experimental treatment was carried out with 48 periods of 35 minutes, during 24 weeks (twice a week). In addition to regular sports activities during physical education, the first control group was subjected to physical activities during non-institutional sports schools activities, focused on the development of specific sports knowledge and skills for 45 minutes, twice a week. The girls attended the school of rhythm and dance, and the boys the school of karate and taekwondo. The second control group, apart from regular activities during physical education in the kindergarten, did not attend any non-institutional program content in the field of physical exercise. The experimental program showed good results in the reduction of subcutaneous and fat tissue and body volume and body mass in children. The best results were obtained in terms of the mechanism for structuring the movement, which dominated in the program of targeted motor activities. Differentiated programs (for boys and girls in the first control group), showed good results in terms of reduction of subcutaneous fat tissue and volume and body weight, but in terms of motor abilities there was no progress in the mechanism for structuring the movement. In children in the second control group, there was an increase of subcutaneous fat tissue and volume and body weight, as well as a decrease of individual motor abilities, (there were poorer results in body coordination, speed and static arm and shoulder

strength), “which indicates that the mandatory program physical education in pre-school institutions is not sufficient for a preparatory preschool group” (Pelemiš, 2016: 175).

Method

In the conducted empirical research, using the descriptive method, we attempted to find out to what extent, within the daily activities in kindergartens, physical activities are represented, what types of exercises and games are used, in which space they take place and who realizes them with children as well as how educators encourage children to lead a healthy lifestyle and motivate parents to involve children in sports. We used a survey as a research technique. The non-standardized questionnaire, compiled for the purpose of this research, contains 12 questions out of which 8 are open-type and two are closed and combined types respectively. The research sample consisted of 50 students of specialist and master vocational studies at the Preschool Teacher Training College in Šabac, during school year of 2018/19.

The surveyed students work as educators in state (37 preschool teachers) and private preschool institutions (13 preschool teachers). The structure of the sample in relation to the place where they work is as follows: in Belgrade (22), Valjevo (10), Šabac (9), Smederevo (2) and in other places one (Krupanj, Ljig, Ljubovija, Novi Sad, Priboj, Ub, Vladimirci). The age of the children they work with ranges from 3 years to starting school: the younger age group 13, the middle group 10, the older group 8, the pre-school group 12 and the mixed age group 7 preschool teachers. As for to the program model - 31 educators work on the basis on the Model A while 19 educators work according to the Model B.³³

Findings

Do physical activities in kindergartens comply with the recommendations contained in the Principles of Pre-school Program (2006) and standards for development and learning (Nikolić, 2012)?

Starting from the recommendations contained in the General Principles of Pre-school Program „...in addition to recreational breaks, walks, trips, ten-minute exercises, it is necessary to organize physical exercise in agym or courtyardfor at least half an hour on daily basis“ (General Principles, 2006: 63), first we have tried to find out how much time, in the daily work with children, is given to physical activities, at what time of the day and how long they last.

Everyday morning exercises with childrenare realized before breakfast (by 40 preschool teachers), oraround 10 am (by 10 preschool teachers).They include breathing exercises, different forms of movement, body shape exercises, preventive and, if necessary, corrective exercises.

Table 1. The place where morning physical activity takes place

The place	f	%
Working room	26	65
Gym	6	15
Yard	8	20
Σ	40	100

The largest number of teachers stated that the place where the morning exercises are most often done is the working room, because, according to the usual day schedule, they prepare for breakfast after that and it would require more time to go out into the yard.

³³For working with children from age 3 to starting the school, there are two program models with common educational goals and principles. Model A "gravitates towards an open system of upbringing and action development of the program depending on the interest of children, and Model B has the characteristics of a cognitive-developmental program and elaborated educational goals, teachers' tasks and types of activities, among which the educator can choose and elaborate them, depending on the needs, opportunities and interests of children." (Principles of the Program, 2006: 24).

Table 2. Approximate duration of morning exercises

Approximate duration	f	%
5 minutes	2	6.90
10 minutes	7	17.24
15 minutes	9	34.48
20 minutes	6	20.69
25 minutes	1	3.45
30 minutes	4	17.24
Σ	29	100

Although the daily morning practice was mentioned in the answers, 11 educators did not indicate the approximate duration of exercising. Their duration depends on the age of children in the group and is the shortest in younger groups. It is influenced by the number of children present and spatial possibilities, especially when it takes place in working rooms. Also, preschool teachers (from Belgrade) point out that there is a tendency that parents bring their children later, adapting the kindergarten's attendance to their duties and working hours, so a number of children are late or even are not due for the morning exercises.

When it comes to guided motor activities, preschool teachers' responses show that only half of the total number of respondents accurately stated how many times on the weekly level they are maintained as well as their duration. If the activities are carried out by professional associates (teachers of physical education and educators-specialists for realization of physical education methodology) or by preschool teachers in cooperation with professional associates, physical education teams and parents of children from the educational group who are professionally engaged in sports, then the more precise time of their duration and frequency on a weekly basis are stated (Table 3 and 4). Other preschool teachers stated that physical activities take place daily, including recreational breaks, free activities of children and physical activities integrated into other contents.

Table 3. Guided motor activities on a weekly basis

1	8
1-2	1
2	11
2-3	3
3	2
Σ	25

Table 4. Duration of guided motor activities

Up to 20 minutes	1
Up to 25 minutes	4
Up to 30 minutes	12
35-45 minutes	8
Σ	25

Activities take place in the kindergarten gym or in the yard, when allowed by weather conditions, depending on the equipment used. From the preschool teachers' answers we find that all kindergartens do not have their own physical education room (one kindergarten) or another purpose is given to the existing gym (in one kindergarten it has been turned into a dining room). The following activities are maintained - moving games, exercises for the development of all muscle groups, various forms of movement, different polygons and dance activities, as recommended in textbooks for teaching methods of physical education (Džinović, Kojić, 2011; Maksimović, 2017a, 2017b). Children are also introduced to certain sports (mostly football, basketball and volleyball). A number of preschool teachers also say that swimming lessons are

organized for children (in four private kindergartens) as well as getting acquainted with the elements of some martial arts (in two private and one state kindergarten).

Equipment that children use during the activities are in accordance with the requirements contained in the Rulebook on the norms of teaching aids for the realization of the educational program in the preschool institution (*Official Gazette* No. 46/94). In addition to those procured by the institution, whether state or private, it is observed that teachers in state institutions say that they are still making them or in cooperation with parents (goals for small football, balls made of rags) and, if necessary, they are bought by parents.³⁴ Also, when there are not enough financial resources, parents borrow some kind of means that children use and at the end of that working day they return to the owner.

Within the framework of open-ended questions on how the content of different areas in educational work is linked with motor activities, most preschool teachers stated that, depending on the subject being taught (on a weekly or monthly level), they involve them in all areas which is, in accordance with the recommendations contained in the Principles of Pre-school Education. Since the additional instruction stated that the respondents' answers should be focused on those areas and activities that are currently present, for which children show the greatest interest or can be designated as the specificity of a particular educational group, we have received more diverse and richer answers, which we discuss in relation to the age groups.

In 13 younger educational groups, music plays are at the first place, followed by an acquaintance of the environment and the development of speech (imitative behaviour, most frequently mimicking of the movement of animals, certain movements and actions mentioned in stories), basic mathematical concepts (relation of sizes), art education. One example is the topic "Rocket", which was realised on a monthly basis, at the initiative of children (in Lazarevac), when in the yard of kindergartens, with participation of parents, "space rocket" were made of coloured tires which were used for motor physical activities (for various forms of movement – getting through the hoop, climbing, jumping, skipping).

In 10 middle education groups, apart from the music games that are also mostly represented in the answers, an acquaintance of the environment, mathematical terms (learning of time relations, geometric shapes), as well as the words of a foreign language (in a private kindergarten in Belgrade) are listed.

In 8 older educational groups dominate topics from the field of environmental awareness (traffic, seasons and animals, ecology), initial mathematical concepts (measurements), rhythmic games and dance with classical music, traditional movable games.

In 7 mixed age groups, the connection of motor activities is equally present in artistic activities - music games, painting (in unusual positions and painting with toes) as well as in acquaintance with the environment (imitation of animals, pantomime games, orientation in nature), and acquaintance with mathematical concepts.

In preparatory preschool groups (12), the emphasis is on linking motor activities with the acquaintance with the environment, the development of mathematical concepts and the practice of fine motoring as a preparation for writing.

When it comes to games and activities according to the choice of children, in the majority of answers, the kindergarten yard is placed first, giving children the most opportunities for free movement and development of physical abilities and skills. Also, educators are trying to use the advantages of proximity to parks, sports fields, meadows or nearby mountains. The kindergarten in Ljig organizes day trips and walks to the mountain Rajac; kindergartens near Košutnjak organize sports activities - competitions between educational groups; children from the kindergarten in Šabac go to the football playground of the FC "Mačva" and their coaches and football players come once a month to the kindergarten and organize children's activities of a competitive character.

³⁴One preschool teacher states that parents also bought a rugby ball so children could get acquainted with the basics of the sport.

The answers of preschool teachers on how often kindergartens organize sports days, which stimulate the competitive spirit of children, and team work, show that there are different approaches in their preparation, organizational levels, time and way of organizing. Sports competitions between educational groups at the kindergarten level are usually performed on a monthly basis, while sporting events, with the participation of parents, are organized most often once a year, on the occasion of Children's Week, in the first week of October. If they take place 2 to 3 times, then it is in the spring, they are designed by educators in cooperation with professional associates, parents, representatives of the local community, and these are different polygons, races, children's cross race (in Šabac - Sports Olympiad; in Belgrade - May Meetings, Challenge Day, New Year's Games, Children's Marathon, Playing with Marbles).

Monitoring and recording data on children's physical development, as well as other aspects of development, take place at least twice during the working year (at the beginning and at the end) and are implemented by educators - preschool teachers and professional associates for physical education. In addition, the preschool teachers state that children's observation takes place continuously and write down their observations into the Book of Work every 2-3 months.

When asked about the way parents of children get familiar with the importance of physical exercise at early age, the largest number of answers refers to parental meetings as well as through organizing lectures related to sports and recreational activities, which include professional associates for physical education or parents who are professionally engaged in sports; then lectures on health and a healthy lifestyle are organized in order to prevent various diseases and deformities. Parents are involved in workshops (when they make children's sports equipment for kindergartens) and projects (such as "Sports Games and Fantasy" and "Happy Orienteering" in Ljig).

Table 5. Informing parents about the importance of physical exercise at early age

The forms of cooperation	f	%
Parental meetings	24	48
Lectures	11	22
Workshops	6	12
Projects and events	5	10
Individual interviews	3	6
Texts on notice boards for parents	1	2
Σ	50	100

Discussion

The results of the research showed that the morning physical exercises take place daily in working rooms and, depending on the space, age and number of children present, last about 15 minutes and are realized by preschool teachers. They include breathing exercises, different forms of movement, body shape exercises, preventive and, if necessary, corrective exercises. When it comes to guided motor activities, they are organized most often twice a week, in gyms or in the yard, depending on meteorological conditions and on the equipment used. They are realized by professional associates for physical education and preschool teachers and most often they last for 30 minutes.

By integrating into the contents of other educational areas, physical activities are present during the introductory or final part of the activity or in the form of recreational breaks. Adhering to the initiative of children, free activities take place in the open space whenever meteorological conditions permit, and then children choose a variety of moving and competitive games, with elements of sports (football most often chosen by boys, basketball and volleyball).

Sports competitions between educational groups at the kindergarten level are usually performed on a monthly basis, while sporting events, with the participation of parents, are organized most often once a year, on the occasion of Children's Week, in the first week of October.

Preschool teachers introduce parents of children with the importance of physical exercise most often at parental meetings, as well as by organizing lectures, engaging in workshops and projects.

Monitoring and recording data on children's physical development, as well as other aspects of development, take place at least twice during the working year (at the beginning and at the end) and are implemented by educators - preschool teachers and professional associates for physical education.

Conclusion

The answers of the surveyed preschool teachers indicate that the conditions for realization of physical activities in kindergartens are not always favorable. Spatial constraints - insufficient space in working rooms, number of children in educational groups, lack of gyms - make the work difficult, but they are at the same time an incentive to use other opportunities that are provided in the immediate environment (kindergarten yard, gyms, nearby sports grounds, picnic areas, meadows or mountains) which indicates that educators are aware of the importance of physical exercise at the early age.

Special attention should be paid to developing team work of preschool teachers, professional associates for physical education or specialists for methodology of physical education, parents and the local community, in order to more intensively promote the positive influence of physical activities on the development of pre-school children, since this is the most sensitive age.

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ULOGA VASPITAČA U RAZVIJANJU NAVIKE BAVLJENJA SPORTSKIM AKTIVNOSTIMA KOD DECE PREDŠKOLSKOG UZRASTA

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Uvod

Motoričke veštine kod dece mlađeg uzrasta imaju uticaja na opšte zdravstveno stanje i na različite sposobnosti, bilo da je u pitanju pozitivna korelacija (razvija se samopoštovanje, kardio-respiratorna izdržljivost, kognitivne sposobnosti) ili negativna korelacija, kao što je gojaznost.

Brojne su studije koje se bave uticajem fizičkih aktivnosti na morfološki i motorički razvoj dece. Jedna od novijih studija, Zanga i saradnika (Zang at al. 2017), zasniva se na analizi istraživanja o efektima programa različitih fizičkih aktivnosti na razvoj dece predškolskog uzrasta. Izdvojeno je 10 studija koje se bave efektima fizičkih aktivnosti na motoričke veštine i 5 studija o uticaju na kognitivni razvoj.³⁵ U 8 studija ukazuje se na značajne pozitivne promene u razvoju motoričkih veština i sposobnosti a jedna studija ima mešovite nalaze, zapaženo je jedino značajno poboljšanje u vežbi ravnoteže i u mišićnoj snazi ruku ali ne i u ostalim merenjima (brzina hodanja, pokretljivost, brzina ustajanja iz sedećeg položaja, penjanje i silaženje niz stepenice, test hodanja tokom dva minuta). Jedno od ponuđenih mogućih objašnjenja je da se razlike nisu ispoljile i u ostalim merenjima jer nije bila obezbeđena dovoljna doza fizičkih aktivnosti.

Kada su u pitanju efekti fizičkih aktivnosti na kognitivni razvoj, četiri studije ukazuju na značajne promene u učenju jezika, pažnje i kognitivnih funkcija. Jedna od njih je studija Tumpaniori i saradnika (Toumpaniori at al. 2015. prema: Mavilidi at al. 2017:5-6) koja ukazuje na pozitivne efekte kombinovanih fizičkih i kognitivnih aktivnosti u učenju reči stranog jezika na uzrastu 4-5 godina.³⁶

Mavilidi i saradnici (Mavilidi at al., 2017) su primenili svoj program, namenjen deci predškolskog uzrasta. Istraživanjem koje je realizovano u Australiji, obuhvaćeno je 87 dece iz 8 predškolskih ustanova, slučajno odabranih. Deca su učila imena kontinenata i po jedne životinje koja je tipična za svaki kontinent.³⁷ Korišćena je mapa sveta koja se nalazila na podu i igračke u obliku životinja napravljene od mekog materijala. Tokom programa, sesije učenja su se odvijale tri puta (ponedeljak, sreda, ponedeljak). Uzorak je bio podeljen u tri grupe. Prva grupa je učila tako što su fizičke aktivnosti bile integrisane sa sadržajem. Deca su "putovala" sa jednog na drugi kontinent imitirajući kretanje životinje. U drugoj grupi, deca bi uzela jednu od životinja i onda trčala ukруг oko mape a zatim spuštala životinju na početnu poziciju tako redom, dok ne završe sa svim životinjama. U kontrolnoj grupi, deca su stajala ispred mape i gledala a istraživač je pokazivao kontinente i njihove životinje, stojeći pored deteta. Svima su istim redosledom pokazivani kontinenti i životinje. Testiranje je izvršeno neposredno po završetku programa a zatim posle 5 sedmica. Prva hipoteza, da će deca u uslovima fizičke aktivnosti biti uspešnija u odnosu na kontrolnu grupu, potvrdila se u oba testiranja. Međutim, druga hipoteza, da će deca koja su učila u integrisanim uslovima biti uspešnija, nije se potvrdila. Pokazalo se da su deca u drugoj grupi bila uspešnija a autori to objašnjavaju nivoom fizičke aktivnosti. Treća hipoteza, da će integrisani pristup u učenju najviše odgovarati deci, potvrđena je jer su deca

³⁵Kriterijumi za izbor radova bili su, između ostalog, da su objavljeni na engleskom jeziku u periodu od januara 2000. do jula 2017. godine i da se odnose na uzrast dece od 4 do 6 godina. Od 632 rada, 15 je ispunjavalo postavljene zahteve.

³⁶Deci su pokazivane fleš kartice sa napisanim imenima životinja, u dve jednočasovne sesije, tokom 4 sedmice. Trebalo je da dete pokaže fizičku aktivnost koja je karakteristična za tu životinju (kako se kreće, oglašava, da stoji ili sedi kao ta životinja). Učenje stranog jezika uz pomoć fizičkih aktivnosti rezultiralo je najboljim ishodima i takođe je način učenja u kome su deca najviše uživala.

³⁷Australija – kengur, Evropa - lisica; Azija – panda; Afrika – žirafa; Amerika – medved; Antarktik - pingvin.

iz prve grupe bila najviše zadovoljna načinom rada i pokazala su najviše interesovanja da i ubuduće uče na taj način.

Novija istraživanja o uticaju fizičkih aktivnosti na morfološki i motorički status predškolske dece, realizovana kod nas (Pelemiš, 2016; Savičević, Suzović i Dragić, 2012) takođe ukazuju na pozitivne efekte primenjenih programa.

U istraživanju realizovanom u Predškolskoj ustanovi u Sremskoj Mitrovici, na uzorku od 128 dece koja pohađaju pripremni predškolski program, autori su pošli od pretpostavke da će specifični kurikulum fizičkih aktivnosti dovesti do pozitivnih transformacijskih efekata motoričkih sposobnosti dece predškolskog uzrasta (Savičević, Suzović i Dragić, 2012). Devetomesečni program realizovan je pet puta nedeljno u obe grupe, eksperimentalnoj i kontrolnoj, ali je svaka organizaciona forma fizičkog vaspitanja u eksperimentalnoj grupi realizovana u 30% dužem vremenskom trajanju (jutarnje telesno vežbanje pet puta nedeljno, u trajnju od 10 do 15 minuta; usmerena motorička aktivnost dva puta nedeljno, 40-45 minuta; rekreativna pauza pet puta nedeljno, 10-15 minuta).³⁸ Utvrđena je statistički značajna razlika ($F=436.35$, $p<0.01$, eta kvadrat= 6.67) u razvojnom nivou motoričkih sposobnosti obe grupe dece. Između grupa, utvrđena je statistički značajna razlika (na nivou značajnosti $p\leq 0.05$) u varijablama koje definišu silu, eksplozivnu, repetativnu snagu i elemente brzine, u korist eksperimentalne grupe. Razvojni nivo motoričkih sposobnosti dece obuhvaćene eksperimentalnim tretmanom statistički se značajno razlikuje od postignutog nivoa motoričkih sposobnosti dece obuhvaćene redovnim kurikulumom fizičkog vaspitanja u dečjem vrtiću (Isto: 119).

Istraživanje o uticaju dodatnog programa fizičkog vežbanja na morfološki i motorički status dece (Pelemiš, 2016) realizovano je u tri vrtića Predškolske ustanove „Čukarica“ u Beogradu, tokom 2014/15. školske godine, na uzorku od 211 dece, koja su bila podeljena u tri grupe. Eksperimentalni tretman je realizovan sa 48 termina od po 35 minuta, tokom 24 nedelje (dva puta nedeljno). Prva kontrolna grupa je pored redovnih sportskih aktivnosti iz fizičkog vaspitanja, podvrgnuta vaninstitucionalno u sportskim školicama, fizičkim aktivnostima usmerenim na razvoj specifičnih sportskih znanja i veština u trajanju od 45 minuta, dva puta nedeljno (devojčice su pohađale školu ritmike i plesa a dečaci školu karatea i taekwonda). Druga kontrolna grupa imala je samo redovne aktivnosti iz fizičkog vaspitanja u vrtiću. Eksperimentalni program je dao dobre rezultate u redukciji potkožnog i masnog tkiva i volumena i mase tela kod dece. Najbolje rezultate dao je u pogledu mehanizma za strukturiranje kretanja, što je i dominiralo u programu usmerenih motornih aktivnosti. Diferencirani programi (za dečake i devojčice u prvoj kontrolnoj grupi), dali su dobre rezultate u pogledu redukcije potkožnog masnog tkiva i volumena i mase tela ali u pogledu motoričkih sposobnosti nije bilo pomaka u mehanizmu za strukturiranje kretanja. Kod dece u drugoj kontrolnoj grupi došlo je čak do povećanja potkožnog masnog tkiva i volumena i mase tela kao i pada pojedinih motoričkih sposobnosti „što nam ukazuje da obavezni program fizičkog vaspitanja u predškolskim ustanovama nije dovoljan za pripremnu predškolsku grupu“ (Isto:175).

Metod

U realizovanom empirijskom istraživanju, primenom deskriptivne metode, nastojali smo da saznamo u kojoj meri su, u okviru svakodnevnih aktivnosti u vrtićima, zastupljene fizičke aktivnosti, koje vrste vežbi i igara su zastupljene, u kojim prostorima se odvijaju i ko ih realizuje sa decom; na koji način vaspitači podstiču kod dece naviku za zdravim načinom života i kako motivišu roditelje da decu uključuju u sportske aktivnosti. Od istraživačkih tehnika je primenjeno anketiranje. Nestandardizovani upitnik, sačinjen za potrebe ovog istraživanja, sadrži 12 pitanja od kojih su 8 otvorenog tipa i po dva zatvorenog i kombinovanog tipa.

³⁸Programski sadržaji fizičkih aktivnosti su realizovani u okviru sledećih tematskih celina: Saobraćaj, Planeta Zemlja, Cirkus, Zima, Ja i moje telo, crtani filmovi, Uskrs, Olimpijske igre, Svet oko nas (isto:122).

Uzorak u istraživanju je činilo 50 studenata specijalističkih i master strukovnih studija u Visokoj školi strukovnih studija za vaspitače u Šapcu, školske 2018/19. godine. Anketirani studenti rade kao vaspitači u državnim (37 vaspitača) i privatnim predškolskim ustanovama (13 vaspitača). Struktura uzorka po mestu u kom rade je sledeća: u Beogradu (22), Valjevu (10), Šapcu (9), Smederevu (2) a u ostalim mestima po jedan (Krupanj, Ljig, Ljubovija, Novi Sad, Priboj, Ub, Vladimirci). Uzrast dece sa kojom rade je od 3 godine do polaska u školu i to: sa mlađom uzrasnom grupom 13, sa srednjom grupom 10, sa starijom grupom 8, sa pripremnom predškolskom grupom 12 i sa mešovitom 7 vaspitača. U odnosu na programski model, 31 vaspitač radi po Modelu A dok po Modelu B radi 19 vaspitača.³⁹

Rezultati

Da li su fizičke aktivnosti u vrtićima, usklađene sa preporukama sadržanim u okviru Opštih osnova predškolskog programa (2006), standarda za razvoj i učenje (Nikolić, 2012)?

Polazeći od preporuke sadržane u Opštim osnovama predškolskog programa da je, „...osim rekreativnih pauza, šetnji, izleta, desetominutnih vežbanja, neophodno tokom svakog dana bar pola sata organizovati vežbanje u sali za fizičko ili u dvorištu“(Opšte osnove, 2006: 63), najpre smo nastojali da saznamo koliko vremena se, u okviru svakodnevnog rada sa decom, poklanja fizičkim aktivnostima, u koje doba dana i koliko traju.

Svakodnevne jutarnje vežbe (pre doručka) sa decom realizuje 40 vaspitača ili se fizičke aktivnosti sa decom se odvijaju tokom prepodneva, oko 10 časova (10 vaspitača). Obuhvataju vežbe disanja, različite oblike kretanja, vežbe oblikovanja, preventivne i po potrebi, korektivne vežbe.

Tabela 1. Prostor u kojem se najčešće odvijaju jutarnje fizičke aktivnosti

Prostor	f	%
radna soba	26	65
sala	6	15
dvorište	8	20
Σ	40	100

Najveći broj vaspitača je kao mesto gde se najčešće odvijaju jutarnje fizičke vežbe naveo radnu sobu jer se, po uobičajenom režimu dana, posle toga pripremaju za doručak pa bi izlazak u dvorište zahtevao više vremena.

Tabela 2. Približno vreme trajanja jutarnjih vežbi

Približno vreme trajanja	f	%
5 minuta	2	6,90
10 minuta	7	24,14
15 minuta	9	31,03
20 minuta	6	20,69
25 minuta	1	3,45
30 minuta	4	13,79
Σ	29	100

Mada su u odgovorima naveli svakodnevno jutarnje vežbanje, 11 vaspitača nije naznačilo okvirno vreme njegovog trajanja. Ono zavisi od uzrasta i najkraće je u mlađim vaspitnim grupama. Na trajanje utiču i broj prisutne dece i prostorne mogućnosti, naročito kada se odvija u radnim sobama. Takođe, vaspitači (iz

³⁹Za rad sa decom uzrasta od 3 godine do polaska u školu predviđena su dva programska modela, sa zajedničkim vaspitno-obrazovnim ciljevima i načelima. Model A „gravitira otvorenom sistemu vaspitanja i akcionom razvijanju programa zavisno od interesovanja dece a Model B ima karakteristike kognitivno-razvojnog programa i razrađene vaspitno-obrazovne ciljeve, zadatke vaspitača i tipove aktivnosti, među kojima vaspitač može da bira i razrađuje ih, zavisno od potreba, mogućnosti i interesovanja dece“ (Opšte osnove predškolskog programa, 2006:24).

Beograda) iznose zapažanja da postoji tendencija da roditelji sve kasnije dovode decu, prilagođavajući dolazak u vrtić svojim obavezama i radnom vremenu, pa jedan broj dece kasni ili čak i ne stigne na jutarnje vežbanje.

Kada su u pitanju usmerene motoričke aktivnosti, odgovori vaspitača pokazuju da je samo polovina od ukupnog broja anketiranih tačno navela koliko puta se na nedeljnom nivou održavaju i njihovo trajanje. Ukoliko aktivnosti realizuju stručni saradnici (profesori fizičkog vaspitanja i vaspitači-specijalisti za realizaciju metodike fizičkog vaspitanja) ili ih vaspitači realizuju u saradnji sa stručnim saradnicima, timovima za fizičko vaspitanje i roditeljima dece iz vaspitne grupe koji se profesionalno bave sportom, tada je preciznije navedeno vreme njihovog trajanja i učestalost na nedeljnom nivou (*Tabela 3 i 4*). Ostali vaspitači su naveli da se fizičke aktivnosti odvijaju svakodnevno, uključujući tu rekreativne pauze, slobodne aktivnosti dece, kao i fizičke aktivnosti integrisane u ostale sadržaje.

Tabela 3. Usmerene motoričke aktivnosti na nedeljnom nivou

jednom nedeljno	8
dva puta nedeljno	12
tri puta nedeljno	5
Σ	25

Tabela 4. Trajanje usmerenih motoričkih aktivnosti

do 20 minuta	1
do 25 minuta	4
do 30 minuta	12
35-45 minuta	8
Σ	25

Aktivnosti se odvijaju u sali ili u dvorištu vrtića, kada to dozvole vremenski uslovi i u zavisnosti od toga koje se sprave i rekviziti koriste. Iz odgovora vaspitača saznajemo i da nemaju svi vrtići svoju salu za fizičko vaspitanje (jedan državni vrtić) ili je postojećoj sali data druga namena (u jednom državnom vrtiću je pretvorena u trpezariju). Zastupljeni su raznovrsni oblici kretanja, pokretne igre, vežbe za razvoj svih mišićnih grupa, različiti poligoni, plesne aktivnosti, kao što se preporučuje u udžbenicima za metodiku fizičkog vaspitanja (Džinović Kojić, 2011; Maksimović, 2017a, 2017b). Deca se upoznaju i sa pojedinim sportovima (najčešće su navođeni fudbal, košarka, odbojka) a jedan broj vaspitača navodi i da su za decu organizovani časovi plivanja (u četiri privatna vrtića) kao i upoznavanje sa elementima pojedinih borilačkih veština (u dva privatna i jednom državnom vrtiću).

Rekviziti koje deca koriste u toku aktivnosti su u skladu sa zahtevima sadržanim u Pravilniku o normativu sredstava za realizaciju vaspitno-obrazovnog programa u predškolskoj ustanovi (Službeni glasnik br. 46/94). Osim onih koje nabavlja ustanova, bilo državna ili privatna, zapaža se da vaspitači zaposleni u državnim ustanovama navode da ih još i sami ih prave ili u saradnji sa roditeljima (golići za mali fudbal, lopte krpenjače) a po potrebi ih kupuju i roditelji.⁴⁰ Takođe, kada nema dovoljno sredstava, roditelji pozajme neko sredstvo koje deca koriste i na kraju tog radnog dana vrata vlasniku.

U okviru pitanja otvorenog tipa o tome na koji način se u vaspitno-obrazovnom radu integrišu sadržaji različitih oblasti sa motoričkim aktivnostima, većina vaspitača je navela da, u zavisnosti od teme koja se obrađuje (na nedeljnom ili mesečnom nivou), uključuju ih u sve oblasti što je u skladu sa preporukama sadržanim u Osnovama programa predškolskog vaspitanja. Pošto je u dodatnoj instrukciji navedeno da se u odgovorima baziraju na one oblasti i aktivnosti koje su trenutno aktuelne, za koje deca pokazuju najveće

⁴⁰U odgovoru jednog vaspitača se navodi da su roditelji kupili i loptu za ragbi, da bi deca mogla da se upoznaju sa osnovama tog sporta.

interesovanje ili se mogu označiti kao specifičnost konkretne vaspitne grupe, dobili smo raznovrsnije i bogatije odgovore, koje prikazujemo po uzrasnim grupama.

U 13 mlađih vaspitnih grupa, na prvom mestu su muzičke igre a zatim upoznavanje okoline i razvoj govora (imitativno ponašanje, najčešće oponašanje kretanja životinja, određenih pokreta i radnji koje se pominju u pričama), osnovni matematički pojmovi (odnosi veličina), likovno vaspitanje. Jedan primer je tema „Raketa“ relizovana na mesečnom nivou, na inicijativu dece (u Lazarevcu) kada su, uz učešće roditelja, u dvorištu vrtića od obojenih automobilskih guma napravljene „rakete“ koje su korišćene za motoričke aktivnosti (za različite oblike kretanja - provlačenje, penjanje, skakanje, preskakanje).

U 10 srednjih vaspitnih grupa, sem muzičkih igara koje su takođe najviše zastupljene u odgovorima, navodi se i upoznavanje okoline, matematički pojmovi (učenje vremenskih relacija, geometrijskih oblika), kao i reči stranog jezika (u jednom privatnom vrtiću u Beogradu).

U 8 starijih vaspitnih grupa dominiraju teme iz oblasti upoznavanja okoline (saobraćaj, godišnja doba, životinje, ekologija), početni matematički pojmovi (merenja), ritmičke igre i ples uz klasičnu muziku, tradicionalne pokretne igre.

U 7 mešovitih uzrasnih grupa povezivanje motoričkih aktivnosti je podjednako zatupljeno u umetničkim aktivnostima - muzičkim igrama, slikanju (u neuobičajenim položajima i slikanje nožnim prstima) kao i pri upoznavanju okoline (oponašanje životinja, igre pantomime, orijentisanje u prirodi), i upoznavanju sa matematičkim pojmovima.

U pripremnim predškolskim grupama (12) naglasak je na povezivanju motoričkih aktivnosti sa upoznavanjem okoline, razvojem matematičkih pojmova i vežbanjem sitne motorike kao pripreme za pisanje.

Kada su u pitanju igre i aktivnosti po izboru dece, na prvo je mesto stavljeno dvorište vrtića koje deci pruža najviše mogućnosti za slobodno kretanje i razvijanje fizičkih sposobnosti i veština. Takođe, vaspitači nastoje da koriste i prednosti koje im pruža blizina parkova, sportskih terena, livada ili obližnjih planina. Vrtić u Ljigu organizuje izlete i šetnje do planine Rajac; vrtići u blizini Košutnjaka tu organizuju sportske aktivnosti – takmičenja između vaspitnih grupa; deca iz vrtića u Šapcu odlaze na stadion Fudbalskog kluba „Mačva“ a njihovi treneri i fudbaleri dolaze jednom mesečno u vrtić i organizuju deci aktivnosti takmičarskog karaktera.

Odgovori vaspitača o tome koliko često se u vrtićima organizuju sportski dani, kojima se kod dece podstiče takmičarski duh ali i timski rad, pokazuju da postoje različiti pristupi u njihovoj pripremi, nivou organizacije, vreme i način organizovanja. Sportska takmičenja između vaspitnih grupa, na nivou vrtića, odvijaju se najčešće na mesečnom nivou dok se sportski susreti, uz učešće roditelja, organizuju najčešće jednom godišnje, povodom Dečje nedelje, u prvoj nedelji oktobra meseca. Ukoliko se odvijaju 2 do 3 puta, onda je to u proleće, osmišljavaju ih vaspitači u saradnji sa stručnim saradnicima, roditeljima, predstavnicima lokalne zajednice i to su različiti poligoni, trke, dečji kros (u Šapcu - Sportska olimpijada, u Beogradu - Majski susreti, Novogodišnje igrarije, Dani izazova, Dečji maraton, Klikerijada).

Praćenje i beleženje podataka o dečjem fizičkom razvoju, kao i ostalim aspektima razvoja, odvija se bar dva puta u toku radne godine (na početku i na kraju) i realizuju ih vaspitači i stručni saradnici za fizičko vaspitanje. Sem toga, vaspitači navode da se posmatranja dece odvijaju kontinuirano a svoja zapažanja unose u Knjigu rada na svaka 2-3 meseca.

Na pitanje o tome na koji način upoznaju roditelje dece sa značajem fizičkog vežbanja na ranim uzrastima, najveći broj odgovora se odnosi na roditeljske sastanke i organizovanje predavanja o sportsko-rekreativnim aktivnostima, u koja se uključuju i stručni saradnici za fizičko vaspitanje ili roditelji koji se profesionalno bave sportom; zatim se organizuju predavanja o zdravlju i zdravom načinu života, u cilju prevencije različitih bolesti i deformiteta. Roditelji se uključuju u radionice (na kojima sa decom prave

sportske rekvizite za potrebe vrtića) i projekte (kao što su „Sportske igrarije i maštarije“ i „Veseli orijentiring“, u Ljigu).

Tabela 5. Upoznavanje roditelja sa značajem fizičkog vežbanja na ranim uzrastima

Oblici saradnje	f	%
Roditeljski sastanci	24	48
Predavanja	11	22
Radionice	6	12
Projekti	5	10
Individualni razgovori	3	6
Tekstovi na panou za roditelje	1	2
Σ	50	100

Diskusija

Rezultati istraživanja pokazuju da se jutarnja fizička vežbanja odvijaju svakodnevno, najčešće u radnim sobama i u zavisnosti od uzrasta, broja prisutne dece i prostornih mogućnosti, traju približno 15 minuta. Obuhvataju vežbe disanja, različite oblike kretanja, vežbe oblikovanja, preventivne i po potrebi, korektivne vežbe. Kada su u pitanju usmerene motoričke aktivnosti, organizuju se najčešće dva puta sedmično, u salama ili u dvorištu, u zavisnosti od meteoroloških uslova i od toga koje se sprave i rekviziti koriste. Realizuju ih stručni saradnici za fizičko vaspitanje i vaspitači i traju najčešće 30 minuta.

Integrisanjem u sadržaje ostalih vaspitno-obrazovnih oblasti, fizičke aktivnosti su prisutne tokom uvodnog, završnog dela aktivnosti ili u vidu rekreativnih pauza. Poštujući inicijativu dece, slobodne aktivnosti se odvijaju na otvorenom prostoru kad god to dozvoljavaju meteorološki uslovi i tada deca biraju raznovrsne pokretne i takmičarske igre, sa elementima sportova (fudbala koji najčešće biraju dečaci, košarke i odbojke).

Sportska takmičenja između vaspitnih grupa, na nivou vrtića, odvijaju se najčešće na mesečnom nivou dok se sportski susreti, uz učešće roditelja, organizuju najčešće jednom godišnje, povodom Dečje nedelje, u prvoj nedelji oktobra meseca. Vaspitači upoznaju roditelje dece sa značajem fizičkog vežbanja najčešće na roditeljskim sastancima, kao i organizovanjem predavanja, uključivanjem u radionice i projekte.

Praćenje i beleženje podataka o dečjem fizičkom razvoju, kao i ostalim aspektima razvoja, odvija se bar dva puta u toku radne godine (na početku i na kraju) i realizuju ih vaspitači i stručni saradnici za fizičko vaspitanje.

Zaključak

Odgovori anketiranih vaspitača ukazuju da uslovi za realizaciju fizičkih aktivnosti u vrtićima nisu uvek povoljni. Prostorna ograničenja – nedovoljno prostora u radnim sobama, brojnost dece u vaspitnim grupama, nepostojanje sale – otežavaju radali su istovremeno i podsticaj da se iskoriste druge mogućnosti koje se pružaju u neposrednom okruženju (dvorište vrtića, sale i sportski tereni, izletišta, livade i planine), što ukazuje da su vaspitači svesni značaja fizičkog vežbanja na ranim uzrastima. Potrebno je usmeriti posebnu pažnju na razvijanje timskog rada vaspitača, stručnih saradnika za fizičko vaspitanje, roditelja i lokalne zajednice, da bi se intenzivnije promovisao pozitivni uticaj fizičkih aktivnosti na razvoj predškolske dece, jer je to najosetljivije uzrasno doba.

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THE EFFECTS OF THE PROGRAMMED EXERCISE ON MOTOR SKILLS OF THE PRESCHOOL-AGE CHILDREN

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Introduction

Modern lifestyle influences immensely the overall physical activity decrease of a child during the whole day. Movement plays an important part in the general development of children. Well planned and organised physical activity is of great importance for good health condition, as well as personality development.

Most of motor skills and habits are developed and acquired in the childhood. It is believed that the complete differentiation of motor skills happens later in child's life, but still the influence should be started at an earlier stage. The preschool period of life is more than convenient for such a start, from year 4 to year 7 (Bala, 2002; Bala i Popovic, 2007; Mesaros-Zivkov i Markov, 2008; Savicevic, Suzovic i Dragic, 2012; Jankovic, 2014; Krneta et al, 2015; Stupar, 2016).

Organisational forms of exercise in which children's motor skills are developed are: a class or workout at a sports club, school of sport, sports workshop, sports camp, programmed exercises in sports and recreation centres, within outdoor teaching and similarly (Ropret, 2011). Sports school programs, which are conducted as a type of an exercise during preschool period, are focused on encouraging the general and proper body development, getting wider motoring experience, setting useful habits, health preservation, as well as satisfying children's need to move and play. While preschool children are being physically active, it is necessary to be particularly cautious in what way the exercises influence the children's organism, respectively the influence they have on their physical growth and development. Regarding this, it is important to know the development legalities and form an adequate choice of exercises in accordance with this.

The study shown in this work also included the observation of some motor skills: velocity, strength, flexibility and coordination. The aim of the study was to present the effects of the programmed exercises on the motor skills development of the preschool-age children.

Method

The research was conducted over a six-month-period. The respondents' sample was basen on 60 children of male sex, aged from 5 to 6 and a half, all of them being attendants of the sports school „ToSport“ in Belgrade. The mentioned group had a program of physical education twice a week, lasting 60 minutes each, when they did not practice any additional motor activities. Seven tests adapted for the youngest children were used for the evaluation of the motor skills (Bala, Popovic, Stupar, 2002): to evaluate running speed – 20 metre run, to estimate the coordination –polygon backwards, to estimate the static arm and shoulder strength – the hang in the hinge, to evaluate the repetitive body muscles strength – trunk lift in 60s, to evaluate the explosive leg strength - standing long jump, to evaluate the velocity (frequence) of hand motion – hand tapping, to estimate the flexibility – deep preinclination.

The T-test for the dependent patterns was applied for determining statistically significant difference in the initial and final measurement. Distribution curvature was determined by the coefficient values of

asymmetry ("Skewness"), and distribution height by flattening coefficient ("Kurtosis"). The program for statistical processing SPSS 20 was used for data processing.

Results with discussion

Central and dispersion parameters of the respondents' motor skills in the initial measurement are shown in the Table 1.

Table 1. Descriptive statistical parameters in the initial measurement

	N	Min	Max	Mean	StDev	Var	Skew	Kurt
Polygon backwards (s)	60	11.2	78.2	23.08	8.68	75.44	4.51	27.67
Hand tapping (no. of rep)	60	13.0	26.0	19.77	3.08	9.47	-.07	-.34
Preclination (cm)	60	15.0	56.0	37.57	7.60	57.84	-.35	.62
Long jump (cm)	60	62.0	137.0	104.33	16.29	265.45	-.48	.29
Trunk lift (no. of rep)	60	0.0	35.0	19.50	8.55	73.17	-.59	-.02
Hang in the hinge (s)	60	0.0	48.1	9.08	8.80	77.53	2.05	6.00
20 metre run (s)	60	4.1	6.8	5.23	.49	.24	.24	.92

N – number of respondents, Min – minimal score, Max – maximum score, Mean – middle value, StDev – standard deviation, Var – coefficient of variation, Skew. – coefficient of asymmetry, Kurt. – coefficient of curvature

Central and dispersion parameters of the respondents' motor skills in the final measurement are shown in the Table 2.

Table 2. Descriptive statistical parameters in the final measurement

	N	Min	Max	Mean	StDev	Var	Skew	Kurt
Polygon backwards_fin (s)	60	9.8	38.7	17.30	5.02	25.17	2.13	5.87
Hand tapping_fin (no. of rep)	60	14.0	27.0	23.07	2.76	7.62	-.95	1.08
Preclination_fin (cm)	60	23.0	61.0	41.85	8.53	72.74	.16	-.56
Long jump_fin (cm)	60	77.0	153.0	121.55	15.12	228.73	-.32	.11
Trunk lift_fin (no. of rep)	60	7.0	39.0	26.28	7.36	54.17	-.25	-.16
Hang in the hinge_fin (s)	60	0.0	37.7	13.11	8.57	73.44	.63	.19
20 metre run_fin (s)	60	4.0	6.2	4.77	.39	.156	.89	1.75

Having an insight into descriptive data, as well as comparing them with the research results of other authors in this field, it can be said that the values of the tests are at the level obtained in other studies at this age. The differences between variables of the motor skills in the initial and final measurement are shown in Table 3.

Table 3. The differences between the initial and final measurement of children's motor skills (t-test for dependent patterns)

	mean	t	df	sig. (p)
Polygon - Polygon_f	5.78	7.75	59	.000
Hand tapping - Hand tapping_f	-3.30	-13.66	59	.000
Preclination - Preclination_f	-4.28	-5.13	59	.000
Long Jump - Long Jump_f	-17.22	-9.78	59	.000
Trunk lift - Trunk lift_f	-6.78	-9.14	59	.000
Pull-up - Pull-up_f	-4.03	-3.39	59	.002
20 metre run - 20 metre run_f	.46	10.32	59	.000

Based on the data, which can be seen in Table 3, it can be said that there is a statistically significant difference on the level $r < .05$ which is determined in each variable. After implementing the six-month program, the results of the research showed that the level of the motor skills of the boys who were involved

in the reasearch improved significantly. Under the influence of the applied program of exercising there has been noticeable progress in coordination, leg strength, the strength of the abdominal muscles and flexibility. In order to explain the positive effects of the applied program it is necessary to look at the wider context of the sports school. By the school program it is predicted that the new moves and exercises are constantly learnt, which develops their central nervous system. The exercises which encourage the coordination development are practiced the most, and by the coordination development all other forms of motor skills are developed in an indirect way. With that comes the improvement in solving complex motor tasks, children use their potential in a more rational way and the conditions for the maximum motor skills manifesting are created.

The modern lifestyle was the trigger for the parents having less free time so the children spend most of the time in preschool institutions. However, the research shows that preschool children, who are not engaged in an organised sort of physical activity, nowadays are more likely to be less successful in motor skills both in their childhood and adolescence (Hardy et al, 2010).

The results of the research indicate that the exercise program which is conducted in sports school is important and very effective. The positive effects come as a result of the program concept which is used at sports school *ToSport*. The very concept of work is not based solely on the improvement and development of motor skills, but is focused on a general development of the child's organism. The program is designed to regularly give new tasks to children, that is to avoid constant repetition of certain tasks. The main goal of the exercise program implementation in the sports school is the positive influence on children's motor skills. Having a wider perspective, the program itself has an equally good impact on the proper body posture development, the encouragement of discipline and self-control in children. The attendants of the sports school are under the continuous surveillance of their P.E. teachers, who follow not only the motor skills development, but also their psychological development and health status.

The fact that children are less and less active brings along the opinion that the frequency of exercise should be adapted to today's circumstances. Researching the influence of the sports school program on three generations, Stupar (2016) comes to the result that in the third (last) generation exercising twice a week, each lasting an hour was effective only in 4 out of 7 motor variables, unlike the previous generations, who had improved all their motor variables. The probable reason is children's inactivity during the rest of their free time. Concerning this, the author conludes that the exercise should be present at least five times a week.

The employment od both parents, lack of their free time, the unsafe environment for children, reduces their time for playing in their nearest surroundings which is children's natural need. In this case schools of sports are a good solution.

Conclusion

When it comes to the development of motor skills, one can have a significant influence on preschool-age children. However in this period, frequency, intensity and exercising content in the preschool institutions do not present enough stimulation for developing motor skills more than it is achieved by the daily biological and physiological processes.

The results of this study showed that the general level of the motor skills of the boys who were involved in exercise program, within a school of sports, was significantly higher after conducting the six-month program, than it was at the very beginning of the program. It was noticed that coordination, leg strength and abdominal muscle strength and flexibility immensely improved under the influence of the applied exercise program. The scope of training on a weekly basis (2 sixty-minute classes) has made significant improvements

in every of the observed motor skills, though it can be concluded that more classes (3 to 5) during a week would achieve even better results.

The results of this study confirm the justification of programmed exercise in pre-school age, as well as the existence of the "schools" of sports. It is essential that the children get the best possible motor base before starting school, because the further motor skills development depends to a large extent on its forming in the preschool period. When concluding, one should bare in mind that at this age there is the effect of becoming mature and that the development of motor skills cannot be ascribed only to the influence of the applied program.

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EFEKTI PROGRAMIRANOG VEŽBANJA NA MOTORIČKE SPOSOBNOSTI DECE PREDŠKOLSKOG UZRASTA

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Uvod

Savremen način života u velikoj meri utiče na smanjenje ukupne fizičke aktivnosti deteta tokom čitavog dana. Važnu ulogu u opštem razvoju dece ima kretanje. Dobro isplanirana i organizovana fizička aktivnost od velikog je značaja za dobro zdravstveno stanje, ali i formiranje ličnosti.

Većina motoričkih sposobnosti i navika razvija se i stiče u periodu detinjstva. Smatra se da kod dece tek u kasnijem periodu dolazi do potpune diferencijacije motoričkih sposobnosti, ali ipak sa uticajem treba započeti ranije. Za takav početak veoma je pogodan predškolski period života, od 4. do 7. godine (Bala, 2002; Bala i Popović, 2007; Mesaroš-Živkov i Markov, 2008; Savičević, Suzović i Dragić, 2012; Janković, 2014; Krneta i sar, 2015; Stupar, 2016).

Organizacione forme vežbanja u kojima se razvijaju motoričke sposobnosti dece su: čas ili trening u sportskom klubu, sportskoj školi, sekciji, sportskom kampu, programima vežbanja u sportsko-rekreativnim centrima, u okviru nastave u prirodi, i dr. (Ropret, 2011). Programi škola sporta, koji se sprovode kao vid vežbanja tokom predškolskog perioda, imaju za cilj podsticanje opšteg i pravilnog razvoja tela, dobijanje što šireg motoričkog iskustva, stvaranje korisnih navika, očuvanje zdravlja, kao i zadovoljenje dečijih potreba za kretanjem i igrom. Tokom fizičkog vežbanja predškolske dece potrebno je dobro voditi računa na koji način samo vežbanje utiče na organizam deteta, odnosno kako utiče na fizički rast i razvoj. U tom smislu, važno je poznavati zakonitosti razvoja i u skladu sa tim praviti adekvatan izbor vežbi.

Istraživanje koje je prikazano u ovom radu podrazumevalo je posmatranje nekih od motoričkih sposobnosti: brzine, snage, gipkosti i koordinacije. Cilj istraživanja je bio da se prikažu efekti uticaja programiranog vežbanja na razvoj motoričkih sposobnosti dece predškolskog uzrasta.

Metod

Istraživanje je sprovedeno u trajanju šest meseci. Uzorak ispitanika je činilo 60 dece, muškog pola, uzrasta od 5 do 6,5 godina, svi polaznici škole sporta „ToSport“ u Beogradu. Navedena grupa je imala program fizičkog vežbanja dva puta nedeljno, po 60 minuta, pri čemu nisu upražnjavali dodatne motoričke aktivnosti. Za procenu motoričkih sposobnosti korišćeno je sedam testova prilagođenih za decu najmlađeg uzrasta (Bala, Popović, Stupar, 2002): za procenu brzine trčanja - trčanje na 20 m, za procenu koordinacije - poligon natraške, za procenu statičke snage ruku i ramenog pojasa - izdržaj u zgibu, za procenu repetitivne snage mišića trupa - podizanje trupa za 60s, za procenu eksplozivne snage opružaća nogu - skok udalj iz mesta, za procenu brzine (frekvencije) pokreta rukom - taping rukom, za procenu gipkosti - pretklon u sedu raznožno.

Za utvrđivanje statistički značajne razlike na inicijalnom i finalnom merenju primenjen je T - test za zavisne uzorke. Zakrivljenost distribucije je utvrđena preko koeficijenta asimetrije ("Skjunis"), a visina distribucije preko koeficijenta spljoštenosti ("Kurtosis"). Za obradu podataka korišćen je program za statističku obradu SPSS 20.

Rezultati sa diskusijom

U Tabeli 1. prikazani su centralni i disperzioni parametri motoričkih sposobnosti ispitanika, na inicijalnom merenju.

Tabela 1. Deskriptivni statistički parametri na inicijalnom merenju

	N	Min	Max	Mean	StDev	Var	Skew	Kurt
Poligon natraške (s)	60	11,2	78,2	23,08	8,68	75,44	4,51	27,67
Taping rukom (broj pon)	60	13,0	26,0	19,77	3,08	9,47	-,07	-,34
Pretklon (cm)	60	15,0	56,0	37,57	7,60	57,84	-,35	,62
Skok udalj (cm)	60	62,0	137,0	104,33	16,29	265,45	-,48	,29
Podizanje trupa (broj pon)	60	0,0	35,0	19,50	8,55	73,17	-,59	-,02
Izdržaj zgib (s)	60	0,0	48,1	9,08	8,80	77,53	2,05	6,00
Trčanje 20m (s)	60	4,1	6,8	5,23	,49	,24	,24	,92

N – broj ispitanika, Min – minimalni rezultat, Max – maksimalni rezultat, Mean – srednja vrednost, StDev – standardna devijacija, Var – koef. varijacije, Skew. – koeficijent asimetričnosti, Kurt. – koeficijent zakrivljenosti

U Tabeli 2. prikazani su centralni i disperzioni parametri distribucije motoričkih sposobnosti ispitanika, na finalnom merenju.

Tabela 2. Deskriptivni statistički parametri na finalnom merenju

	N	Min	Max	Mean	StDev	Var	Skew	Kurt
Poligon natraške_fin (s)	60	9,8	38,7	17,30	5,02	25,17	2,13	5,87
Taping rukom_fin (broj pon)	60	14,0	27,0	23,07	2,76	7,62	-,95	1,08
Pretklon_fin (cm)	60	23,0	61,0	41,85	8,53	72,74	,16	-,56
Skok udalj_fin (cm)	60	77,0	153,0	121,55	15,12	228,73	-,32	,11
Podizanje trupa_fin (broj pon)	60	7,0	39,0	26,28	7,36	54,17	-,25	-,16
Izdržaj zgib_fin (s)	60	0,0	37,7	13,11	8,57	73,44	,63	,19
Trčanje 20m_fin (s)	60	4,0	6,2	4,77	,39	,156	,89	1,75

Uvidom u deskriptivne podatke, kao i njihovog upoređivanja sa rezultatima istraživanja drugih autora u ovoj oblasti, može se reći da su vrednosti testova u nivou dobijenih u drugim istraživanjima na ovom uzrastu.

U Tabeli 3 su prikazane razlike između varijabli motoričkih sposobnosti na inicijalnom i finalnom merenju.

Tabela 3. Razlike između inicijalnog i finalnog merenja motoričkih sposobnosti dece (t-test za zavisne uzorke)

	mean	t	df	Sig. (p)
Poligon - Poligon_fin	5,78	7,75	59	,000
Taping - Taping_fin	-3,30	-13,66	59	,000
Pretklon - Pretklon_fin	-4,28	-5,13	59	,000
Skok - Skok_fin	-17,22	-9,78	59	,000
Podizanje trupa - Podizanje trupa_fin	-6,78	-9,14	59	,000
Zgib - Zgib_fin	-4,03	-3,39	59	,002
Trčanje 20m - Trčanje 20m_fin	,46	10,32	59	,000

Na osnovu podataka, koji se mogu videti u Tabeli 3, može se reći da postoji statistički značajna razlika na nivou $r < .05$ koja je utvrđena kod svih varijabli. Nakon sprovođenja programa od šest meseci, rezultati istraživanja su pokazali da je nivo motoričkih sposobnosti dečaka koji su bili uključeni u istraživanje značajno poboljšan. Pod uticajem primenjenog programa vežbanja u značajnoj meri su napredovale koordinacija, snaga mišića opružača nogu, snaga mišića pregibača trupa i gipkost.

Da bi se objasnili pozitivni efekti primenjenog programa potrebno je pogledati širi kontekst sportske škole. Programom škole je predviđeno da se stalno uče novi i deci nepoznati pokreti i vežbe, čime se razvija njihov centralni nervni sistem. Najviše se zadaju vežbe koje podstiču razvoj koordinacije, a sa razvojem koordinacije indirektno se razvijaju i svi drugi vidovi motoričkih sposobnosti. Time dolazi do poboljšanja u rešavanju složenijih motoričkih zadataka, deca racionalnije koriste svoje potencijale i stvaraju se uslovi za maksimalno ispoljavanje motoričkih sposobnosti.

Savremeni način života doveo je do smanjenja slobodnog vremena roditelja te deca provode veliki deo vremena u predškolskim ustanovama. Međutim, istraživanja pokazuju da predškolska deca koja nisu uključena u neki organizovani oblik fizičke aktivnosti, danas, imaju veće šanse da budu manje uspešna u motoričkim veštinama i u periodu detinjstva i adolescencije (Hardy i sar, 2010).

Rezultati ovog istraživanja ukazuju da je programirano vežbanje koje se sprovodi u školi sporta značajno i veoma efikasno. Pozitivni efekti dolaze kao rezultat koncepcije programa koja čini rad škole sporta *ToSport*. Sama koncepcija rada nije zasnovana samo na poboljšanju i razvoju motoričkih sposobnosti, već za cilj ima jedan opšti razvoj organizma deteta. Program je osmišljen tako da se deci redovno zadaju novi zadaci, tj. da nisu u ritmu konstantnog ponavljanja određenih zadataka. Glavni cilj sprovođenja programa vežbanja u školi sporta jeste pozitivan uticaj na razvoj motoričkih sposobnosti dece. Posmatrajući šire, sam program ima podjednako dobar uticaj i na razvoj pravilnog držanja tela, podsticanje discipline i samokontrole kod dece. Polaznici škole sporta su pod neprekidnim nadzorom profesora fizičkog vaspitanja, koji pored razvoja motoričkih sposobnosti, prate i njihov psihološki razvoj i zdravstveni status.

Činjenica da su deca sve manje aktivna povlači sa sobom i razmišljanje da bi se učestalost vežbanja trebalo prilagoditi današnjim okolnostima. Stupar (2016) istražujući uticaj programa sportske škole na tri generacije dolazi do rezultata da je kod treće (poslednje) generacije vežbanje dva puta nedeljno po sat vremena dalo efekte u samo 4 od 7 motoričkih vatrijabli, za razliku od prethodnih generacija, kod kojih je bilo poboljšanja u svim motoričkim varijablama. Verovatni razlog je neaktivnost dece u preostalom svom slobodnom vremenu. S tim u vezi autor zaključuje da bi vežbanje trebalo biti zastupljeno bar pet puta nedeljno.

Zaposlenost oba roditelja, manjak njihovog slobodnog vremena, nebezbedno okruženje za decu, smanjuje igru u svom najbližem okruženju, kao prirodnu potrebu dece. U ovom slučaju sportske škole jesu dobro rešenje.

Zaključak

Na razvoj motoričkih sposobnosti može se izuzetno povoljno uticati u predškolskom uzrastu dece. Međutim u tom periodu, frekvencija, intenzitet i sadržaji vežbanja u predškolskim ustanovama ne predstavljaju dovoljan nadražaj da bi se motoričke sposobnosti razvile više nego što se to dešava svakodnevnim biološkim i fiziološkim procesima.

Rezultati ovog istraživanja su pokazali da je opšti nivo motoričkih sposobnosti dečaka koji su bili uključeni u programirano vežbanje, u okviru jedne sportske škole, značajno veći nakon sprovođenja programa od šest meseci, nego što je bio na samom početku programa. Uočeno je da su pod uticajem primenjenog programa vežbanja u velikoj meri napredovale koordinacija, snaga mišića opružaća nogu, snaga mišića pregibača trupa i gipkost. Obim treninga na nedeljnom nivou (2 časa po 60 minuta) je doneo značajna poboljšanja u svim posmatranim motoričkim sposobnostima, međutim, može se zaključiti da bi veći broj časova (3 do 5) tokom jedne nedelje doveo do toga da rezultati budu još bolji.

Rezultati ovog istraživanja potvrđuju opravdanost programiranog vežbanja u predškolskom uzrastu, kao i postojanje sportskih „školica“. Neophodno je da deca do polaska u školu dobiju što bolju motoričku osnovu, jer dalji razvoj motorike u velikoj meri zavisi od njenog formiranja u predškolskom uzrastu. Prilikom

zaključivanja trebalo bi imati u vidu da u ovom uzrastu postoji i efekat sazrevanja i da se napredak u motoričkim sposobnostima ne može pripisati samo uticaju primenjenog programa.

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Methodical aspects of the effects of physical activity application in sport

Metodički aspekti primene
fizičke aktivnosti u sportu

INFLUENCE OF TECHNOLOGICAL SOLUTIONS ON THE METHODOLOGY OF WINDSURFING

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Introduction

Windsurf is a water activity that for years thrills and provokes water sports enthusiasts to face and overcome new challenges. It originates from water movement on boards without any additional equipment (Surf, surfing). Technological advancement allows more and more people to master the windsurfing skills. Surf has been a lifestyle for thousands of years among the Pacific Islands residents. In Polynesia, surf was the centerpiece of its culture. For Polynesia residents, surfing was a way to establish a place in society and political power, and surfing skills were highly respected (Warshaw, M. 2010). Traditionally, surf was a means to maintain powerful leaders in good physical fitness. In Tahiti and Samoa, surf was popular in past times as part of the training of warriors. The first meeting of Europeans with surfing was recorded in 1767. on the coasts of Tahiti. (Shilling, F.S. Surfing - The History and Origins of Surfing (www.centralhome.com)). Famous writers also contribute to surfing. Mark Twain tried to surf, and Jack London, who also tried to surf, wrote the essay "A Royal Sport" published in October 1907 the first recorded written trace of a man's attempt to describe the learning of the surf. Journalist Alexander Hume Ford in 1908 founded Surf Club, the first modern organization to promote surf. Hawaiian residents founded their surf club called Club of the Waves in 1911. But the first real surf icons that spread surfing culture around the world were Duk Kahanamoku and George Frit (Markus, B. www.surfingforlife.com). Duk Kahanamoku began to rediscover the ancient art of surfing, which was almost lost and represented it to the world, enjoying the status of a world surf representative. In December 1914 Duck introduced the surf in Sydney, Australia. The Australians immediately accepted surfing and Kahanamoku as the paternal figure of that sport in Australia until the present day.

Surf has developed internationally as early as in the early days of its expansion from Hawaii and was under the great influence of new technologies. At that time, there were still no standards that would limit the design and progress of surf boards. Surfers choose the style and material of the board depending on performance, personal feeling and price. Surf boards were made by global professional brands, local artists, and even amateurs in their yards or workshops. In 1935 Tom Blake added a finisher to the surf board - a stabilizer at the bottom of the feed. This plug-in made the board more manageable, more stable, and thus surf far easier to learn.

The great impact of the expansion of the surf, as in many sports, has had technological innovations. Boards began to be made of artificial materials cheaper, easier to process, with better quality and which enabled serial production. Finding and applying new materials such as artificial rubber (neoprene) in the production of waterwears has contributed to surfing in many places or in periods when the water was cold and the waves are good. Also, in places that were typical summer season, it could be extended in autumn and winter. Such sites are more numerous than those tropical like Hawaii, so the surf has become a global attraction with help of the technology of equipment production. The influence of neoprene clothing was so big that we can share world surf history on the period before neoprene and neoprene period. Analyzing the history of the classic surf and the technological solutions that make it more

accessible bring us closer to the main topic of this paper, windsurfing. Windsurfing is an upgrade to classic surf, with all the most important technological solutions of the surf directly applicable for windsurfing: plastic boards, serial production, fine, neoprene suits.

Windsurfing as a water activity originated in California in 1968 by joining a classical surfboard with sailing. Two friends, fans of Surf, Americans Jim Drake, who was an expert in sailing and outstanding engineer and scientist, and Hoyle Switzer, came up with the idea of combining sailing and surfing. Analyzing changes and applications of technological solutions that have influenced the sailing board's methodology and techniques, three clearly limited phases can be singled out. The finders who marked these phases have contributed to facilitating training, increasing windsurfers safety, and increasing accessibility, which has significantly improved windsurfing. New technological solutions have had the tendency to attract new enthusiasts into water sports by their use, and to increase the number of those who would return to windsurfing.

The first phase of the development of windsurfing on the board 1968-1999. years

The key invention for such unification was the universal joint. This patent allowed the sail to move forward, backward and sideways and rotating around the longitudinal axis by 360°. "The choice between moving feed or moving sail or center of pressure in the core was an unexplored zone." (Drake, 2003). In addition to the joint, an important part of the patent was the boom, a horizontal handle on both sides of the sail which was used for controlling the sail, and at the same time it strengthened it. The centreboard, which found its application on the windsurf boards, and is inspired by classic sailing, prevents the slipping of the boards aside, increasing the side-resistance proved to be extremely important for driving against the wind when the winds are weak. For beginners it is important as an additional booster stabilizer that reduces its rotation around the longitudinal axis and gives the learner additional stability.

The patent relating to the universal joint created by Jim Drake and Hoyle Schwitzer was accepted in 1970. With the help of the universal joint, windsurf board could be controlled using wind power and windsurfing was possible wherever there was water and wind. Waves were no necessary for surfing. Windsurfing became available on rivers, lakes, pools. Windsurfing schools were open in almost every hotel on the sea, which holds up to the renome. The training program very quickly, already in the 1970s, became obligatory at many Faculties for sport and physical education, as well as within the subject of Camping at the Faculty of Physical Education in Belgrade. The windsurfing equipment consisted of boards of about 3.5 meters in length, about 0.65 meters wide and about 200 l volume, a sail of about 5 to 7 m² connected with the universal joint. The universal joint is the most important innovation in the construction of the equipment.

In the mid - '70s, began world championships, while in the mid - '80s there was a golden period of windsurfing: "It was very unique to see how a sport arises and then becomes the fastest growing sport in the world" (Drake, 2003). After initial enthusiasm, there were problems with organizing this type of activity. It was difficult to wear and hold a hard windsurf board, especially if the apartment was on the higher floors. A special effort was to carry the stairs, and it was necessary to know the knitting skills to be firmly fixed on the roof of the car.

In any case, the transport of classic, hard boards was one of the main reasons for the decline in the popularity of this sport. Manufacturers and designers produced boards for rare fanatics and wondered where millions of fans of this sport had disappeared. The boards became shorter and more routine, and the media reported on the record of world records in speed and fantastic achievements in sailing on waves. Activity has taken on all forms of extreme sport. Learning of windsurfing on these boards was not

easy. The rarely of the many who attended the windsurfing schools really learned, and less of them bought equipment.

A review of the basics of technique and methodology of training in the period from 1968 to 1999

Training boards were too long (3.5 m or more), and narrow (about 0.65 m). Excessive length has been severely hampered by manageability. In order for such a long, and at the same time a narrow board to be turned, redirected, controlled, turned, a relatively large force was required, and it was realized by a relatively large sail and a great shift of the windsurfer and the sail relative to the center of the rotation of the board in order to achieve a congruent force. This great move of the driver and necessarily large and heavy sails was an extremely difficult and complex task because the board was too narrow and therefore unstable. The boards were narrow and long because the designers focused on performance such as speed in low winds and a greater angle in wind direction.

The methodology mainly focused on overcoming the problem of balance. These exercises were standing on the board center, walking to the stern and towards the bow, half turn, full turn, rocking the board and the like (Kukolj, 1985). The first sailing exercises were also based on training and maintenance of balance. Working on the technique of sailing rarely arrived. Analyzing this problem, it became apparent that beginner training boards should be shorter and more manageable, and considerably wider and more stable in order for the learner to deal with the driving technique, not by balancing.

By looking at the catalogs of all of the world's most famous manufacturers (Mistral, HiFly, F2, Fanatic, Tiga, Bic...), no model was found that would at least satisfy the needs of a good learning board. Based on everything analyzed, the conclusion was drawn that the whole idea of a learning board was going in the wrong direction. In the next 10 years, analyzing specialized journals in various languages: French (Planchemag), English (Windsurfing UK, Windsurf Magazine), Italian (Tavola e Vela) and German (Surfen, Surf), no serious analysis of the problem of beginner training has been noticed and the need for equipment to adapt to change. There were talk of competitions, spectacular new tricks, beautiful paradise destinations for windsurfing and the like. New and improved equipment models for competitors were promoted in these journals. During the entire first phase, which lasted from 1968 to 1999, school equipment remained as ineffective as at the beginning. It was hard to transport and disposal, complicated for training and inaccessible. There were few places where learning could be safely implemented.

The second phase of the development of windsurfing on the board 2000 – 2018

The second phase in the development of windsurfing starts with the emergence of a wide training board. The short and wide board, as a solution to almost all problems in the beginner's training, came in a completely unexpected and roundabout way. The solution was developed by the technology of improving equipment for the competitive discipline Course. This discipline implies that competitors drive one part of the race cruising against the wind, striving to reach the control point (bove) a mile away as soon as possible and with as few turns as possible directly at the wind. In order for this task to be done successfully, it is necessary for the windsurfer to use and control the aerodynamic lift force and the force of the side slip resistance. The side slip is controlled by a fine (vertical stabilizer) underneath the stern. In the beginning the fines were from bad materials and they broke. The use of carbon fines significantly increased their efficiency (their resistance to elastic deformation increased). They tolerate larger lateral forces and allowed a quick drive at a higher angle to the wind.

Seeing these competitors were getting bigger fine until there was a break of fine boxes. Since the bearings were not adjusted and was broken before the fine, this resulted in the improvement of the

bearing and the appearance of better boxes for setting up a fine, such as power box, tuttle box, trim box and similarly. With the help of this, competitors could put even bigger, longer and more powerful fine. Accordingly, they could have use larger sails without fear that they would slack off and slip laterally.

Within the analysis and presentation of possible technological possibilities that would facilitate training of windsurfing, three forces which are important for understanding the process of creating a "perfect" beginner training board will be presented. Wind power over the sail has a tendency to push the sail-windsurfer-board system down the wind. The other force works over the fine as a resistance to that tendency. Due to this fact, the two forces are in the same direction, and the opposite course is the consequence of torque. In order to balance this torque, a third force appears. That is the weight of the surfer standing during a race at the edge of the board. In other words, if the competitor want to reach the point with the wind as soon as possible, he used the larger sail followed with the larger fine, and not to overturn the board due to the torque, he also used the wider board.

The organizers of the competition limited the sail to a size of 12.5 m² while the maximum width of the board was 1.05 m. The sail was already too big, but the board came to the perfect width. It was fast and manageable; it easily reached the speed of surfing or gliding. Thus, by the forerunner, through the development of the competition, the design of a perfect board for beginners came about. They added a keel for added stability in the direction and ability of driving along the wind when the wind is weak.

The length of this board was about 2.9 m and a width of 0.85 m and more. Because they were relatively short, these boards could be controlled on a very weak wind with a very small sail. For the same reason, the amplitude of motion by the sail and the windsurfer was far less than with the old, long boards. With the board wide almost one meter, it can be said that the beginner could have been more relaxed to learn the driving technique from the beginning of the training. It is not necessary to spend time, effort and patience for balancing exercises. The feeling for the board and the improvement of balance is gained spontaneously through direct learning of the technique.



Figure 1. The look of a new board with marked standing zones depending on the speed of movement

Apart from the excellent ratio of length, width and volume, the board has on the top surface interesting and also useful graphics where the different colors presented where it should stand in different situations. The basic position of the windsurfer, as well as where the sail should be held in this position, is marked in gray. The blue color is marked and easily visible where it is necessary to stand and hold the sail at low speeds. At high speeds the position of the windsurfer and the sail should be in orange color. The top surface is coated with a thin layer of soft rubber that gives added comfort when moving and

climbing on the board. With this solution, it is possible to add a clearly marked central line that longitudinally splits the board into half, making the instructions easier for the beginner. The line would help in training beginners who very often take the wrong stance at the first ride and instead of holding the feet on the same half of the board, keep the foot on the opposite side or the same side with the sail.

Wide, and short boards proved to be far less demanding in terms of the expected force impulse that would achieve a torque in the horizontal plane compared to the boards used in the first phase. This force impulse can be achieved by the action of the core and the weight of the windsurfer. In other words, the dimensions of the sails used for windsurfing on the shorter and wider boards could have been far smaller as well as the weight of the windsurfer. Wide board is a stable platform that allows the child to learn continuously and without unnecessary physical overload and psychological frustration due to frequent falls from unstable boards and lifting of heavy sail from the first period. Wide boards have enabled the teacher to be on the same board with young learners and use one sail, optionally with two booms. These solutions made it possible for even an eight-year-old child to successfully maneuver with the board with the help of tilting a sail of only 2 m².

The concept of a wide board, though very successful in the beginner's training, failed to increase the number of fans. The main reasons should be stated as unavailability, that is, the problem with transport and disposal. This problem is identical and not overcome as in the first phase. Boards are shorter, but they are much wider.

The third phase of the development of windsurfing on the year 2018

The third phase begins at the time of the idea to write this paper. Elements for its launch have been in existence for several years, but they have not been integrated or presented sufficiently. By constructing sailing boards, sails that can be packed in a bag not bigger 1m, and the use of folding paddles as a mandatory part of the windsurfing equipment is finally available.

These third-phase elements for the first time in the history of windsurfing make this sport really easy to access. After several decades in Belgrade, and throughout Serbia, it is possible to buy such equipment in sports equipment stores. These boards are mainly used for standing paddling (Stand Up Paddle - SUP). The few models have a factory-integrated sail adapter, however, all others can be easily and cheaply adapted for windsurfing. Inflatable boards, together with folding sail and paddle, become a common part of windsurfing equipment. They can easily be packed in a backpack (Figure 2).



Figure 2. The windsurfing equipment can be easily packed into the bag

This fact indicates that it is clearly and more easily facilitated to go to a learning environment. It's not a necessary to travel by car, as was the case with hard boards. It is possible to go by bicycle, motorcycle, bus, train, plane and even by foot. The current equipment for the windsurfing school is five times smaller. Due to the use of paddles in the training methodology, there is an increase in the number of potential training sites that can be considered safe. For example, rivers that have been extremely unfavorable and unsafe places to learn because of their flow, by using paddles, become safer and more acceptable places for training. In the new method of windsurf training, one of the key details is the use of paddles. The possibility of using the paddle contributes to the use of hundreds of new, good places in Serbia where it will be possible to organize a safe windsurfing school.

The old methodology was adapted for professional camps that followed the standards with shallow, flat, calm water, and constant and frequent winds. There are few such sites and they are mostly located in distant destinations, which makes it more difficult to access and increase the price. The old methodology did not provide safe training on the rivers. It was necessary to wait for the southern wind to help the beginner to stay in a safe zone as the wind blows upstream. Such a wind is very rare. It is much more frequent in the northwestern part of Belgrade, which blows in the same direction from the course of the river and further complicates the learning process.

In the old methodology, the beginner returned with a hard swim lying down or sitting on a board. At sea conditions returning was possible bay walking at shallow and dragging the board, which is almost impossible on the Danube and Sava. Windsurf training on the river is far more complex and demanding than learning on a shallow plain lake. Direction of the river is from north-west to south-east, so the south-east wind is much more favorable and safer for windsurfing, because it blows upstream and compensates for downfall (downhill) downstream of the river, and the wind maintains the windsurfers in a zone suitable for surfing. The stream of the river in this case helps the windsurfer not to fall down the wind. The northwest wind, which blows from the direction of the Danube River, is almost not used at all for practicing because the wind and the stream of the river relate the beginners from the favorable zone.

The use of the paddle ensures safety of exercise in progress as it allows returning to a safe zone for optimal exercise by paddling in a standing or kayak position. The paddle is from several parts and within a few seconds it is disassembled and placed on the bow of the board, where is secured by the net.

In the event that the wind enhances paddling, it is possible to search for a safe retreat paddling by wind. A paddle with kayak and a SUP option should be an obligatory part of windsurfing equipment, especially on rivers, and it is good to have it on lakes. Kayak options allow for faster rowing and more efficient movements in moderate and stronger winds. Also, kayaking options for rowing are learned more quickly. There is no need to change the shift ("upper hand"), which is the case with the SUP option in the case of a beginner. The center of body mass is much lower and the problem of maintaining balance is no longer present. The appropriate paddle must have the possibility of quick and easy folding and loading on the bow under the elastic net. Due to the possible slipping of the paddle from the boards, it is necessary to be unsinkable, bright colors for easier finding.

This is a training board that has sufficient volume and width to provide stable paddling. The proposed equation of the volume of the board could be: three times body mass, and more, and the width: three feet and more. The length of training boards depends largely on its width and volume. Training boards would be 3 m or more long, for greater longitudinal stability during surfing at low speeds and due to the stability of paddling, as well as due to rowing with sail laid on a stern which is used in a weak wind when returning to a safe zone.

The mast is made of four segments instead of the previous two, booms from two or more segments instead of the one that has been previously, and the sail with the option to fold and wrap at half the length of the previous one, so that they are foldable and compact when depositing on the bow under the elastic net. It can be mounted on the coast and placed on the board or, possibly, to be mounted on the stern, and using the paddle to get to a good location with the sail folded on the bow, then mounted on the water itself, using the board as a mounting platform. The paddle is folded and placed on the bow of the board. During the training of the beginner or in the first stages of training, the learners will “slip” down the river and down the wind, losing the so-called “height” and leaving the optimum training zone, and sailing will be alternately replaced by rowing. Also, it can happen that the wind “stops”, so rowing is a solution in that case too.

This concept will enable hundreds of kilometers of our rivers to be accessible and safe for windsurfing fans but also for those who will just become aware of the advantages of the principle of the board, the sail and the paddle.

Due to the utilization of favorable parts of the river and lake coasts, as well as the plant world that can be extremely dense in the shallow parts, parts of the equipment need to be adjusted so that the safety of both the windsurfer and the parts of the board is at a high level. Shallow, under angle cut fine would solve the problem of grass that growing in shallow and fresh waters in the spring and makes it difficult windsurf training due to accumulation around the usual vertical fine. This allows entry and exit from the water at almost inaccessible places, which is ensured by the compactness and foldability of the sail and paddles.

Because of the above facts, it is necessary to advocate for a new methodology in windsurf training, with the key addition to the mandatory use of paddles. Short and interesting paddle training at the sitting, kneeling and standing position as well as climbing on the board precede the training of the windsurf technique. Stand up paddling contribute to learning safety, especially on rivers, but also it is applicable on other water surfaces.

Conclusion

Windsurfing is a synthesis of classic sailing and surfing. In its development it has always been related to technological solutions. During its existence, three phases are outlined, where the third one is just beginning with the application of the latest technological solutions. The method of making boards directly influenced the development of windsurfing as a sport discipline, but also its popularity as widespread water activities.

The paper presents technological solutions that influenced all aspects of windsurfing. As the most important one can distinguish the structure of the universal joint that funded all other changes and essentially defined the possibilities of further development. The improvement of synthetic materials influenced further changes in construction and led to the development of stabilizer and wider board design, which enabled quicker and easier technique learning lowering the age limit for the start of successful learning.

Revolutionary change takes place in this period with the advent of inflatable boards and an innovative method for the application of paddles in learning, training and its constant application in the new period of windsurfing. Innovative transport and safety solutions are presented as well as rowing movement when the sail is located on the stern of the board. These changes can significantly influence the development of windsurfing as a sport and extremely ecological and healthy activities in the territory of Serbia and in the environment, which can be considered a great potential, in every aspect.

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UTICAJ TEHNOLOŠKIH REŠENJA NA METODIKU JEDRENJA NA DASCIMA

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Uvod

Jedrenje na dasci (eng. Windsurf) je aktivnost na vodi koja godinama oduševljava i provocira zaljubljenike u vodene sportove da se suoče i savladaju nove izazove. Svoje poreklo vodi iz kretanja na vodi na daskama bez ikakve dodatne opreme (Surf, surfing). Napredovanje u tehnološkom smislu omogućava sve većem broju ljudi da ovladaju veštinom jedrenja na dasci. Surf je hiljadama godina bio način života među ostrvljanima Pacifika. Na Polineziji surf je predstavljao centralno mesto tamošnje kulture. Za stanovnike Polinezije, surfovanje je bio način da se utvrdi mesto u društvu i politička moć, a surferske veštine su bile veoma poštovane (Warshaw, M. 2010). Tradicionalno, surf je bio sredstvo za održavanje moćnih lidera u dobroj fizičkoj kondiciji. Na Tahitiju i Samoi surf je bio popularan u prošlim vremenima kao deo treninga ratnika. Prvi susret Evropljana sa surfom zabeležen je 1767. na obalama Tahitija. (Šiling, F.S. Surfing – The History and Origins of Surfing (www.centralhome.com)). Svoj doprinos surfu daju i poznati pisci. Mark Tven koji je probao da surfuje, a Džek London koji se takođe oprobao u surfu za sobom je ostavio esej „A Royal Sport” izdat u oktobru 1907. koji je prvi zabeleženi pisani trag o pokušaju čoveka da opiše učenje surfa. Ekscentrični novinar Aleksandar Hjum Ford je 1908. osnovao Surf klub, prvu modernu organizaciju koja je promovisala surf. Lokalni Havajci osnivaju svoj surf klub nazvan „Club of the waves” 1911. Ali prve prave surf ikone koje su raširile surf kulturu širom sveta su bili Duk Kahanamoku i Džordž Frit (Markus, B. www.surfingforlife.com). Duk Kahanamoku je počeo ponovo otkrivati drevnu umetnost surfovanja, koja je gotovo bila izgubljena i predstavljao ga svetu, uživajući status svetskog surf predstavnika. U decembru 1914. Duk je predstavio surf u Australiji, Sidneju. Australijanci su odmah prihvatili surfing i Kahanamokua kao očinsku figuru tog sporta u Australiji sve do današnjih dana.

Surf se kao sport internacionalno razvijao još u ranim danima njegovog širenja sa Havaja i bio je pod velikim uticajem novih tehnologija. Tada još nisu postojali standardi koji bi ograničili dizajn i progres surf daske. Surferi biraju stil i materijal daske u zavisnosti od performansi, ličnog osećaja i cene. Surf daske su pravili globalni profesionalni brendovi, lokalni umetnici ali čak i amateri u svojim dvorištima ili radionicama. Tom Blejk je 1935. na surf dasku dodao smernik (finu) - stabilizator na donji deo krme. Ovaj dodatak je učinio dasku upravljivijom, stabilnijom, a time surf daleko lakšim za učenje.

Ogroman uticaj širenju surfa kao i u mnogim sportovima je imao tehnološki napredak. Daske su počele da se prave od veštačkih materijala koji su bili jeftiniji, lakši za obradu, kvalitetniji i omogućavali serijsku proizvodnju. Pronalazak i primena novih materijala kao što je veštačka guma (neopren) u proizvodnji odela za vodu doprinela je tome da surf bude moguć na mnogim mestima ili u periodima kada je voda bila hladna, a talasi dobri. Takođe i na mestima koja su bila tipično letnja sezona je mogla da se produži na jesen i zimu. Takvih mesta ima mnogo više nego onih tropskih poput Havaja pa je surf zahvaljujući tehnologiji proizvodnje opreme postao globalna atrakcija. Uticaj neoprenske odeće je bio toliki da svetsku surf istoriju možemo podeliti na eru pre neoprena i neoprensku eru. Osvrt na istoriju klasičnog surfa i tehnološka rešenja koja su ga učinila dostupnijim približavaju nas glavnoj temi ovog rada, a to je jedrenje na dasci ili windsurf. Jedrenje na dasci je nadgradnja na klasičan surf, pri čemu sva

najvažnija tehnološka rešenja surfa su direktno primenjiva na jedrenje na dasci: plastične daske, serijska proizvodnja, fina, neoprenska odela.

Jedrenje na dasci (eng. Windsurf) kao aktivnost na vodi nastalo je 1968. Godine u Kaliforniji spajanjem klasičnog surfa sa klasičnim jedrenjem. Dvojica prijatelja, zaljubljenika u surf, Amerikanci Džim Drejk koji je bio poznavalac jedrenja i izuzetan inženjer i naučnik i Hojl Švajcer došli su na ideju da spoje jedrenje i surf. Analizirajući promene i primene tehnoloških rešenja koja su uticala na metodiku i tehniku upravljanja daskom za jedrenje, mogu se izdvojiti tri faze koje su jasno ograničene. Pronalasci koji su obeležili ove faze uticali su na olakšanje obuke, veću sigurnost vozača i na povećanje dostupnosti čime je značajno unapređeno jedrenje na dasci. Nova tehnološka rešenja imala su tendenciju da svojom primenom da privuku nove zaljubljenike u sportove na vodi, i da povećaju broj onih koji bi se vratili jedrenju na dasci.

Prva faza razvoja jedrenja na dasci 1968-1999. Godine

Ključni izum za takvo sjedinjenje je bio univerzalni zglob. Taj patent omogućio je da se jedro pomera napred, nazad i u stranu i rotira oko uzdužne ose za 360°. „izbor između pokretne krme ili pokretnog jedra ili centra pritiska u jedru bila je neistražena zona.“ (Drake, 2003). Osim zgloba važan deo patenta predstavljao je bum, horizontalna drška sa obe strane jedra pomoću koje se upravljalo jedrom, a ujedno ga je i učvršćivala. Kobilica, koja je našla svoju primenu na *windsurf* dasci, a inspirisana je klasičnim jedrenjem, sprečava otklizavanje daske u stranu povećavajući bočni otpor pokazala se kao izrazito važna za vožnju protiv vetra pri slabom vetru. Za početnike je bitna kao dodatni stabilizator daske koji smanjuje njeno obrtanje oko uzdužne ose te učeniku daje dodatnu stabilnost.

Patent koji se odnosio na univerzalni zglob koji su napravili Džim Drejk i Hojl Švajcer prihvaćen je 1970. godine. Zahvaljujući univerzalnom zglobu daskom za jedrenje moglo se upravljati uz pomoć vetra i surfovati gde god ima vode i vetra, talasi više nisu bili neophodni. Jedrenje na dasci tako je postalo dostupno na rekama, jezerima, bazenima. Škole jedrenja na dasci otvarane su u skoro svakom hotelu na moru koji iole drži do renomea. Program obuke vrlo brzo, već 1970-tih, postaje obavezan na mnogim fakultetima za sport i fizičko vaspitanje pa tako i u sklopu predmeta Logorovanje na Fakultetu fizičkog vaspitanja u Beogradu. U opremu za jedrenje na dasci osim same daske koja je dužine oko 3,5 m, širine oko 0,65 m i zapremine oko 200l, spadalo je i jedro veličine od oko 5 do 7m² spojeni ključnim delom za postojanje ovog sporta pod nazivom univerzalni zglob. Univerzalni zglob je najbitnija inovacija u konstrukciji opreme.

Sredinom 70-tih počinje održavanje svetskih takmičenja, dok je sredina 80-tih je bila zlatna era jedrenja na dasci: „Bilo je vrlo unikatno videti kako sport nastaje, a zatim postaje najbrže rastući sport na svetu“ (Drake, 2003). Nakon početnog oduševljenja pojavili su se problemi oko organizacije aktivnosti ovog tipa. Bilo je teško nositi i čuvati tvrdu dasku za jedrenje tokom godine, naročito ako se stan nalazio na višim spratovima. Poseban napor predstavljalo je nošenje stepenicama, a neophodno je bilo poznavati veštinu vezivanja čvorova kako bi bila dobro učvršćena na krovu auta.

U svakom slučaju transport klasične, tvrde daske bio je jedan od glavnih razloga za pad popularnosti ovog sporta. Proizvođači i dizajneri proizvodili su daske za retke fanatike i čudili se gde su nestali milioni obožavalaca ovog sporta. Daske su postale sve kraće i sve uže, a mediji su izveštavali o obaranjima svetskog rekorda u brzini i fantastičnim dostignućima u jedrenju na talasima. Aktivnost je poprimila sve forme ekstremnog. Učenje jedrenja na ovim daskama nije bilo lako. Od mnogih koji su pohađali škole jedrenja na dasci retki su i zaista naučili, a još ređe su kupovali opremu.

Osvrt na osnove tehnike i metodiku obuke na daskama iz perioda 1968 - 1999. Godine

Daske za obuku bile su predugačke (3,5 m i više), a preuske (oko 0,65 m). Prevelika dužina je jako ometala upravljivost. Da bi se tako dugačka, a istovremeno uska daska skrenula, preusmerila, upravljala, zaokrenula bila je potrebna relativno velika sila, a ostvarivala se relativno velikim jedrom i velikim pomeranjem vozača i jedra u odnosu na centar obrtanja daske da bi se ostvario spreg sila. Ovo veliko pomeranje vozača i obavezno velikog i teškog jedra je bio izuzetno težak i složen zadatak jer je daska bila preuska i stoga nestabilna. Daske su bile uske i dugačke jer su se konstruktori fokusirali na performanse kao što su brzina pri slabom vetru i postizanje većeg ugla u vožnji protiv vetra.

Metodika se uglavnom svodila na prevazilaženje problema sa ravnotežom. To su bile vežbe stajanje na centru, hodanje ka krmi i ka pramcu, polu okret, pun okret, ljuljanje daske i slično (Kukolj, 1985). Prve vežbe sa jedrom su se takođe bazirale na uvežbavanju i održavanje ravnoteže. Do rada na tehnici jedrenja se retko stizalo. Analizirajući ovu problematiku došlo se do stanovišta da daske za obuku početnika treba da budu kraće pa time i upravljivije, a znatno šire pa time i stabilnije da bi se učenik bavio tehnikom vožnje, a ne balansiranjem.

Detaljnim prelistavanjem i analiziranjem kataloga svih poznatijih proizvođača na svetu (Mistral, HiFly, F2, Fanatic, Tiga, Bic...) nije pronađen ni jedan model koji bi bar približno zadovoljavao potrebe dobre daske za učenje. Na osnovu svega analiziranog nametao se zaključak da cela ideja o dasci pogodnoj za učenje ide u pogrešnom smeru. U narednih 10 godina, analizirajući specijalizovane časopise na različitim jezicima: francuskom (Planchemag), engleskom (Windsurfing UK, Windsurf Magazin), italijanskom (Tavola e Vela) i nemačkom (Surfen, Surf), ni u jednom nije uočena ozbiljna analiza problema obuke početnika i potrebe da se oprema prilagodi promeni. Pričalo se i pisalo o takmičenjima, spektakularnim novim trikovima, prelepim rajskim destinacijama za odlazak na jedrenje na dasci i slično. Novi i poboljšani modeli opreme za takmičare promovisani su u tim časopisima. U toku cele prve faze koja je trajala od 1968 - 1999. godine školska oprema je ostala isto tako neefikasna kao na početku. Teška za transport i odlaganje, komplikovana za obuku, nedostupna. Bilo je malo mesta na kojima bi učenje moglo bezbedno da se sprovede.

Druga faza razvoja jedrenja na dasci 2000 - 2018. Godine

Druga faza u razvoju jedrenja na dasci započinje pojavom široke daske za obuku. Do kratke i široke daske, kao rešenja skoro svih problema u obuci početnika, došlo se potpuno neočekivano i zaobilaznim putem. Rešenje je donela tehnologija unapređenja opreme za takmičarsku disciplinu Kurs (eng. Course racing). Ova disciplina podrazumeva da takmičari voze jedan deo trke krstareći protiv vetra, odnosno da se trude da što pre i sa što manje okreta stignu do kontrolne tačke (bove) koja se nalazi oko milju direktno uz vetar. Da bi se ovaj zadatak uspešno obavio potrebno je da vozač dobro koristi i kontroliše silu aerodinamičkog uzgona i silu otpora bočnom otklizavanju. Silu bočnog otklizavanja kontroliše pomoću fine (vertikalnog stabilizatora) koja se nalazi ispod krme. U početku su fine bile od slabih materijala pa su pucale. Upotrebom karbonskih fina značajno se povećala njihova efikasnost (povećana je njihova otpornost na elastično deformisanje). Izdržavale su veće bočne sile i omogućavale brzu vožnju pod većim uglom na vetar.

Uvidevši ovo takmičari su stavljali sve veće fine, dok nije došlo do pucanja ležišta za fine ili kutije za finu. Pošto ležišta fina nisu bila prilagođena i pucala su pre nego fine ovo je izazvalo usavršavanje ležišta i pojavu kvalitetnijih kutija za postavljanje fina, kao što su pauer boks (power-box), tjtutl boks (tuttle-box), trim boks (trim-box) i slično. Zahvaljujući ovome takmičari su mogli da stavljaju još veće, duže i moćnije fine. Shodno tome mogli su da koriste i veća jedra bez straha da će fina popustiti i proklizati bočno.

U okviru analize i prikaza eventualnih tehnoloških mogućnosti koje bi olakšale obuku i samo jedrenje na dasci biće predstavljene tri sile koje su važne za razumevanje procesa nastanka „savršene“ daske za obuku početnika. Sila vetra preko jedra ima tendenciju da gurne sistem jedro-vozač-daska niz vetar. Druga sila deluje preko fine kao otpor toj tendenciji. Usled ovog dejstva dveju sila na istom pravcu, a suprotnog su smera, posledično dolazi do pojave obrtnog momenta. Da bi se ovaj obrtni moment uravnotežio pojavljuje se i treća sila, a to je težina surfera koji stoji u toku trke na ivici daske. Drugim rečima, da bi takmičar što pre stigao do tačke uz vetar koristio je sve veće jedro koje je pratila i sve veća fina, a da se daska zbog obrtnog momenta ne bi prevrnula koristio je i sve širu dasku.

Organizatori takmičenja su ograničili povećavanje jedara na veličinu 12,5 m² dok je maksimalna širina daske bila 1,05 m. Jedro je već bilo preveliko, ali daska je došla na savršenu širinu. Bila je brza i upravljiva, lako je dosegala brzinu surfovanja odnosno glisiranja. Tako je zaobilaznim putem, preko razvoja takmičarske, znači potpuno suprotne daske, došlo do dizajna savršene daske za početnike. Dodali su joj kobilicu za dodatnu stabilnost po pravcu i sposobnost vožnje uz vetar kada je vetar slab.

Dužina ove daske je bila oko 2,9 m, a širina od 0,85 m i više. Zbog toga što su bile relativno kratke, ove daske je bilo moguće na vrlo slabom vetru kontrolisati sa vrlo malim jedrom. Iz istog razloga amplitude pokreta jedrom i telom bile su daleko manje nego kod starih, dugačkih dasaka. Kada se svemu tome doda da je daska široka skoro jedan metar može se reći da je početnik mogao opuštenije da se bavi tehnikom vožnje od samog početka obuke. Nije potrebno posebno izdvajanje vremena, truda i strpljenja za vežbe ravnoteže. Osećaj za dasku i unapređenje ravnoteže stiče se spontano kroz direktnije učenje tehnike.



Slika 1. Izgled nove daske sa obeleženim zonama stajanja u zavisnosti od brzine kretanja

Osim odličnog odnosa dužine, širine i zapremine, daska ima na gornjoj površini i zanimljivu, a ujedno i korisnu grafiku gde je različitim bojama predstavljeno gde treba da se stoji u različitim situacijama. Osnovni položaj vozača, kao i gde pri tom položaju treba držati jedro obeleženo je sivom bojom. Plavom bojom je označeno i lako vidljivo gde stajati i držati jedro pri malim brzinama kretanja, a pri velikim, glisirajućim brzinama položaj vozača i jedra trebalo bi da je na narandžastoj boji. Gornja površina je obložena tankim slojem meke gume koja daje dodatnu udobnost pri kretanju i pri penjanju na dasku. Ovakvom rešenju moguće je dodati jasno obeleženu centralnu liniju koja dasku uzdužno deli na pola čime bi instrukcije početniku bile olakšane. Linija bi pomogla u obuci početnika koji vrlo često zauzimaju pogrešan stav pri prvim vožnjama i umesto da stopala drže na istoj polovini daske, dalje stopalo drže na suprotnoj strani ili tamo gde je i jedro.

Široka, a kratka daska pokazala se kao daleko manji zahtevna po pitanju očekivanog impulsa sile kojim bi se ostvario obrtni moment u horizontalnoj ravni u poređenju sa daskama koje su korišćene u prvoj fazi. Ovaj impuls sile moguće je ostvariti delovanjem jedra i težine samog vozača. Drugačije rečeno površina jedra koje se koristi prilikom jedrenja na dasci koja je kraća i šira mogla je biti daleko manja, a i masa vozača koji bi upravljao daskom takođe. Široka daska je stabilna platforma koja detetu omogućava da uči kontinuirano i bez nepotrebnog fizičkog preopterećivanja i psihičkih frustracija nastalim čestim padovima sa nestabilne daske i podizanja teškog jedra iz prve faze. Široke daske su omogućile i da učitelj bude na istoj dasci sa mladim učenicima i koriste jedno jedro, opciono sa dva buma. Ova rešenja omogućila su da čak i osmogodišnje dete uspešno manevriše daskom uz pomoć naginjanja jedra od samo 2 m².

Koncept široke daske, iako veoma uspešan u obuci početnika nije uspeo da poveća broj pristalica. Kao glavne razloge treba navesti nedostupnost, odnosno problem sa transportom i odlaganjem. Ovaj problem je identičan i nije prevaziđen kao ni u prvoj fazi. Daske jesu kraće, ali su i znatno šire.

Treća faza razvoja jedrenja na dasci 2018. Godina

Treća faza započinje u vreme nastanka ideje za pisanje ovog rada. Elementi za njeno započinjanje postoje već nekoliko godina ali nisu integrisani niti dovoljno predstavljeni. Konstruisanjem dasaka za jedrenje koje se naduvavaju, jedara koja mogu da se spakuju u torbu ne duže od 1m i upotrebe takođe sklopivog vesla kao obaveznog dela opreme za jedrenje na dasci konačno postaje dostupno.

Ovi elementi treće faze prvi put u istoriji jedrenja na dasci čine ovaj sport zaista lako dostupnim. Posle više decenija u Beogradu, a i širom Srbije moguće je kupiti ovakvu opremu u radnjama sportske opreme. Ove daske uglavnom služe za stojeće veslanje (eng. Stand Up Paddle - SUP). Manji deo ima fabrički integrisan adapter za jedro, međutim i sve ostale se mogu vrlo lako i jeftino adaptirati za jedrenje na dasci. Daske na naduvavanje, zajedno sa sklopivim jedrom i veslom, postaju uobičajen deo opreme za jedrenje na dasci. Lako se mogu spakovati u ranac (slika 2).



Slika 2. Oprema za jedrenje na dasci koju je moguće lako spakovati u torbu

Ova činjenica ukazuje da je izrazito i višestruko olakšano otići na mesto pogodno za učenje. Nije neophodan automobil kao što je bio slučaj kod tvrdih dasaka. Moguće je otići biciklom, motorom, autobusom, vozom, avionom pa čak i peške. Aktuelna oprema za školu jedrenja na dasci zauzima pet puta manju zapreminu. Usled korišćenja vesla u metodici obuke povećava se broj potencijalnih mesta za obuku

koja se mogu smatrati bezbednim. Na primer, reke koje su bile izrazito nepovoljna i nebezbedna mesta za učenje zbog svog toka, korišćenjem vesla postaju bezbednija, uobičajena i prihvatljiva mesta za obuku. U novoj metodici obuke jedrenja na dasci jedan od ključnih detalja je korišćenje vesla. Mogućnost upotrebe vesla doprinosi tome da se u Srbiji iskoriste stotine novih, dobrih mesta na kojima će biti moguće raditi bezbednu školu jedrenja na dasci.

Stara metodika bila je prilagođena za profesionalne kampove koji su pratili standarde koji su predviđali da bude plitka, ravna, mirna voda, konstantan i čest vetar. Takvih mesta je malo i uglavnom se nalaze na dalekim destinacijama, što višestruko otežava dostupnost i povećava cenu. Stara metodika nije omogućavala bezbednu obuku na rekama. Potrebno je bilo sačekati južni vetar koji pomaže da početnik ostane u bezbednoj zoni jer vetar duva uzvodno. Takav vetar je leti vrlo redak. Mnogo je češći severozapadni koji u zoni Beograda duva u istom smeru sa tokom reke i dodatno otežava proces učenja.

U staroj metodici početnik se vraćao napornim plivanjem ležeći ili sedeći na dasci ili u morskim uslovima hodajući plićakom i vukući dasku, što je gotovo nemoguće na Dunavu i Savi. Obuka jedrenja na reci je daleko složenija i zahtevnija nego što je učenje na nekom plitkom ravničarskom jezeru. Smer toka reka od severozapada ka jugo-istoku pa je jugoistočni vetar daleko povoljniji i bezbedniji za jedrenje, jer duva uzvodno i kompenzuje opadanje (otklizavanje) niz tok reke, odnosno vetar održava jedriličara u zoni pogodnoj za vožnju. Tok reke u tom slučaju pomaže jedriličaru da ne opadne niz vetar. Severozapadni vetar, koji duva iz smera odakle teče Dunav, skoro uopšte se ne koristi za vežbanje jer i vetar i tok reke odnose početnika iz povoljne zone.

Upotreba vesla obezbeđuje sigurnost vežbanja na toku jer omogućava ponovni povratak u bezbednu zonu za optimalno vežbanje putem veslanja u stojećem ili kajak stavu. Veslo je iz više delova i za nekoliko sekundi se rastavlja i odlaže na pramac daske, na kome je mrežom osigurano.

U slučaju da vetar pojača veslanje omogućava da se potraži bezbedno pribežište veslajući niz vetar. Veslo koje ima kajak i SUP opciju treba da bude obavezan deo opreme za jedrenje na dasci, naročito na rekama, a dobro je imati ga i na jezerima. Kajak opcija omogućava brže veslanje i efikasnije kretanja po umerenom i jačem vetru. Takođe kajak opcija veslanja se brže uči. Ne mora hvat da se menja („gornja ruka“), što je kod SUP opcije redovan slučaj kod početnika. Težište je daleko niže i prestaje problem sa održavanjem ravnoteže. Odgovarajuće veslo mora da ima mogućnost brzog i lakog sklapanja i odlaganja na pramac ispod elastične mreže. Zbog mogućeg iskliznuća vesla sa daske neophodno je da bude nepotopivo, svetlih boja radi lakšeg nalaženja.

Podrazumeva se da se radi o dasci za obuku ili za krstarenje koja ima dovoljnu zapreminu i širinu da omogući stabilno veslanje. Predložena formula zapremine daske mogla bi da bude: masa tela puta tri, i više, a širine: tri stope i više. Dužina daske dobre za obuku u mnogome zavisi od njene širine i zapremine. Za obuku bi bile preporučene daske duge 3 m i više, radi veće uzdužne stabilnosti prilikom jedrenja malom brzinom i zbog stabilnosti prilikom veslanja, takođe i zbog veslanja sa položenim jedrom na krmi koji se koristi pri slabom vetru prilikom povratka u bezbednu zonu.

Jarbol je iz četiri segmenta umesto dosadašnjih dva, bum iz dva ili više segmenata umesto dosadašnjeg jednog, a platno sa opcijom da se preklopi i umota na upola manju dužinu od dosadašnje, kako bi bili sklopivi i kompaktni prilikom odlaganja na pramcu ispod elastične mreže. Može da se montira na obali i postaviti na dasku, ili eventualno, da se postavi na krmi i da se korišćenjem vesla odvesla do dobrog mesta pri čemu je jedro sklopljeno na pramcu, potom da se montira na samoj vodi, koristeći dasku kao platformu za montiranje. Veslo se sklapa i odlaže na pramčani deo daske. U toku vežbanja početnika ili u prvim fazama obuke učenici će „otklizavati“ niz reku i niz vetar, gubeći takozvanu visinu i izlazeći iz optimalne zone vežbanja, pa će, naizmenično, jedrenje zamenjivati veslanjem. Takođe, može se desiti i da vetar „stane“, pa je veslanje rešenje i u tom slučaju.

Ovaj koncept će omogućiti da stotine kilometara naših reka budu dostupne i bezbedne za ljubitelje jedrenja na dasci ali i za one koji će to tek postati kada spoznaju prednost principa daska, jedro i veslo.

Zbog iskorišćenosti povoljnih delova obala reka i jezera, kao i biljnog sveta koji može da bude izuzetno gust u plićim delovima potrebno je i delove opreme prilagoditi kako bi bezbednost i vozača i delova daske bila na visokom nivou. Plitka, kosa fina bi rešila problem trave koja u plitkim i slatkim vodama u proleće buja i onemogućava obuku jedrenja na dasci zbog nagomilavanja oko uobičajene vertikalne fine. Ovim je omogućen ulazak i izlazak iz vode na do sada prilično nepristupačnim mestima što je omogućeno kompaktnošću i sklopivošću jedra i vesla.

Zbog navedenih činjenica potrebno je zalaganje za novu metodiku u obuci jedrenja na dasci, pri čemu je ključna dopuna obavezno korišćenje vesla. Kratka i zanimljiva obuka veslanja na dasci u položaju sedenja, klečanja i stajanja kao i penjanja na dasku prethode obuci tehnike samog jedrenja. Umeće veslanja na dasci doprinosi bezbednosti učenja, naročito na rekama, ali ima svoju primenu i na drugim vodenim površinama.

Zaključak

Jedrenje na dasci predstavlja sintezu klasičnog jedrenja i surfa. U svom razvoju je uvek bilo vezano za tehnološka rešenja. U toku svog postojanja izdvojene su tri faze, gde treća upravo počinje usled primene najnovijih tehnoloških rešenja. Način izrade dasaka je direktno uticao na razvoj jedrenja na dasci kao sportske discipline ali i na njenu popularnost kao široko rasprostranjene aktivnosti na vodi.

U radu su navedena tehnološka rešenja koja su uticala na sve aspekte jedrenja na dasci. Kao najbitnije može se izdvojiti konstrukcija univerzalnog zgloba koji je fundirao sve ostale promene i suštinski definisao mogućnosti daljeg razvoja. Usavršavanje sintetičkih materijala je uticalo na dalje promene u konstrukciji i dovelo do razvoja stabilizatora i konstrukcije šire daske što je omogućilo brže i lakše učenje tehnike i spuštanje starosne granice za početak uspešnog učenja.

Revolucionarna promena se dešava u ovom periodu sa pojavom dasaka na naduvavanje i inovativnom metodikom primene vesla u učenju, usavršavanju i njegovoj stalnoj primeni u novoj eri jedrenja na dasci. Prikazana su inovativna rešenja vezana za transport i bezbednost kao i kretanje veslanjem kada se jedro nalazi položeno na krmi daske. Ove promene mogu bitno uticati na razvoj jedrenja na dasci kao sporta i izuzetne ekološke i zdrave aktivnosti na teritoriji Srbije i u okruženju, što se može smatrati velikim potencijalom, u svakom pogledu.

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THE RELATIONSHIP BETWEEN VERTICAL JUMP PERFORMANCE AND NUMBER OF REBOUNDS DURING NBA GAMES

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Introduction

Vertical jumps are one of the dominant ways of moving in many sports (e.g. basketball, volleyball, gymnastic), as part of the competition or training session (Matavulj, Kukolj, Ugarkovic, Tihanyi, & Jaric, 2001; Ziv & Lidor, 2010). In basketball, vertical jump (VJ) is a part of the defensive (e.g. defensive rebound, jump for the ball in the beginning of the game, blocking shots) and offensive skills (e.g. offensive rebound, shooting, passing the ball from the jump). During the game, basketball player average execute 1050 ± 51 different moves, such as standing, walking, running, jumping, while there are around 46 ± 12 vertical jumps (McInnes, Carlson, Jones, & McKenna, 1995). Ben Abdelkrim et al. (2007) found similar results, 997 ± 183 different moves, and 44 ± 7 vertical jumps.

Functional evaluation of muscle strength capacities based on movements related to the given sport is mainly used in present testing sessions. This kind of evaluation is important for analyzing the level of physical fitness and prediction of sport success. Given that many sports, including basketball, contain jumps or similar activities that depend on the explosive strength of leg muscles, VJ represent an adequate tool for the functional assessment of leg muscle strength in basketball (Cordova & Armstrong, 1996). The fact we don't know is can we predict success in on-court performance, specifically number of offensive and defensive rebounds based on the performance of the VJ.

In order to improve evaluation of prospective young players NBA (National Basketball Association) has developed a system for their monitoring so-called NBA Draft Combine. It consists of tests for measuring anthropometrics, motor skills, and shooting skills. It also includes scrimmages, which is playing games between teams during summer. All of them seem to address the skills important for basketball players. However, it is not known whether the NBA draft Combine measures can predict future performance of basketball players. Draft combine should help NBA teams to pick a player who can best fit into their system. This kind of specific basketball testing is important for analyzing the level of physical fitness and prediction of success in the NBA league. However, there is a few evidence about predictive validity of NBA Draft Combine. Teramoto et al. (2018) showed that most of the NBA draft combine individual measures alone don't have a huge impact on future performance. This kind of research has been also conducted on the NFL Scouting Combine and its ability to predict future success of football players (Kuzmits & Adams, 2008; Teramoto, Cross & Willick, 2016). Some studies found significant relations of NFL Draft Combine measures with future performance (Teramoto, Cross & Willick, 2016), while some other studies questioned the usefulness of this kind of testing for prediction of future NFL performance (Kuzmits & Adams, 2008).

In basketball, testing of the vertical jump is generally used for evaluation of leg power. However, it is still unclear whether this kind of test can predict the successfulness of defensive and/or offensive rebounds on-court. We hypothesized that players with higher vertical jump achieve bigger number of rebounds in game. Therefore the aim of the study was to assess the relationship between vertical jump performance and number of rebounds during NBA games in rookie basketball players.

Method

This study used a descriptive design (Thomas, Silverman, & Nelson, 2015). Statistical data were obtained from open-access official NBA records in period from 2012–2016 regular seasons. All data used from the NBA pre-draft Combine were collected using official NBA league web site (<http://stats.nba.com/draftcombine/>).

The subjects of the study were rookie NBA players in four consecutive seasons, in the period from 2012/13 until 2015/16. In order to increase the reliability of basketball data (Kubatko, Oliver, Pelton, & Rosenbaum, 2007) the inclusion criteria for participation in the study were: (1) number of games played in the first season (more than 20 games), and (2) average time on court in the first season (minimum 20 minutes played per game).

From total number of 240 rookie players drafted in these four seasons, after stratification the sample included 65 players who matched the inclusion criterions. The sample of physical ability variables included data from the following standardized Pre-draft combine test: measured by the vertical jump from spot (VJ from spot) and from running (VJ from running) and rebound performance on NBA games (total number of rebounds, offensive rebounds, defensive rebounds).

Test vertical jump from spot was performed according to standardized procedure for counter-movement jump with hands. The subjects were instructed to jump as high as they can with self-selected counter movement depth (Cordova & Armstrong, 1996). Vertical jump from running was performed with self-selected technique. Players were allowed to execute two or three steps prior to the maximal vertical jump.

Statistical analysis

Statistical analysis included basic descriptive statistics and Pearson coefficient of correlation. All data were analyzed using SPSS (20.0).

Results

Basic descriptive statistics of the sample is presented in table 1.

Table 1. Descriptive statistics of physical abilities and basketball performance

Variable	Mean ± SD	Min - Max
Age	21.12 ± 1.27	19.00 - 24.00
Body height	197.43 ± .29	178.00 - 215.00
Body mass	97.34 ± 11.63	75.00 - 126.00
BMI	24.91 ± 1.80	21.75 - 29.61
VJ from spot	77.68 ± 7.31	62.23 - 96.52
VJ from running	92.51 ± 7.86	73.66 - 111.76
Off Reb	1.12 ± 0.95	0.10 - 5.40
Def Reb	3.04 ± 1.43	1.00 - 8.10
Total Reb	4.15 ± 2.28	1.10 - 13.20

Table 2. Correlation between pre-draft combine VJ performance and rebounding performance in games

Test / performance	Off Reb	Def Reb	Total Reb
VJ from spot	r -.157	.039	-.034
	Sig. (2-tailed) .239	.770	.802
VJ from running	r -.306*	-.059	-.152
	Sig. (2-tailed) .020	.660	.256

Legend: Off Reb – the number of offensive rebounds; Def Reb - the number of defensive rebounds; Total Reb – the total number of rebounds, Total Reb = Off Reb + Def Reb

Vertical jump from running showed significant correlation ($r = -.306$) with offensive rebound performance. No other data showed significant correlations with rebounding performance.

Discussion

The main finding of this study is that maximal vertical jump from running is the only parameter significantly correlated with offensive rebound performance during game.

The results of present study showed small association with on-court rebounding performance. One of a very few previous studies on this topic, showed similar small correlation between individual Combine measures and future on-court performance (Teramoto et al. 2018). During game, defensive and offensive rebounds are executed in contact conditions where many players try to reach the ball. Vertical jump should allow the player to reach the highest vertical point for assessing the ball. However, it is obvious that besides reaching maximal height, the efficiency of the jump is connected with optimal jump timing as well as speed of jump. Many coaches also connect the player feeling for prediction of ball direction and positioning on the court as important parameter for rebounding efficiency. Namely, most of the missing shots from corner will bound on opposite side. Shots from central position will bounce near the basket in the paint. Shots from 45° angle to the basket, will bounce to the opposite side in the same angle. Some players execute jump in offense and defense starting from the perimeter positions, which allows the player to predict ball bouncing. Also, these kinds of jumps are mostly performed without contact. This might explain the reason why only jump from running is connected with rebounding performance.

Among all, NBA pre-draft testing includes vertical jump testing as one of the basic benchmarks for player evaluation. Previous reports about importance of the VJ in basketball mainly address height of the VJ both male and female basketball players, and their differences according to playing positions or skill levels. Also, numerous studies have been concerned with the impact of different training programs on jumping ability in basketball players (Ziv & Lidor, 2010). However, when we look on the on-court performance, defensive rebound is one of main winning components in high level club basketball (Puente, 2017; Gomez et. al., 2008; Ibanez et al., 2009; Garcia et al., 2014; Oliver, 2004) and national team basketball (Csataljaj et al., 2009; Čaušević, 2015).

NBA Draft Combine testing is an opportunity for NBA teams to evaluate basic level of player performance by conducting standardized tests. However, while is regularly used in previous years, it is obvious that accurate assessment latent performance level is questionably associated with future on-court performance. While it seems that tests in the standardized NBA Draft Combine appear to address most of the elements important for basketball performance, it is not known if the Draft Combine player evaluation can predict future performance of players (Teramoto et al. 2018).

Conclusion

In conclusion the results of the present study, shows that rebounding performance in basketball game have very small relationship with level of basic jumping abilities, measured on NBA Draft Combine. This questions the future usefulness of two jumping tests for the same ability in the NBA Draft Combine procedure. These tests probably can be used as evaluation tool for players jump ability and possible individual differences between players and they should be analyzed with caution in regards to future on-court performance.

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BEGINNING OF BALL POSSESSION TOWARD FIELD ZONES IN THE GAME OF FOOTBALL WORLD CHAMPIONS 2014

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Introduction

Ball possession in football attracts the attention of researchers for the last fifty years. Analyzing a football game is a process that analyzes, among other characteristics, how, where and why the team came in or lost possession of the ball (Franks & Hughes, 2016, p. 13). During the evolutionary development of the football game, spatial and temporal parameters, depending on the trends that were in the given circumstances, were modified and reduced (Aleksic and Jankovic, 2006 p. 285). The essence of a football game and the ultimate goal is to score more than the opposing team and win. It is known that in football as well as in some other team sports with a ball, achievement of goals (points) is realized in the phase of attack. For this reason, the investigation of the characteristics of the phase of attack by top teams / representation, and especially the medal winner at great world competitions, is needed and can also benefit from the theory and practice of the analyzed sport.

By introducing modern computerized software to monitor the activities of the players during the game: ProZone, AMISCO Pro, SICS System, etc. the ball possession began to be much more commonly explored at major tournament and league competitions (Lago-Peñas, Dellal, 2010; Carling, 2010; Carling, Dupont, 2011; Dellal, Chamari, Wong, Ahmaidi, Keller, Barros, Bisciotti, Carling, 2011; Bradley, Lago-Peñas, Rey, Gomez 2013). However, the results of the ball's positions during the game, expressed numerically or in seconds, can be found in works published forty and over (Gagajev, 1973, p. 66). Another way of finding information about ball possession and contact with the ball within these properties is a notational analysis. It is available to all who are interested and have minimal technical conditions (tv and dvd player).

When a decision on action on the field is made, the first thing that the player has to consider is who is in ball possession: "Is the team for whom I play in possession of the ball or not"? (Franks & Hughes, 2016 p. 43). The ball possession is also one of the characteristics of the game style of one team (Hewitt, Greenham, Norton, 2016).

The problem of this research is the beginning of ball possession in relation to four terrain zones (A, B, C and D). The aim of the research is to examine whether there are differences in the analyzed football team in the representation of the beginning of ball possession in the field zones. It is expected that there will be differences between the four field zones (A, B, C and D) in relation to the representation of the beginning of ball possession in them. In the time of industrial science when the production of scientific articles has a frequency of five articles per minute or one scientific article every 12 seconds (Slijepcevic, 2018), and only one small part with the topic of football, and even a minor part concerning the events during the attack phase, in this work to the football researchers will be presented the results that have occurred with the new approach concerning the well-known problem of ball possession (four-zone field).

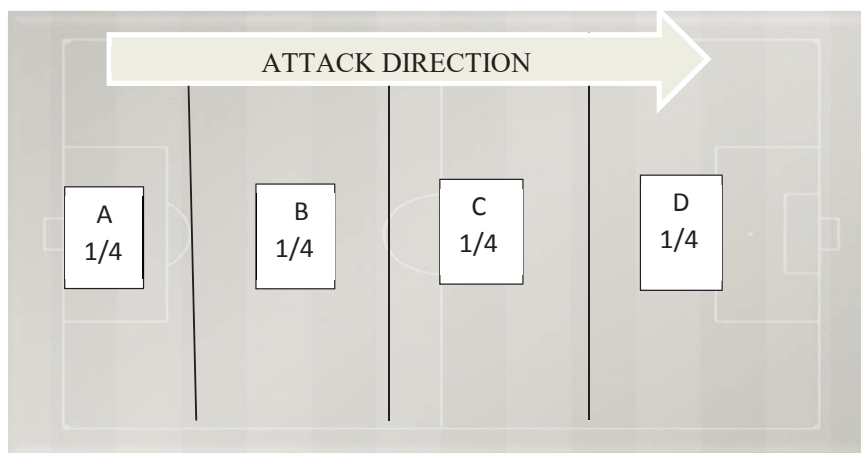
Method

The sample of respondents is represented by a total of seven matches of the German National football team on the 2014 World Football Championship. The sample of variables consists of independent

variables representing the field zones: A, B, C, and D. The dependent variable represents the ball possession. A sample of measuring instruments represents an observation sheet in which all ball possessions are recorded in the appropriate field zone.

Statistical data processing was done using the statistical program SPSS 20. The descriptive characteristics of the analyzed variables were calculated. For defining the differences between the field zones was used the t-test. The results of the intermediate ranking for all observed matches in the field zones are also shown.

Operational definition of variables: Zone A is a zone of defense and occupies $\frac{1}{4}$ of the surface area, zone B is the zone of organization of attacks on its half part of field and occupies $\frac{1}{4}$ of the surface area, zone C is the zone of organization of attacks on the opponent's half part of field and occupies $\frac{1}{4}$ of the surface area and Zone D the zone of the ending of the attack and also occupies $\frac{1}{4}$ of the total area surface.



Graph 1. Football field divided in four zones

The ball possession is counted and lasts from the moment when the player of a team gets the ball from a teammate or takes the ball from the opponent's, or the player of the opponent team mistakenly give him the ball until the moment of throwing the ball by adding it or shooting to the opponents goal. In this research it is expressed numerically.

Results

With this research were obtained the results of the representation of beginning of ball possession by field zones on the observed matches of the National team of Germany. The obtained results are expressed in absolute values and percentage. It is known that within an attack action, the possession of the ball and the return to her possession may occur several times. So the number of attacking actions and the number of arrivals in the possession of the ball are most often different in favor of the possession of the ball.

Table 1 shows the results of descriptive statistics for the beginning of possession of the ball towards the field zones.

Table 1. Descriptive characteristics of the beginning of ball possession through the field zones

Zone	N	Min	Max	Sum	Mean	Std. dev.	Cv%
PA	7	31	78	364	52.00	16.30	265.67
PB	7	31	58	286	40.86	10.64	113.14
PC	7	19	47	228	32.57	8.83	77.95
PD	7	10	23	103	14.71	4.15	17.24
N	7						

Discussion

The aim of this research is to investigate the existence of differences between the four field zones in the beginning of ball possession in them. The study showed statistically significant differences between individual field zones in the beginning of the ball possession in them using the t-test of paired samples. A statistically significant difference was found between zone A and D $t = 5.92$ and $p = 0.001$ between zone B and D $t = 7.94$ and $p = 0.000$ and between zone C and D $t = 4.40$ $p = 0.005$. There are no statistically significant differences between other zones. It is noted that the maximum number of starts of ball possession in one match is achieved in zone A and is 78, and minimum in zone D 10. It is also noticed that in all seven games most of the beginning of ball possession is recorded in zone A 364 and this is expressed in percentage 37.10% of the total possession of the German National team in this competition, and the lowest in zone D 103, which is 10.49%. In zone B, 286 of the ball possession was recorded, which is 29.15% of the total achieved positions in the ball possession, and in zone C 228, which is 23.24%.

When we collect the beginnings of ball possession on the so-called "own" half field part which covers zones A and B, this amounts to 650 or 66.25% of the total recorded ball possessions. In the so-called "opponent" half part of field were recorded 331 beginnings of ball possession, i.e. 33.75%. On 1440 matches of the Chinese Super League in the seasons 2012-2017 it was found that the ball possession on the opponent's half part of field has great variability under the influence of the location of the match, whether it is played at home or away (Gong, Gomez, Zhou & Cui, 2018).

In all seven games, the first ranked team at the 2014 World Football Championship achieved 981 beginning ball possessions on the level of whole team. On a sample of 21 matches played by medal winners at the 2010 World Cup, using the Kruskal Wallis test, differences in possession of the ball were determined $\chi^2 = 10.716$ $p = 0.005$. By testing the differences between the teams with Mann Whitney test, it was found that there is a statistically significant difference in the possession of the ball between the representations of Spain and the Netherlands $z = -2.875$ $p = 0.004$, contact with the ball $z = -3.130$ $p = 0.002$ and contact indexes $z = -2.056$ $p = 0.040$. Between the representations of Spain and Germany statistically significant differences were found in the ball possession $z = -2.492$ $p = 0.013$ and contact with the ball $z = -2.108$ $p = 0.035$, and no statistically significant differences were found by the contact index $z = -1.215$ $p = 0.224$. Between the representations of the Netherlands and Germany no statistically significant differences were found in any of the variables $p > 0.05$. These results point to different approaches in solving the same technical-tactical tasks during the game, although according to the achieved placement in the table of close positions. On the same sample, it was found that the analyzed teams scored on average per match, counting each player 546.48 ball possessions. The minimum established value of ball possessions per match is 325, and the maximum is 698 (Đošić, 2014).

The difference in this research conducted on a sample of seven matches of the winner on the World Championship 2014 compared to the Medal winners at the 2010 World Championship, was that in this study the ball possession was analyzed according to the representation in four field areas and the ball possession was recorded as a group activity, not as an activity of each individual player. That is precisely why by same number of played matches, at first glance, there are great differences in ball possessions of the same National team in two consecutive World Championships. The German team on the 2010 Championship performed 3.735 ball possessions and on the next 981. Exactly that difference in the researching approach of well-known football problem could give his contribution and importance to football theory.

The relationship between the ball possession, ball contacts and contact indexes has been determined. The relationship between the ball possession and ball contact is $r = 0.899$ $p = 0.000$ and between the ball possession and contact index $r = 0.107$ $p = 0.644$ (Đošić, 2017).

Expectations are partially confirmed, but in future research it is necessary to increase the sample, and also explore the same characteristic in the next Championships, National and Continental league competitions and in younger categories of players.

Conclusion

The study showed statistically significant differences between individual field zones in the beginning of the possession of the ball in them using the t-test of paired samples. A statistically significant difference was found between zone A and D $t = 5.92$ and $p = 0.001$ between zone B and D $t = 7.94$ and $p = 0.000$ and between zone C and D $t = 4.40$ $p = 0.005$. There are no statistically significant differences between other zones. It is noted that the maximum number of beginning of ball possession per one match is achieved in zone A and is 78, and minimum in zone D 10. It is also noticed that in all seven games most of the beginning of ball possession is recorded in zone A 364 and expressed in percentage 37.10% of the total ball possession of the German National team in this competition, and the lowest in zone D 103, which is 14.71%. In zone B, were recorded 286 ball possessions i.e. 29.15% of the total achieved positions in the ball possession, and in zone C 228 i.e. 23.24%. In all seven games, the first ranked team at the 2014 World Football Championship achieved 981 beginning ball possessions on the level of whole team.

The obtained results are important for a better understanding of the events during the football match, in one of the two basic stages of the football game i.e. in the attack stage. There is also a new approach (four-zone fields) to investigating a known problem possession of a ball.

As after the attack phase follows the defense phase, so every attack start (possession of the ball) has its ending. Precisely this deficiency of information and results of the completion of attack phase (possession of the ball), and even some other characteristics of the possession of the ball could be interpreted as a lack of this work. Also, the number of watched games is also a research lack.

However, the results presented in this paper are part of the results of a more extensive research which deals with the searching for answers to the questions referred to the previous paragraph as defects, and also on some other issues related to the phase of attack (possession of the ball) in football, which are not shown in the work because it would significantly exceed the allowed volume of pages.

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POČETAK POSEDA LOPTE PREMA ZONAMA TERENA U IGRI SVETSKIH FUDBALSKIH ŠAMPIONA 2014. GODINE

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Uvod

Posed lopte u fudbalu privlači pažnju istraživača poslednjih pedesetak godina. Analiziranje fudbalske utakmice je proces u kome se između ostalih karakteristika analizira i kako, gde i zašto je tim došao ili izgubio posed lopte (Franks & Hughes, 2016, str. 13). U toku evolutivnog razvoja fudbalske igre, prostorno – vremenski parametri su se, u zavisnosti od trendova koji su bili u datim okolnostima aktuelni, modifikovali i menjali (Aleksić i Janković, 2006, str. 285). Suština fudbalske utakmice i krajni cilj je postići gol više od protivničkog tima i ostvariti pobjedu. Poznato je da se u fudbalu kao i u još nekim ekipnim sportovima sa loptom postizanje golova (poena) ostvaruje u fazi napada. Iz tog razloga istraživanje karakteristika faze napada vrhunskih timova/reprezentacija, a naročito osvajača medalja na velikim svetskim takmičenjima je potrebno i od njega mogu imati koristi i teorija i praksa analiziranog sporta.

Posed lopte je uvođenjem savremenih kompjuterizovanih softvera za praćenje aktivnosti fudbalera u toku utakmice: ProZone, AMISCO Pro, SICS System i dr. počeo znatno češće da se istražuje na velikim turnirskim i liga takmičenjima (Lago-Peñas, Dellal, 2010; Carling, 2010; Carling, Dupont, 2011; Dellal, Chamari, Wong, Ahmaidi, Keller, Barros, Bisciotti, Carling, 2011; Bradley, Lago-Peñas, Rey, Gomez 2013). Međutim rezultati o posedima lopte u toku utakmice izraženi brojačano ili/i u sekundama se mogu naći i u radovima objavljenim i pre četrdesetak i više godina (Gagajev, 1973, str. 66). Drugi način dolaženja do informacija o posedima lopte i kontaktima sa loptom u okviru tih poseda je notativna analiza. Dostupna je svima koji su zainteresovani i imaju minimalne tehničke uslove (tv i dvd plejer).

Prilikom donošenja odluka o delovanju na terenu prva stvar koju igrač mora uzeti u obzir je u čijem posedu je lopta: "Da li je tim za koji igram u posedu lopte ili nije?" (Franks & Hughes, 2016, str. 43). Posed lopte je i jedna od karakteristika stila igre (Hewitt, Greenham, Norton, 2016).

Problem kojim se bavi ovo istraživanje je početak poseda lopte u odnosu na četiri zone terena (A, B, C i D). Cilj istraživanja je ispitati da li postoje razlike kod analizirane reprezentacije u zastupljenosti početaka poseda lopte po zonama terena. Očekuje se da će se dobiti razlike između četiri zone terena (A, B, C i D) u odnosu na zastupljenost početaka poseda lopte u njima. U vreme industrijske nauke kada proizvodnja naučnih radova ima frekvenciju od pet radova po minuti odnosno jedan naučni rad na svakih 12 sekundi (Slijepčević, 2018) od kojih jedan manji deo za temu ima fudbal, a još manji dešavanja u toku faze napada u ovom radu će biti prikazani rezultati do kojih se došlo novim pristupom (četiri zone terena) istraživačima fudbala – po zatom problemu, posedu lopte.

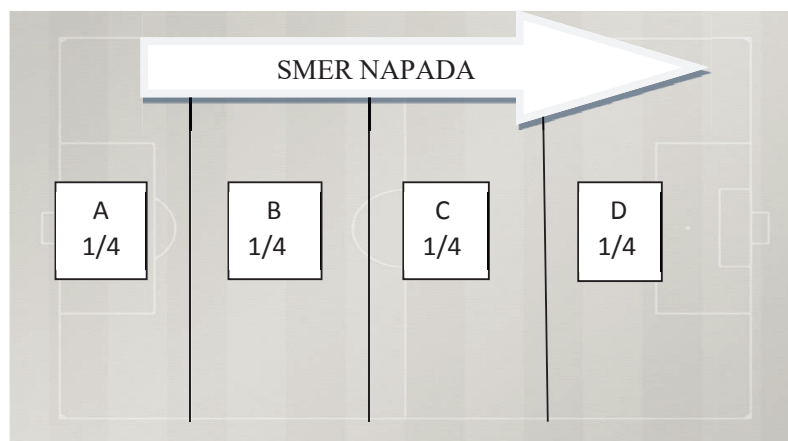
Metod

Uzorak ispitanika predstavljaju utakmice reprezentacije Nemačke koje je odigrala na Svetskom fudbalskom prvenstvu 2014. godine, ukupno sedam. Uzorak varijabli sastoji od nezavisnih varijabli koje predstavljaju zone terena: A, B, C i D. Zavisnu varijablu predstavlja posed lopte. Uzorak mernih

instrumenata predstavlja posmatrački list u koji je evidentaran svaki početak poseda lopte u odgovarajućoj zoni terena.

Statistička obrada podataka je urađena uz pomoć statističkog programa SPSS 20. Izračunate su deskriptivne karakteristike analiziranih varijabli. Za utvrđivanje razlika između zona terena primenjen je t-test. Prikazani su i rezultati srednjeg ranga za sve posmatrane utakmice po zonama terena.

Operativne definicije varijabli: Zona terena A je zona odbrane i zauzima $\frac{1}{4}$ površine terena, zona B je zona organizacije napada na svojoj polovini terena i zauzima $\frac{1}{4}$ terena, zona C je zona organizacije napada na protivničkoj polovini terena i zauzima $\frac{1}{4}$ površine terena i zona D je zona završnice napada i takođe zauzima $\frac{1}{4}$ ukupne površine terena.



Grafikon 1. Fudbalski teren podeljen na četiri zone terena

Posed lopte se računa i traje od trenutka kada igrač jedne ekipe (u ovom istraživanju to je reprezentacija Nemačke) dobije loptu od saigrača ili je oduzme protivničkom igraču ili mu je igrač protivničke ekipe greškom dodaju do momenta oslobađanja od lopte dodavanjem lopte ili upućivanjem šuta prema голу protivnika. Izražava se u ovom istraživanju brojčano.

Rezultati

Ovim istraživanjem su dobijeni rezultati o zastupljenosti početaka poseda lopte po zonama terena na posmatranim utakmicama reprezentacije Nemačke. Dobijeni rezultati su izraženi u apsolutnim vrednostima i procentualno. Poznato je da u okviru jedne napadačke akcije može doći do gubljenja poseda lopte i ponovnog dolaska u njen posed i po nekoliko puta. Tako da se broj napadačkih akcija i broj početaka poseda lopte najčešće razlikuju u korist poseda lopte. U tabeli jedan su prikazani rezultati deskriptivne statistike za početke poseda lopte prema zonama terena.

Tabela 1. Deskriptivne karakteristike početaka poseda lopte po zonama terena

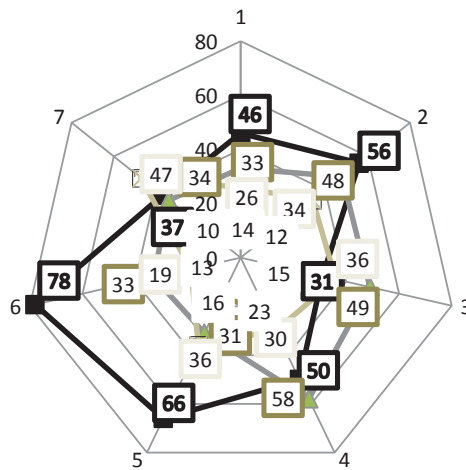
Zona	N	Min	Max	Sum	Mean	Std. dev.	Cv%
A	7	31	78	364	52,00	16,30	265,67
B	7	31	58	286	40,86	10,64	113,14
C	7	19	47	228	32,57	8,83	77,95
D	7	10	23	103	14,71	4,15	17,24
N	7						

U tabeli broj 2 su prikazane vrednosti srednjeg ranga koji pokazuje kako se kretala zastupljenost početaka poseda lopte po zonama terena na svakoj pojedinačnoj utakmici.

Tabela 2. Srednji rang početaka poseda lopte prema zonama terena

Utakmica	Zona	Srednji rang	Zona	Srednji rang	Zona	Srednji rang	Zona	Srednji rang
Nemačka - Portugal		3,00		2,50		2,00		4,00
Nemačka - Gana		5,00		5,00		4,00		2,00
Nemačka - Usa		1,00		6,00		5,50		5,00
Nemačka - Alžir	A	4,00	B	7,00	C	3,00	D	7,00
Nemačka - Francuska		6,00		1,00		5,50		6,00
Nemačka - Brazil		7,00		2,50		1,00		3,00
Nemačka - Argentina		2,00		4,00		7,00		1,00

Na grafikonu broj 1 su prikazani brojčani rezultati za zastupljenost početaka poseda lopte po zonama terena za svih sedam utakmica reprezentacije Nemačke.



Grafikon 2. Zastupljenost početaka poseda lopte na utakmicama prema zonama terena. Brojevi na spoljnom delu heptagrama predstavljaju redni broj utakmice. Crnom bojom uokvireni su rezultati za zonu A, tamnom nijansom braon boje za zonu B, svetlom nijansom braon boje pretstavljani su rezultati za zonu C, a brojevi najbliže centru koji nisu ni uokvireni predstavljaju početke poseda lopte koji su se desili u zoni D.

U tabeli 3 su prikazani rezultati t-testa za razlike između zona terena u zastupljenosti početaka poseda lopte u njima. Primećuje se da su statistički značajne razlike utvrđene između zona A i D $t = 5,92$ $p = 0,001$, između zona B i D $t = 7,94$ $p = 0,00$ i između zona C i D $t = 4,40$ $p = 0,005$. Takođe primećuje da statistički značajne razlike u zastupljenosti početaka poseda lopte nisu utvrđene između zona A i B, A i C i B i C zato što je $p > 0,05$.

Tabela 3. Rezultati t-testa za razlike u zastupljenosti početaka poseda lopte između zona terena

Zone	Mean	Std. dev.	Lower	Upper	t	df	p
A - B	11,14	22,40	-9,58	31,86	1,32	6	,236
A - C	19,43	22,91	-1,76	40,61	2,24	6	,066
A - D	37,27	16,67	21,87	52,70	5,92	6	,001
B - C	8,29	13,59	-4,28	20,85	1,61	6	,158
B - D	26,14	8,71	18,09	34,20	7,94	6	,000
C - D	17,86	10,73	7,93	27,78	4,40	6	,005

Legend: 95 % Confidence interval the difference

Diskusija

Cilj ovog istraživanja je da se ispita postojanje razlika između četiri zone terena u počecima poseda lopte u njima. Studijom su primenom t-testa uparenih uzoraka utvrđene statistički značajne razlike između pojedinih zona terena u počecima poseda lopte u njima. Statistički značajna razlika je utvrđena između zona A i D $t = 5,92$ a $p = 0,001$ između zona B i D $t = 7,94$ a $p = 0,000$ i između zona C i D $t = 4,40$ $p = 0,005$. Između ostalih zona nisu utvrđene statistički značajne razlike. Primećuje se da je maksimalan broj početaka poseda lopte na jednoj utakmici ostvaren u zoni A i iznosi 78, a minimalan u zoni D 10. Takođe primećuje se da je ukupno na svih sedam utakmica najviše početaka poseda lopte evidentirano u zoni A 364 a to izraženo u procentima iznosi 37,10 % od ukupno ostvarenih poseda lopte reprezentacije Nemačke na ovom takmičenju, a najmane u zoni D 103 što iznosi 10,49 %. U zoni B je evidentirano 286 početaka poseda lopte što je 29,15 % od ukupno ostvarenih početaka poseda lopte, a u zoni C 228 što je 23,24 %.

Kada saberemo početke poseda lopte na tzv „svojoj“ polovini terena koje obuhvataju zone A i B to iznosi 650 ili 66,25 % od ukupno evidentiranih početaka poseda lopte. A na tzv. „protivničkoj“ polovini terena evidentirano je 331 početak poseda lopte a procentualno izraženo to iznosi 33,75 %. Na 1440 utakmica kineske Super lige u sezonama 2012-2017 utvrđeno je da posed lopte na protivničkoj polovini terena ima veliku varijabilnost pod uticajem lokacije meča, da li se igra kući ili u gostima (Gong, Gomez, Zhou & Cui, 2018).

Na svih sedam utakmica prvoplasirana reprezentacija na Svetskom fudbalskom prvenstvu 2014. godine je ostvarila 981 početak poseda lopte na nivou cele ekipe.

Na uzorku od 21 utakmice koje su odigrali osvajači medalja na Svetskom fudbalskom prvenstvu 2010 primenom Kruskal Wallis testa utvrđene su razlike u posedima lopte $\chi^2 = 10,716$ $p = 0,005$. Testiranjem razlika između parova reprezentacija Mann Whitney testom utvrđeno je da između reprezentacija Španije i Holandije postoji statistički značajna razlika u posedima lopte $z = 2,875$ $p = 0,004$, kontaktima sa loptom $z = 3,130$ $p = 0,002$ i kontakt indeksima $z = 2,056$ $p = 0,040$. Između reprezentacija Španije i Nemačke utvrđene su statistički značajne razlike u posedima lopte $z = 2,492$ $p = 0,013$ i kontaktima sa loptom $z = 2,108$ $p = 0,035$, a kod kontakt indeksa nisu utvrđene statistički značajne razlike $z = 1,215$ $p = 0,224$. Između reprezentacija Holandije i Nemačke nisu utvrđene statistički značajne razlike u nijednoj varijabli $p > 0,05$. Ovi rezultati ukazuju na različite pristupe tri prvoplasirane reprezentacije u rešavanju istih tehničko-taktičkih zadataka u toku utakmice iako su po ostvarenom plasmanu na tabeli bliskih pozicija. Na istom uzorku je utvrđeno da su analizirane reprezentacije prosečno ostvarile po utakmici, računajući svakog igrača 546,48 poseda lopte. Minimalna utvrđena vrednost poseda lopte po utakmici je 325, a maksimalna 698 (Đošić, 2014).

Razlika kod ovog istraživanja sprovedenog na uzorku od sedam utakmica pobednika Svetskog fudbalskog prvenstva 2014. godine u odnosu na osvajače medalja na Svetskom fudbalskom prvenstvu 2010. godine je što su u ovom istraživanju analizirani posedi lopte prema zastupljenosti u četiri zone terena i što se posed lopte evidentirao kao timska aktivnost, a ne kao aktivnost svakog pojedinog igrača. Upravo to je razlog zašto su na istom broju odigranih utakmica na prvi pogled velike razlike u ostvarenim posedima lopte iste reprezentacije na dva uzastopna Svetska prvenstva. Reprezentacija Nemačke je na svetskom prvenstvu 2010. godine ostvarila 3.735 poseda lopte, a na sledećem 981. Upravo ta razlika u pristupu istraživanju već dobro pozatog fudbalskog problema bi mogla biti i njegov doprinos i značaj za teoriju fudbala.

Utvrđena je i povezanost poseda lopte sa kontaktima sa loptom i sa kontakt indeksima. Povezanost između poseda lopte i kontakata sa loptom i iznosi $r = 0,899$ $p = 0,000$ i između poseda lopte i kontakt indeksa $r = 0,107$ $p = 0,644$ (Đošić, 2017).

Očekivanja su delimično potvrđena ali je potrebno u budućim istraživanjima povećati uzorak, a takođe istraživati istu karakteristiku i na sledećim prvenstvima, nacionalnim i kontinentalnim liga takmičenjima, a takođe i kod mladih kategorija fudbalera.

Zaključak

Studijom su primenom t-testa uparenih uzoraka utvrđene statistički značajne razlike između pojedinih zona terena u počecima poseda lopte u njima. Statistički značajna razlika je utvrđena između zona A i D $t = 5,92$ a $p = 0,001$ između zona B i D $t = 7,94$ a $p = 0,000$ i između zona C i D $t = 4,40$ $p = 0,005$. Između ostalih zona nisu utvrđene statistički značajne razlike. Primećuje se da je maksimalan broj početaka poseda lopte na jednoj utakmici ostvaren u zoni A i iznosi 78, a minimalan u zoni D 10. Takođe primećuje se da je ukupno na svih sedam utakmica najviše početaka poseda lopte evidentirano u zoni A 364 a to izraženo u procentima iznosi 37,10 % od ukupno ostvarenih poseda lopte reprezentacije Nemačke na ovom takmičenju, a najmanje u zoni D 103 što iznosi 10,49 %. U zoni B je evidentirano 286 početaka poseda lopte što je 29,15 % od ukupno ostvarenih početaka poseda lopte, a u zoni C 228 što je 23,24 %. Na svih sedam utakmica prvoplasirana reprezentacija na Svetskom fudbalskom prvenstvu 2014. godine je ostvarila 981 početak poseda lopte na nivou cele ekipe.

Dobijeni rezultati su važni za bolje razumevanje dešavanja u toku fudbalske utakmice, u jednoj od dve osnovne faze fudbalske igre, fazi napada. Takođe nov je i pristup (četiri zone terena) istraživanju poznatog problema, poseda lopte.

Kao što posle faze napada sledi faza odbrane tako i svaki početak napada (poseda lopte) ima i svoj završetak. Upravo taj nedostatak informacija o rezultata o završetku faze napada (poseda lopte), a i još nekih karakteristika poseda lopte bi se mogao protumačiti kao nedostatak rada. Takođe i broj posmatranih utakmica je nedostatak istraživanja.

Međutim, rezultati prikazani u ovom radu su deo rezultata obimnijeg istraživanja koje se bavi i traženjem odgovora na pitanja koja su pomenuta u prethodnom pasusu kao nedostaci, a i na još neka pitanja vezana za fazu napada (poseda lopte) u fudbalu, a koji nisu prikazani u radu zato što bi se znatno premašio dozvoljeni obim stranica.

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SPEED OF THE JUMP SHOT AS A FACTOR OF ACCURACY IN BASKETBALL

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Introduction

In team sports speed and accuracy are very important parameters of throwing performance (Freeston, Ferdinads & Rooney, 2007; Van Den Tillaar & Ettema, 2003; 2006). A speed-accuracy trade-off is one of the crucial factors for the throwing efficiency (passing and shooting). Maximum release speed of the ball can negatively affect the precision. Namely, cricket players achieve the best accuracy at speed between 75% and 85% maximal throwing speed (Freeston et al., 2007), and handball players at 85% maximal shooting speed (Van Den Tillaar & Ettema, 2003). In basketball, throwing is manifested through passing and shooting the ball. Passing is always execute with almost straight path (exception is lob pass), like in handball, while shooting (except dunk) requires parabolic flight of the ball, considering that basket is horizontal (Hay, 1993; Fonatella, 2006).

Jump shot is the most used shot for scoring points, or attempt to score it in basketball (Karalejić & Jakovljević, 2008). Release height, release speed, release angle and entering angle into the basket are common parameters that describe the flight characteristics of the ball (Hay, 1993). The speed of the jump shot execution is one of the basic kinematic variables of that shot in basketball (Dobovičnik et. al., 2015; Okazaki & Rodacki, 2012). During the jump shot body of the player can't be in the same position long time before releasing the ball, especially arms and hands, while the game conditions sometimes requires quicker execution of the jump shot in terms of presence of defensive player (Cooper, Adrian & Glasgow, 1982). That means that speed of the jump shot performance can influence his efficiency. Less release speed are in the direct relationship with more accuracy (Knudson, 1993; Satern, 1988). Indeed, basketball player has minimum time for the jump shot execution without constraint of opponent in game conditions, but on the other hand shortening of the preparation period for the jump shot can negatively affect its efficiency. Preparation for the jump shot is extremely important (Karalejić & Jakovljević, 2008). Cooper et. al. (1982) found that total time for the jump shot is 0.656 seconds, with more time for preparation in female basketball players. Preparation for the jump shot implies: taking stable stance position, quality bounce, calmness during flight phase, and calmness throughout releasing the ball (Karalejić & Jakovljević, 2008). Therefore, time (speed) for the jump shot execution can be considered as sum of the time for preparation and time for execution itself, regarding to the moment of losing contact between hand of the player and the ball.

In this investigation focus is on the time for the preparation of the jump shot. With time limit for the certain number of shots basketball players are forced to have less preparation time. First aim was to compare the results of the shooting test in two conditions, with and without time limit. It was hypothesized that basketball players will be more efficient in test without time limit. On the other hand, as we state above, since game condition sometimes requires faster execution of the shot, second aim was to investigate the influence of the test without time limit on the test with time limit, considering that test with time limit simulate game conditions.

Method

Subjects

The best Serbian basketball players junior level (N=87; 19±0.5 years old), voluntary agree to participated in this study. Average body height was 196 ± 9 cm, and body weight 86.3 ± 11.6 kg. An inclusion criterion was 4 years of systematic basketball practice.

Variables and Instruments

Shooting test from 5 perimeter positions was applied (Perić, 1995) and the same test with time limit of 50 s (Karalejić & Jakovljević, 2009). Figure 1 represent the test, with that shots were executed from 4.55 m distance and 3 shots from each position. In that way we have two variables: accuracy of shooting in test without time limit (Š5SP) and accuracy of shooting in test with time limit of 50 s (Š5SP50). In the second part of the research, variable Š5SP was marked as predictor, and Š5SP50 as criteria variable.

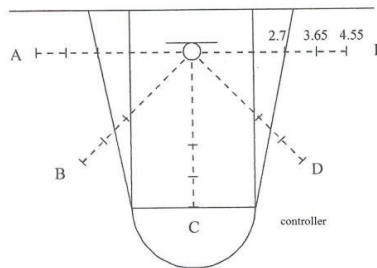


Figure 1. Shooting test from 5 perimeter positions

Statistical analyses

Data was processed with basic descriptive statistic, while relation between scores in two tests was examined with one-factor ANOVA and regression analysis.

Results with discussion

Table 1 represents descriptive parameters of two variables. We can see that subjects scored in average 10.37 successful shots in test without time limit and 9.05 successful shots in test with time limit.

Table 1. Descriptive statistic

Variable	N	M	SD	Max	Min
Š5SP	87	10.37	1.58	14	6
Š5SP50	87	9.05	1.52	12	6

In table 2 are results of one-factor analysis of variance and regression analysis. According to analysis of variance results in this two tests are significantly different (p<.001).

Table 2. ANOVA and regression analysis

ANOVA				
	Difference	Fisher PLSD	F-test	p
Š5SP : Š5SP50	- 1.322	.465	31.422	.001
Regression analysis - predictor: Š5SP criteria: Š5SP50				
DF	R	R ²	F-test	p
86	.647	.419	61.268	.001

These results are expected, considering that shooting without time limit allows “steady” jump shot execution, i.e. to have appropriate balance and concentration on the act of shooting. It is in line with research of Darling & Cooke (1987a, 1987b) which say that less speed decrease the body segments movement variability and in that way increase consistency of movement. In fact, at lower speeds are better body segments controls which contribute movement execution. Act of jump shot is relatively complex movement which includes a series of actions. It begins with extending the legs for starting the vertical jump. Before that player has to flex the knees slightly to give himself flexibility to power his jump. During jump release hands moves the ball above head. After jump, trunk and shoulders keep moving up. At one moment player is extended in the air with ball above his head. That is the moment when releasing the ball starts by extending the shooting elbow up and forward at the same time. Game condition usually demands all of these to be executed at greater speed. That is not simple to do, especially in situation when player has to do it from some kind of movement.

Basketball is a sport of efficiency where accuracy is one of the crucial factors for winning the game! Top level of jump shot performance means "resisting the pressure of competitive conditions", which among all consider: distractive, changeable, uncertain space and time components of the game (imposed by rules of the game and opponent quality); dynamic and unstable environment; solving problems in time-limited conditions, under psychological stress of failure etc. Therefore, there are high demands for taking decisions in that conditions, so basketball player has to react at right time and in the appropriate way, i.e. to choose the appropriate action to be effective.

According to Pajić (2017), increasing mistakes reasons that leads to total shooting efficiency decrease in the game conditions could be internal (related to the player) and external factors (contextual, situational, environmental). Internal factors are: ability of information processing, perception, attention and type of it, memory, focus, cognitive style, emotions, motivation, preferences, and sports quality – experience and condition. External factors are: type of the sport (individual, team/open and closed); cognitive complexity of sport; time structure of the game (time is often crucial factor in taking decisions, and it can be negative pressure for some sportsmen, especially less skill one); social pressure (expectations and pressure by others – coaches, teammates, fans, journalist...). Any misconception of the athlete during complex activity like jump shot can be consequence of disturbance of the technique, or coordination of the movement, i.e. inappropriate nervous system adaptation in movement control. Complexity of the technique adopted implies complex algorithm of activities aimed to adjusted speed of movement (acceleration–deceleration), body center control, body stability, countermovement depth, body inclination angle, adequate foot alignment, synchronized arms and legs work etc. (Pajić, 2017).

In any part of shooting basketball player response to given stimulus, his attention is moving to different information sources (speed of movement, opponent position, time tracking...), where it is valued any aspect of the assignment/situation based on available information. Therefore, jump shot execution is under large perceptual and cognitive abilities influence in terms of reaction on distraction stimulus stated above. Previous research has shown that correlation between perception and action are key factor of superiority high level athletes in relation to low-level athletes (Serpell et al., 2011). There are two types of mistakes during fast move execution: *motor program selection mistake and motor program performance mistake* (Schmidt & Lee, 1988). Basketball player is making a mistake in motor program selection which is influence of the distractors of competitive situation if he select inappropriate decision in term what to do regarding to external demands or motor program performance mistake during execution of correct motor program selection which is distract with unexpected factor. In first case time for correction is 120-200 ms, and it means modification of the motor program. In second case correction time is 30-50 ms, the motor program is properly selected and does not change (Schmidt & Lee, 1988). It can be assumed that shooting

motor program execution mistake which reflects to efficiency of accuracy is consequence of competitive situation distractors influence in terms of violation time, space, intensity, and even kinesthetic organization of movement.

If we take a look to violation of space, and as a consequence speed organization of the jump shot, it can be notice that prior to the jump, countermovement depth must be execute as reaction on actual situation in less time (as high and as fast as he can), as reaction on given stimulus (for example suddenly blocking or change of direction), and that demands countermovement depth decrease. It can be assumed that in most similar situations, basketball player gives advantage not to countermovement depth, actually to speed and time pattern of the movement (so called "timing"). Consequence of this adjustment is self-selected countermovement depth and decreased jump height and decreased shooting accuracy. There is no data to compare these assumptions, but there are researches which confirm that while performing countermovement jump countermovement depth has influence on the muscle activity and as a consequence on mechanical variables such as force and power, as a result of ground reaction force (Mandic, Jakovljevic & Jaric, 2015). To support this finding self-selected countermovement depth was always less than optimal, regardless of the subjects or jump type (Vanrenterghem et al., 2004).

It can be assumed that there are others kinematic and dynamic variables during performance of the jump shot which influence on the efficiency can be both positive and negative (moment of the movement, moment of the inertia, ground reaction force, force of gravity, single or multi joint muscle action, pairing movements, kinetic chain activity etc.). They also can be infective by the same factors, and therefore must be a part of interest for the coaches throughout selecting optimal drills in the practice. In that way they can avoid distraction influence of them.

Results of the regression found that shooting accuracy with time limit is under significant influence of shooting without time limit ($R^2 = 0.419$; $p=0.001$). Influence on athlete's ability to react with more efficiency in critical moment of motor program execution, to react optimally on negative influence of both internal and external factors, is in focus these days. Previous findings can have practical implication on activities during the practice. Motor program performance, over and over, in stable conditions, after that in specific and competitive situation the number of mistakes in the motor program execution is reduced, while reducing mistakes of motor program selection is directly related to cognitive and perceptive capabilities of athletes (Pajić, 2017). It is obvious that we have to create drills with random character during the practice (time, space and intensity uncertainty), because these factors are crucial for success. In other words, positive transfer from practice to competition will have those drills which simulate game situation: biomechanics (kinematic and dynamic), metabolic, specific muscle adaptation etc.

For example, it can be practice with video or on the court, it can be guided by coach or performed by athletes (Raab, Arnold & Tielemann, 2005), as well as the practice must realize with time limit similar game conditions (Magill, 1998). It is easy to assume that this approach will lead to positive transfer of practice to competition, because includes time, space, intensity, and nonetheless kinesthetic uncertainty like game conditions. However, over practice (usually performed) which is limited because it allows over planned adjustments without presence of any constraints stated above can result in movement patterns which are not part of the game and as such are not appropriate for game situation (Pajić, 2017.; Young & Farrow, 2006). This means that this kind of practice can be used for some time, to avoid negative effects of stereotype and stabilization, and then include more demand (this kind or similar) movement patterns with already named uncertainty.

Conclusion

In regard to problem of this research it can be concluded that time limit of the test causes decrease of accuracy relating to the test without time limit. Since trend in basketball is to speed up the game, and that fast shooting getting close test performance to the game conditions, it is desirable for testing shooting accuracy to perform shooting test which demands fast shooting. It can be concluded that efficiency jump shot performance is complex and sensitive mechanism which depends on motor-perceptive-cognitive-conative character of athletes. All internal and external factors named before which determine aspect of decision making are present in reaction moment of basketball player in game situation. They or some of them sometimes prevent player of motor program performance in total, and in contrast in other situation (for example adequate motivation, good perception, and physical condition) can be advantage in agility skills performance, like jump shot. Self-confidence and mental strength is of importance in that segment such is ability of finding optimal performance zone which means optimal level of physical arousal, emotional and cognitive orientation and self-control (Hay, 1993). Usually demand "fast and accurate" is present in basketball (and many other sports). Sometimes "accurate" is on the cost of "fast", even so quality of anticipation, decision making and agile motor performance under time pressure depend on athletes skill, tactical knowledge, not just cognitive capacity of the player, so we can work on this factor. Just to react is not enough for high level performance in modern sport: „we have to create athletes able to recognize the game and able to be at the right place at the right time" (Young & Farrow, 2006). "Anticipation prior to the action" is a common sentence lately related to the direction and future of practice (Pajic, 2017). The importance of the factors stated above in preplanned and uncertainty situations is related to the perceptual-cognitive character which have further implications on motor control processes in terms of selection, execution and eventual motor program modification. This problem can be viewed through the prism of the time interval available for performing agile movements, which, ultimately, has a major impact on its efficiency.

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BRZINA IZVOĐENJA SKOK ŠUTA KAO FAKTOR PRECIZNOSTI U KOŠARCI

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Uvod

Brzina i preciznost kod različitih vrsta bacanja lopte u odgovarajućim timskim sportovima su dva veoma važna parametra njihovog izvođenja (Freeston, Ferdinads, & Rooney, 2007; Van Den Tillaar, & Ettema, 2003; 2006). Odnos između brzine i preciznosti bacanja lopte je veoma bitan segment efikasnosti bacanja (dodavanja ili šutiranja) lopte. Maksimalna brzina izbačaja lopte može negativno uticati na preciznost. Tako u kriketu bacači lopti postižu najveću preciznost bacanja pri brzinama izbačaja od 75 do 80% od maksimalnih brzina (Freeston, et al., 2007), a rukometaši u šutiranju na oko 85% (Van Den Tillaar, & Ettema, 2003). U košarkaškoj igri, bacanje lopte se manifestuje kroz dodavanja i šutiranja. Prilikom dodavanja lopte skoro je uvek poželjna pravolinijska putanja leta lopte (izuzev kod lob dodavanja), slično kao u rukometu, dok je kod šutiranja (izuzev, tzv. zakucavanja) neophodna parabolična putanja leta lopte, s obzirom da je cilj horizontalan (Hay, 1993; Fonatella, 2006).

Skok šut je najčešće sredstvo pomoću koga se postižu ili pokušavaju postići pogoci u košarci (Karalejić i Jakovljević, 2008). Uobičajeni kinematički parametri koji opisuju skok šut su: visina izbačaja lopte, brzina izbačaja, ugao izbačaja i upadni ugao (Hay, 1993). Brzina izvođenja šuta je jedna od osnovnih kinematičkih varijabli šuta u košarci (Dobovičnik i sar., 2015; Okazaki & Rodacki, 2012). Kod izvođenja skok šuta telo košarkaša ne može biti dugo fiksirano pre izbačaja lopte, posebno ruke i šake, a u uslovima utakmice šut treba, u pravilu, da se izvede većom brzinom da bi se povećala mogućnost pogađanja u odnosu na ometanje odbrambenih igrača (Cooper, Adrian, & Glasgow, 1982). To znači da, u odnosu na motoričku strukturu skok šuta, brzina izvođenja može da utiče na njegovu efikasnost. Manja brzina izbačaja lopte je u direktnoj vezi sa većom preciznosti (Knudson, 1993; Satern, 1988). Zaista, u uslovima utakmice košarkaš uobičajeno ima malo vremena da izvede skok šut bez ometanja od strane protivnika, ali sa druge strane skraćenje trajanja pripreme za izvođenje šuta može negativno da utiče na efikasnost. Priprema za izvođenje skok šuta je veoma važna (Karalejić i Jakovljević, 2008). Kuper i saradnici (Cooper et al., 1982) navode da je prosečno vreme izvođenja skok šuta 0.656 sekundi, a da ženama treba duže vreme za pripremu šuta. Priprema šuta, u mehaničkom smislu, podrazumeva: zauzimanje stabilnog položaja iz kojeg će započeti akt šuta, dobar odskok, mirnoću tokom bespotporne faze šuta, i mirnoću prilikom samog akta šuta, odnosno izbačaja lopte (Karalejić i Jakovljević, 2008). Dakle, kada se govori o vremenu trajanja izvođenja skok šuta (brzini), ona se može posmatrati kao suma vremena koje je potrebno za pripremu i vremena samog izvođenja šuta do trenutka kada lopta napušta ruke igrača.

U ovom radu akcenat je stavljen na vreme pripreme za šut. Uvođenjem ograničenog vremena za izvođenje određenog broja šuteva ispitanici su primorani da imaju kraću pripremu za izvođenje šuta. Prvi cilj ovog rada je bio da se uporede rezultati u testu šutiranja u uslovima kada se test izvodi bez vremenskog ograničenja i kada se izvodi sa vremenskim ograničenjem. Pretpostavka je bila da će ispitanici biti značajno efikasniji kod izvođenja šuteva u testu bez vremenskog ograničenja, u odnosu rezultate kada je trajanje izvođenja testa vremenski ograničeno. Sa druge strane, već je rečeno da košarkaši na utakmicama veoma često moraju da šutiraju brzo, a to znači sa kraćim trajanjem pripreme za šut, te je drugi cilj bio da se ispita da li postoji uticaj rezultata u testu bez vremenskog ograničenja na

rezultate testova sa vremenskim ograničenjem, prihvatajući da je izvođenje testa sa vremenskim ograničenjem svojevrsna simulacija uslova pod kojim se šutira na utakmici.

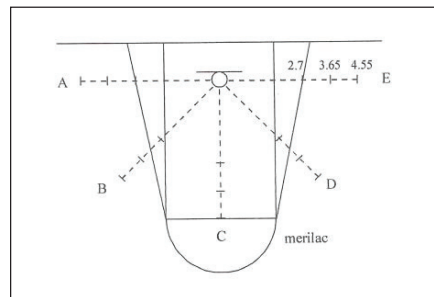
Metod

Uzorak ispitanika

Uzorak ispitanika je činilo 87 košarkaša juniorskog uzrasta (19 ± 0.5 godina), članova najkvalitetnijih klubova u juniorskoj konkurenciji u Srbiji. Prosečna visina je bila 196 ± 9 cm, a telesna masa 86.3 ± 11.6 kg. Ispitanici su imali najmanje 4 godine sistematskog bavljenja košarkom i dobrovoljno su pristali da učestvuju u testiranju.

Uzorak varijabli i instrumenti

Primenjen je test šutiranja sa pet spoljnih pozicija (Perić, 1995) i varijanta istog testa u kojem je izvođenje ograničeno na 50 sekundi (Karalejić i Jakovljević, 2009). Slika 1. pokazuje izgled testa, sa tim što su šutevi izvođeni sa udaljenosti od 4.55 metara i sa svake pozicije su se izvodila po tri šuta. Tako su dobijene dve varijable: preciznost šutiranja u testu bez vremenskog ograničenja (Š5SP) i preciznost šutiranja u testu sa vremenskim ograničenjem od 50s (Š5SP50). U drugom delu, varijabla Š5SP je označena kao prediktorska, a varijabla Š5SP50 kao kriterijumska.



Slika 1. Test šutiranja sa pet spoljnih pozicija

Obrada podataka

Podaci su obrađeni osnovnom deskriptivnom statistikom, a relacije između rezultata u dva testa su ispitane primenom procedura jednofaktorska ANOVA i regresiona analiza.

Rezultati sa diskusijom

Tabela 1 prikazuje deskriptivne parametre dvaju varijabli. Iz tabele 1 se vidi da su ispitanici u testu šutiranja sa pet spoljnih pozicija, koji se izvodi bez vremenskog ograničenja, postigli prosečan rezultat od 10.37 pogodaka, dok su u varijanti sa vremenskim ograničenjem postigli prosečan rezultat 9.05.

Tabela 1. Deskriptivna statistika

Varijable	N	M	SD	Max	Min
Š5SP	87	10,37	1,58	14	6
Š5SP50	87	9,05	1,52	12	6

U tabeli 2 su prikazani rezultati jednofaktorske analize varijanse i regresione analize. Primenom analize varijanse pokazano je da se rezultati u ova dva testa razlikuju na nivou značajnosti od 0.01.

Tabela 2. ANOVA i regresiona analiza

ANOVA				
	Razlika M	Fišer PLSD	F-test	p
Š5SP : Š5SP50	- 1,322	,465	31,422	,001
Regresiona analiza - prediktor: Š5SP kriterijum: Š5SP50				
DF	R	R ²	F-test	p
86	,647	,419	61,268	,001

Ovakvi rezultati su očekivani, s obzirom da šutiranje bez vremenskog ograničenja omogućava igračima da izvedu „miran“ šut, tj. da pre izvođenja šuta obezbede dobru ravnotežu, pravilan tok šuta i dobru koncentraciju na sam akt šutiranja. To je u skladu sa navodima Darlinga i Kuka (Darling & Cooke, 1987a, 1987b) koji kažu da manja brzina smanjuje varijabilnost kretanja segmenata tela i tako se povećava konzistentnost pokreta. Ustvari, pri manjim brzinama je bolja kontrola segmenata tela koji učestvuju u izvođenju pokreta, bolja kontrola izvođenja samog pokreta. Sam akt skok šuta je relativno složen i podrazumeva niz radnji. Ritam i inicijalna sila šuta počinju opružanjem nogu i započinjanjem vertikalnog skoka. Međutim, pre opružanja nogu igrač se spušta u niži stav savijanjem kolena. Tokom trajanja odskoka ruke dovode loptu u poziciju iznad glave. Nakon opružanja nogu i odskoka, trup i ramena nastavljaju opružanje ka gore. U jednom trenutku igrač je opružen u vazduhu sa loptom u poziciji iznad glave. Tada započinje izvođenje šuta opružanjem ruke (kojom šutira) u laktu, idući ka gore i napred. U uslovima utakmice ovo sve je, najčešće, potrebno uraditi što brže. To nije uvek jednostavno, posebno u situacijama kada košarkaš, koji se kreće, pre šuta treba da primi (uhvati) loptu od saigrača i da što pre napravi dobru pripremu za šut (uspostavi ravnotežu, sigurno drži loptu u rukama...).

Košarka spada u sportove efikasnosti, pri čemu je preciznost jedan od odlučujućih faktora koji doprinose stepenu ostvarivanja cilja – pobeđe! Vrhunsko izvođenje šutiranja podrazumeva "odolevanje pritisku takmičarskih uslova", koji između ostalih podrazumevaju: ometajuće, promenljive, neizvesne prostorne i vremenske komponente igre (nametnute pravilima i kvalitetom protivnika); dinamično i nestabilno okruženje; rešavanje problemskih situacija u vremenski ograničenim uslovima, pod psihološkim stresom radi stalno prisutnog rizika neuspeha itd. U takvim uslovima postoje visoki zahtevi za odlučivanjem, te košarkaš mora pravovremeno odreagovati i doneti odluku o izboru i primeni svoga motoričkog odgovora.

Prema Pajiću (2017), razlozi povećavanja grešaka, a samim time i smanjenja ukupne efikasnosti šuta u uslovima takmičarske situacije bi mogli biti u većem broju tzv. unutrašnjih (koji se tiču samog sportiste) i spoljašnjih faktora (kontekstualni, situacioni, okolni). U unutrašnje faktore mogu se ubrojiti: sposobnost obrade informacija, percepcija, pažnja i stil pažnje, pamćenje, koncentracija, kognitivni stil, emocije, preferencije, motivacija, i sportski kvalitet - iskustvo i kondiciona pripremljenost. U drugu, grupu spoljnih faktora spada: tip i vrsta sporta (individualni, ekipni/otvoreni i zatvoreni); kognitivna složenost sporta; vremenska struktura igre (uslovljava da je vreme često kritičan faktor u donošenju odluke, budući da vremenski pritisak može veoma negativno delovati na pojedince, posebno na one koji nisu vešti ili su nesigurni); socijalni pritisak (očekivanja i pritisak drugih aktera sportske situacije - trenera, saigrača, novinara, publike i sl.) Svako neprilagođavanje sportiste pri ovakvim složenim aktivnostima može biti posledica narušavanja i/ili neuspostavljanja tehnike, odnosno koordinacije pokreta, tj. neadekvatne adaptacije nervnog sistema u upravljanju pokretima. Složenost kretnih struktura usvojenosti tehnike podrazumeva složen algoritam niza aktivnosti usmerenih na prilagođavanje brzine kretanja (akceleracija–deceleracija), kontrolu težišta tela, stabilnosti tela, dubinu polučučnja, ugao nagiba tela,

postavljanje stopala u adekvatnom smeru akcije kretanja, sinhronizovan i ritmičan rad ruku i nogu itd (Pajić, 2017).

U svakom trenutku šutiranja košarkaš reaguje na ponuđene stimulanse, njegova se pažnja premešta na različite izvore informacija (brzina kretanja, blizina protivnika, praćenje vremena i sl.), pri čemu se vrednuje svaki aspekt zadatka/situacije na temelju raspoloživih informacija. Dakle, egzekucija šuta je u velikoj meri pod uticajem perceptualnih i kognitivnih sposobnosti u smislu reakcije na pomenute ometajuće stimulanse (tzv. distraktore). Istraživanja su pokazala da je baš "povezanost percepcije i akcije" ključni faktor superiornosti sportista najvišeg nivoa u odnosu na sportiste nižeg ranga (Serpell et al., 2011). Prilikom izvođenja brzih pokreta dva su osnovna tipa grešaka: *greške u izboru motornog programa i greška u izvođenju motornog programa* (Schmidt & Lee, 1988). Košarkaš pravi grešku koja je posledica uticaja distraktora takmičarske situacije u izboru motornog programa ako donese neadekvatnu odluku u smislu šta treba učiniti u odnosu na spoljašnje zahteve ili grešku u izvođenju motornog programa prilikom egzekucije pravilno odabrane matrice mišićne aktivacije (motornog programa), koja je ometena nekim neočekivanim faktorom. U prvom slučaju vreme neophodno za korekciju je 120-200 ms, a sama korekcija, između ostalog podrazumeva promenu aktuelnog motornog programa. U drugom slučaju vreme korekcije je 30-50 ms, motorni program je pravilno odabran i ne menja se (Schmidt & Lee, 1988). Može se pretpostaviti da je greška u izvođenju motornog programa šutiranja koja se reflektuje na efikasnost preciznosti posledica uticaja distraktora takmičarske situacije u smislu narušavanja vremenske, prostorne, intenzitetske pa čak posledično i kinestetske organizacije aktuelnog kretanja.

Ako se uzme primer narušavanja prostorne, a posledično i intenzitetske organizacije skok šuta može se primetiti da se aktuelni ekscentrični odraz mora izvesti kao taktička reakcija na aktuelnu situaciju za što kraće vreme (što više i što brže), kao reakcija na ponuđeni/e stimulans/e (npr. iznenadno blokiranje protivnika ili nagla promena pravca kretanja), a to zahteva smanjenje dubine počučnja. Može se pretpostaviti da u većini situacija u kojima se izvode ove agilne kretnje, košarkaš daje prednost (ili je primoran) ne dubini polučučnja nego brzini i vremenskoj šemi aktuelne kretnje (tzv. „adekvatnom tajmingu“). Posledica ove reorganizacije (prilagođavanja) kretanja je spontana dubina počučnja, a samim time i umanjena visina skoka i posledično manja preciznost šutiranja. Za ove pretpostavke, mada su očigledne, ne postoje podaci sa kojima bi se mogli uporediti, ali postoje istraživanja koja potvrđuju da dubina spuštanja pri realizaciji aktuelne agilne ekscentrične reakcije utiče na mišićnu aktivnost i posledično na obrasce mehaničkih varijabli koje proističu iz tog kretanja, a koja su posledica delovanja sile reakcije podloge (Mandic, Jakovljevic, i Jaric, 2015). U prilog gornjim tvrdnjama ide i nalaz da je spontana dubina polučučnja uvek bila manja od optimalne, nezavisno od grupe ispitanika ili vrste skoka (Vanrenterghem et al., 2004).

Može se pretpostaviti da pri realizaciji efikasnog skok šuta postoje i mnoge druge kinematičke i dinamičke varijable, čiji je očigledan uticaj na faktore koji favorizuju, kao i one koji ometaju efikasnost izvođenja skok šuta (moment količine kretanja, momenat inercije, sila reakcije podloge, gravitacione sile, dejstva jednozglobnih i dvozglobnih mišića, sparivanja pokreta, aktivnosti kinetičkih lanaca i dr.). One isto tako mogu biti ugrožene faktorima distrakcije takmičarske situacije, te moraju biti predmet interesovanja trenera pri konstruisanju optimalnih modela vežbi u treningu, jer će se tako efikasno odupreti njihovom ometajućem uticaju.

Rezultati regresione analize su pokazali da je preciznost šutiranja u uslovima vremenskog ograničenja pod značajnim uticajem veštine šutiranja izražene u testu koji se izvodi bez vremenskog ograničenja ($R^2 = 0.419$; $p=0.001$). Uticaj na sposobnosti sportista da sa većom efikasnošću reaguju u kritičnim trenucima motoričkog ispoljavanja, optimalno reaguju na negativan uticaj i unutrašnjih i spoljnih faktora, je vrlo aktuelan u trenerskoj praksi. Prethodni nalazi mogu imati praktične implikacije na

aktivnosti u treningu. Ponavljanom primenom motornog programa, izgrađenog u stabilnim uslovima, a zatim u specifičnim i takmičarskim situacijama, smanjuje se broj grešaka u izvođenju motornog programa, dok je smanjenje broja grešaka u izboru motornog programa direktno vezano za kognitivne i perceptualne kapacitete sportiste tj. za izbor draži na koje sportista reaguje (Pajić, 2017). Očigledno je da prilikom konstruisanja treninga treba realizovati veliki broj vežbi nasumičnog karaktera (sa većim stepenom vremenske, prostorne i intenzitetske neizvesnosti), jer je očigledno da je kvalitet ispoljavanja ovih mehanizama odlučujući faktor uspešnosti. Drugim rečima, pozitivan transfer sa vežbanja na takmičarsku situaciju će imati samo oni treninzi u kojima postoji kongruentnost (sličnost, pa čak i jednakost) između vežbi na treningu i takmičarske situacije: biomehanička (kinematička i dinamička), metabolička, režima rada, specifične mišićne adaptacije i dr.

Na primer, može se uvežbavati uz video snimke ili na terenu, može biti vođeno od trenera ili izvođeno od sportista (Raab, Arnold, & Tielemann, 2005), kao i da se vežbanje mora realizovati u uslovima vremenskih ograničenja koja su slična situacijama u igri (Magill, 1998). Lako je pretpostaviti da će ovakav i slični pristupi omogućiti pozitivan transfer vežbanja na takmičenje, jer nude vremensku, prostornu, intenzitetsku, a najčešće i kinestetsku neizvesnost koja se pojavljuje u takmičenju. Međutim, preterano vežbanje (često prisutno na treningu) koje je limitirano iz razloga što dopušta preplanirana prilagođavanja bez bilo kojeg od nabrojanih ograničenja, tj. nedostatka bilo kakve neizvesnosti, može dovesti do korišćenja neprivrednih i automatizovanih kretnih obrazaca (dinamičkih stereotipa sa akutnim neuro-fiziološkim barijerama - platoima) koji se ne javljaju u sportskoj igri i ne mogu odgovoriti izazovima takmičarske situacije (Pajić, 2017; Young & Farrow, 2006). Ovo znači da se ovakav oblik vežbanja može koristiti jedno izvesno vreme, da se izbegnu negativni efekti stereotipa i stabilizacija, a zatim bi u trening trebalo uvesti mnogo zahtevnije (ove ili slične) kretne obrasce zasićene nekom od navedenih neizvesnosti.

Zaključak

U odnosu na problematiku ovog rada može se zaključiti da vremensko ograničenje trajanja testa šutiranja uzrokuje postizanje slabijih rezultata u odnosu na rezultate istog testa u kojem nema vremenskog ograničenja. Pošto se igra u košarci i dalje ubrzava, i da brzo šutiranje približava izvođenje testa uslovima igre, poželjno je u prostoru testiranja preciznosti šutiranja u većoj meri, primenjivati testove u kojima ispitanici moraju brzo šutirati. Može se zaključiti da je efikasno motoričko ispoljavanje skok šuta, kao i bilo koje motoričke manifestacije brze reakcije na ponuđene stimulanse takmičarske situacije, složen i vrlo osjetljiv mehanizam koji zavisi od motoričko-perceptivno-kognitivno-konativnog karaktera sportista. Svi, gore navedeni i unutrašnji i spoljni faktori koji determinišu aspekt donošenja odluke, su veoma prisutni u trenucima kada košarkaš reaguje u takmičarskoj situaciji. Oni ili neki od njih ponekad potpuno blokiraju sportistu u ispoljavanju motoričkih manifestacija, a suprotno tome u drugoj situaciji (npr. adekvatna motivacija, dobra percepcija, fizička priprema) donose prevagu u efikasnosti agilnih manifestacija, kao što je skok šut. U tom je segmentu bitan je nivo samopouzdanja i mentalne čvrstoće, kao i sposobnost pronalaženja vlastite zone optimalnog funkcionisanja, koja podrazumeva optimalan nivo telesne pobuđenosti, emotivne i kognitivne usmerenosti, kao i samokontrole (Hay, 1993). U košarci (kao i u mnogim drugim sportovima) je veoma prisutan zahtev „brzo i precizno”. Nekada se „precizno” žrtvuje na štetu „brzo”, ali ipak kvalitet anticipacije, donošenja odluka i agilne motoričke manifestacije kao njihova posledica pod pritiskom vremena ne zavisi samo od kognitivnih kapaciteta pojedinca, već i od njegovog znanja, razumevanja igre i uvežbanosti, pa se na taj faktor može delovati. Moderan sport je sve brži i sama reakcija nije dovoljna za kvalitetno igranje; „moraju se praviti kompletni sportisti sposobni da prepoznaju igru i da budu u pravom trenutku na pravom mestu” (Young, W., & Farrow, D., 2006). „Anticipacija pre reakcije” je rečenica koja se u zadnje vreme često sreće u literaturi i

koja pokazuje pravac i budućnost treninga (Pajic, 2017). Važnost gore analiziranih faktora u preplaniranim i nepredviđenim situacijama je vezana za faktore perceptualno-kognitivnog karaktera, koji imaju dalje implikacije na procese motorne kontrole u smislu odabira, izvršenja i eventualne modifikacije motornog programa. Ova problematika se može posmatrati kroz prizmu vremenskog intervala dostupnog za izvođenje agilnih kretnji, što u krajnjem, ima velikog uticaja na samu njegovu efikasnost.

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FIELD HOCKEY NOW AND THEN IN SERBIA

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Introduction

Field hockey has a rich tradition because it originates from the oldest times of human society and it can be said that it is one of the oldest games in history of human society, and it was played with a stick and a ball, or some other round object (stone, wood, claw hair, skin, and others). The first traces of field hockey were found in Egypt 4000 years ago which is testified by the relief found in tombs in village Beni Hasan. It is showing two players with sticks in the fight for the ball, and similar game was shown on stone engravements in 500 year B.C. in ancient Greece. This corroborates the data which says that antique games contained game with a stick and a ball which we call hockey. The Gales on the territory on present Ireland play hurling. Although most consider it as a predecessor for field hockey, it is still played in Great Britain, America, Australia, and in some African and South African counties so it can be called the oldest team sport which is still played today.

Field hockey is a team sport which is equally played both by men and women, in which players in both teams try to score by hitting or pushing the ball with a bat in a goal. The official name of this sport in the world is hockey and it is the most common name for it in most countries. The term field hockey is used in countries where the term hockey represents other forms of hockey. Field hockey was traditionally played on lawns by which it got its name, however in time the players switched to artificial grass, and since 1970 and on hockey has been played on artificial grass laid on the sand because it gained speed and dynamic of the game. In recent years sand has been switched with water, allowing quick transfer of the ball, and it reduced number of players' injuries.

Field hockey is an Olympic discipline which is played worldwide on five continents; it is equally played by both men and women. It is third sport in the world by its popularity and exists as a professional, amateur, school, recreational sport and sport for disabled people. This Olympic sport is played with a stick and a ball on artificial grass. Dimension of the court is 91,4 m x 55 m (100 x 60 yards), and the size of the goals is 2.14 m (7 feet) height and 3.66 m (12 feet) width. In front of the goal there is a semi - circle line at a distance of 14.63 m (16 yards), which shows allowed zone for shooting at the goal. The court is divided on a quarters by lines which are found at 22.90 m (25 yards) from the last line. The team is made up of 16 players, among which are 10 players and one goalkeeper on the court, and five other players are on the bench. There are two half-times 35 minutes each and between them there is a break of 5 minutes (Forni, 2007). Players hit the ball with a face of a bat or with a part of the handle which continues to the face of the bat and try to insert the ball into rival's goal. One of the most important rules refers to that it is allowed to play with only one side of the bat, which has a flat side. It is allowed to use the bat which is for right handed, by which forehand kick goes from right to left. A backhand kick, considering it is not allowed to kick the ball with other side of the bat, is performed by turning the bat round its axis for approximately 180 degrees and swinging from left to right.

Today hockey is one of the most widespread sports in the world with 137 national associations, among which 43 are in Europe. In some countries like India and Pakistan hockey is a national sport, while in some like the Netherlands, Germany, Argentina, etc. one of the most popular. On the last World

Women's Championship held in London field hockey represents the biggest competition for women in history considering the sales of the tickets.

The World Hockey Federation (FIH) is a global organization of hockey sport. It organizes competitions like the World Championship, and the Committee for rules FIH prescribes the rules for hockey. Hockey associations are further organized via continental and national federations.

Most countries have developed club competitions with big number of players in all categories and professional leagues. Hockey is played by a large number of players in the world and the World Federation represents the second biggest branch of sport association according to the number of national associations (after football). High quality of the game is arranged equally, unlike most of sports, all over the world and on all continents.

The goal of the work was to investigate the development of hockey in Serbia till today and to make recommendations for further development of field hockey and hall hockey in Serbia.

Method

For collecting of the relevant data the archived material Yugoslavian and Serbian Field Hockey Association was used, as well as European Hockey Federation. For the method the content analysis was used.

Results with discussion

Modern game hockey was created in state schools in England in early 19th century, so the first field hockey male club Blackheat was formed in London in 1861, and in 1886 the London Hockey Association was founded. Englishmen brought this sport to India, Pakistan, and Australia, where it got its popularity fast, so the first international games were played already from 1895. At the beginning of the twentieth century it was the massive in India, Pakistan and Afghanistan where it was a national sport. Original rules of field hockey allowed mixed teams, i.e. in the same team could play both men and women in the same team, so this affected the increasing popularity of this game (in some women's schools field hockey was compulsory subject).

It becomes Olympic sport for men in 1908. On the Olympic games in London in 2012, field hockey was the third most viewed sport. On the Olympic games in 1928 India wins gold medal and for many years with Pakistan it keeps their dominance on international performances. This dominance was interrupted by the introduction of the artificial field in 1970, by which hockey experiences significant transformation concerning increasing of the speed of the game with new techniques and tactics, which were followed with new rules. From the seventies primacy was taken over by rich countries as the Netherlands, Germany and Austria. Since 1971 field hockey World Cup has been held Women played this sport by the end of the 19th century, but since 1974 competitions have been held in this sport in women competition on World Cup, and on the Olympic games since 1980.

In January 1896 Franjo Bucar published in magazine *Gymnastic* the article "Ice hockey" whose title does not correspond to its content because it describes technique elements and tactics of playing and rules of field hockey. In the same year Franjo Bucar showed to the course attendees for gymnastic teachers the elements of technique and tactics for field hockey. In 1908 the first field hockey game was played between clubs „Sismis“ and „Concordia“. In the thirties of the twentieth century hockey is played in Serbia. The first game between Croatian and Serbian clubs was played in 1943 between Marathon from Zagreb and HZMLJ from Belgrade. In 1936 in Zagreb Alliance of field hockey was founded in Yugoslavia and the same year it joined FIH, international Association of Field Hockey (Radoslav, 1953).

There are records that in 1948 students of the State Institute of Sports (DIF) studied field hockey. On the initiative of the sport council of Belgrade and students of DIF, in 1949 hockey club „Čukarički“ was formed where the significant role and help at the foundation had professor Živko Vojinović who later provided young players. The first performance by HK „Čukarički“ was on 1st and 2nd March 1949 against Zagreb representation, where „Čukarički“ played under the name of the Team of Belgrade.

The same year The Youth Sport Association of Belgrade, ordered by the decree the formation of at least one field hockey club in Subotica. Since sport club „Spartak“ at that time had most selections and was the most massive, the decree was sent to their address. Sport club „Spartak handed over the order to sport club „Električna Centrala“. So in 10.01.1949. the sport club „Električna Centrala“ was formed with four sections with one of them for hockey. Only two years after the forming of hockey club „Električna Centrala“, women team was formed. Sport club „Električna Centrala“ would change its name on 15.03.1959. in „Elektrovojvodina“. During the second half of the 90s of the last century and first ten years of this century it achieved very noticeable results. Today club has the name „Spartak Elektrovojvodina“. In those years in Subotica there were thirteen clubs (Pizuljica, et. al, 1999).

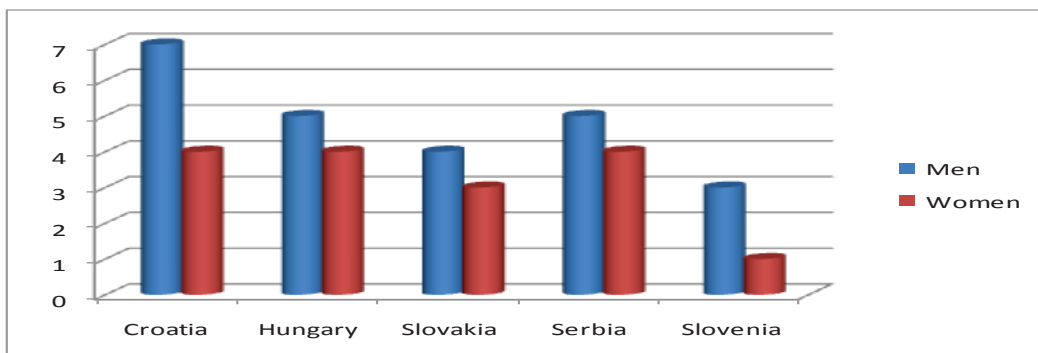
Later HR „BASK“ (1953) was founded. The person who had the big impact at the foundation of the club was Nikola Simić, the son of pre-war banker, who played hockey before the war in France and was the first coach of HR „BASK“. In 1954 the first women hockey team „Čukarički“ was founded. This example was followed by the other clubs in Belgrade and Serbia, before everyone „BASK“ from Belgrade, „Zorka“ from Subotica and „Tehnolog“ under sports section of Chemical school in Belgrade. In that way the necessary competition has been created for league competition. In Croatia there were already several clubs. In the season 1955/1956 Federal league was formed in which they competed for the title of the champion of Yugoslavia in women hockey. Women team HK „BASK“ won twelve times championship of Serbia in indoor hockey and eight times champion of Serbia in field hockey. Since 1958 in Belgrade there have been six clubs for field hockey and these are: Čukarički, Bask, Železnik, Tehnolog, Yugoslavia and Jugostroj. It was followed by the establishment of the other clubs: Zvezda (1954), Toplana (1958), Zorka (1963), Subotica-trans (1963), Subotičanka (1965), Fidelinka (1966), 29. novembar (1966), Student (1967) i Elektrovojvodina (1967). Since 1968 and during 80s in championship of Yugoslavia there were two leagues „West“ Croatia and Slovenia, and „East“ Serbia with clubs from Subotica, Belgrade, Novog Sad and Pančevo. Subotica participated with nine clubs in that championship. In the championship of SFRJ until 1967 all Croatian clubs dominated and in 1968 championship was won by HK Subotičanka and until 1991 it was eleven times championship winner, when the championship of Yugoslavia ceased. The most important success of Yugoslavian representation is winning first place on VIII Mediterranean sport games, in 1979 in Split.

The Championship of Yugoslavia in field hockey is the highest competition in field hockey in The Kingdom of Yugoslavia and later in SFR Yugoslavia. The first official championship in Yugoslavia was held in 1935 and was played until the beginning of the World War II. And in SFRJ it was played from 1950 until the disintegration of Yugoslavia in 1991.

The Championship of Serbia in field hockey is the highest competition in field hockey in the Republic of Serbia. The Championship was played from 1991 i.e. from the disintegration of SFRJ. Since 1991 to 2003 it had the name the Championship of SR Yugoslavia, and from 2003 to 2006 Championship of Serbia and Montenegro. After disintegration of Serbia and Montenegro competition it has the current name. The league is managed by The Association A of Field Hockey in Serbia. In the period from 1991 to 2013 Zorka Subotica won championship ten times, seven times Spartak Elektrovojvodina, two times Sveti Đorđe, and once each time Trikoteks Subotica, Čukarički and Elektrovojvodina Novi Sad.

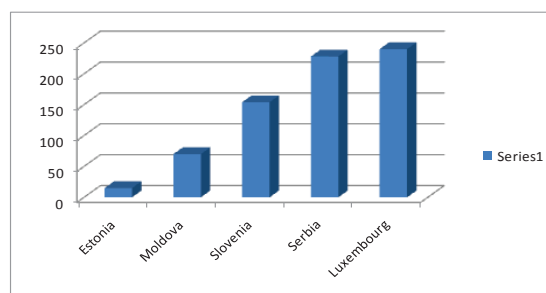
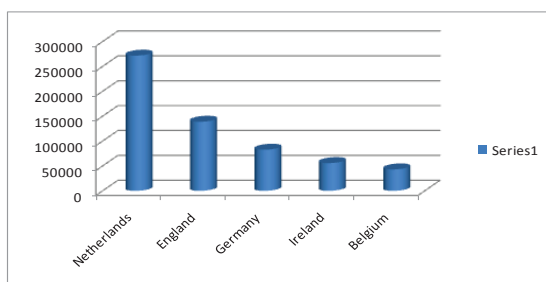
The current situation in Europe and Serbia can be considered by the number of clubs and players, but also by the number of courts which in some European countries like Serbia do not exist.

By the insight into Graph 1. It can be seen that in countries in the central region of the European Hockey Federation by statistical data from 2016 there is a small number of active clubs in male and female competition which are included in the system of national championship. The biggest number of male clubs is in Croatia and that is seven, they are followed by Hungary and Serbia with five each, Slovakia with three and Slovenia with one, while in Bosnia and Hercegovina, Montenegro and Macedonia, field hockey has never been played nor developed. There were some attempts in 2006 and 2007 for hockey to start in Macedonia. After all the plans, agreements, held seminars by the European Development Coordinator (CDO – Continental Development Officer) Norman Hughes and Antonia Antonova for twenty students for college of Physical Culture in Skopje. The plan was to spread hockey across Macedonia, to form at least five clubs which was a condition to form Macedonian Association of Field Hockey. After that, Macedonian Association should have been joined in EHF – European Hockey Federation in order for Macedonian clubs and representation into participate in different competitions (The Balkans Cup, The Championship Cup and similar). All that is done was left on the paper, without any active club until today.



Graph 1. Number of male and female clubs in countries of central region of European Hockey Federation from 2016.

By the insight in Graph 2 we can state that out of 43 national associations in Europe most numerous is Dutch with 271629 active players. In second place is English Association with 138807 players. Then next are German with 82609 players, Irish with 55650 and on fifth is Belgium with 43000 players. What is interesting is that in the three most numerous alliances the number of members increased and that: Netherlands had 238895 players in 2012, that number increased in 2014 to 251909 and growth continued in 2016 with 271629 players. Some smaller growth was in England which had in 2012 115165 players, in 2014 the number had increased to 120404 and in 2016 number had increased to 138807. The situation is similar in Germany which had at the end of 2012 had 77280, at the end of 2014 had 81750 players and 2016 increased to 82609 players. After this five, next is France with 29210 players, Scottish with 20869 players, Spain with 19000, Wels with 18128 and Turkish with 7964 players (FIH, 2018).



Graph 2. Countries with the biggest number of players and Graph 3. Countries with the least number of players

We get a completely different picture by the insight to Graph 3, where Serbia is among five of 43 European countries with the least number of active players. Estonia has the least number of fifteen players. Next is Moldavia with 70 players. Third place with the least number of players of only 154 belongs to Slovenia. Serbia with 228 is on fourth place with the least number of players and next is Luxemburg with 240. Least active number of players is in Armenia with only 290. Next in Finland 300, Swedish 345, Malta 348 and Cyprus 370. In the group countries of Southeast Europe where Serbia belongs the largest number of clubs and 7964 players have Turkey, next is Bulgaria which in five years founded 25 clubs and now is with 3020 players. What is evident is that the biggest drop in number of players has been in Russia with 5077 in 2012 to 3650. Similar situation is in Ukraine which from 3070 players in 2014 had in 2016 only 1674 players. All stated can be attributed to material-spacious conditions i.e. financial situations in national alliances which cannot provide location and adequate, now artificial substrate for the courts.

In recent years in Serbia, there have been slight movements in founding of new clubs. A club HK "Mladost" was founded in Bosilengrad, HK "Spartak" in Subotica. A club HK "Sreten Adzic" was founded in the Pedagogical Faculty in Jagodina on 18th February 2017. which participates in the national championship from the autumn of the same year. Everything started when Professor Zivorad Markovic paid a visit to Professor Antonije Antonov on National Sport Academy "Vasil Levski". In October 2017, professor Antonov paid a return visit with the lecture and demonstration training. At that time he gave as a present to the Faculty the bats and the balls for field hockey. Since then hockey has become the most interesting kind of activity to our students. On 3rd November 2017 Jagodina was a host to Forum for the development of hockey in South-eastern Europe in which the representatives of seven countries took part. Professor Markovic presented to the participants what had been done up to that moment and he presented the development plan for field hockey at the University. The development of field hockey at the University has been planned in several stages: *The first stage* – the founding of a male and female club at the Faculty and their promotion at "Uciteljijada" (teachers' seminar) in Sombor in May 2017. The first stage was realized. *The second stage*: Visits to pedagogical faculties in Serbia, with lectures, demonstrations and distribution of the equipment (the kit with bats and balls). On "Uciteljijada" in 2018, field hockey should become part of competition system. *The third stage* – The presentation of field hockey the University of Kragujevac. On the Dean's Cup 2018 the demonstration of hockey and in 2019 it has to be part of sport competition on Dean's Cup and a try to form a league. *The fourth stage* – the programs of continuous expert seminars for teacher and physical education professors. *The fifth stage* – a visit to the Faculties of Sport and Physical Education in Leposavic, Nis, Beograd and Novi Sad. Realisation 2019/2020/ After the fifth stage the students of teachers' and pedagogical faculties (seven faculties) would be familiar with hockey, the students of University of Kragujevac (12 faculties), the students of

sport and physical culture (four faculties), teachers in primary and secondary schools in central Serbia. This would influence founding of University League in 2019/2020 and eventual inter university league in 2020/2021.

Conclusion

Field hockey has never had adequate facilities as some other sports. The development of field hockey in Serbia can be started only by the enthusiasts who keep this sport from extinction and oblivion with the help of students and professors of Faculty of Sport and Physical Education in Serbia. The basic directions of the development of the field hockey in Serbia are presented in the Forum of Eastern European countries held in 2017 in Jagodina and accepted by EHF.

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HOKEJ NA TRAVI NEKADA I SADA U SRBIJI

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Uvod

Hokej na travi ima bogatu tradiciju, jer svoje poreklo vuče iz najstarijih vremena ljudskog društva i može se reći da je jedna od najstarijih igara u istoriji ljudskog društva, a igrao se pomoću štapa i lopte, odnosno nekog okruglog predmeta (kamena, drveta, klupka dlake, kože i slično). Prve tragove o hokeju na travi pronađeni su u Egiptu pre 4000 godina, o čemu svedoči reljef pronađen u grobnici u selu Beni Hasan. Prikazana su dva igrača sa palicama u borbi za lopticu, a slična igra prikazana je na kamenorezima iz 500. godine p. n. e. u staroj Grčkoj. Ovo potkrepljuje podatak koji govori da su antičke igre sadržavale igru palicom i lopticom koju nazivamo hokej. Gali na području današnje Irske igraju hurling. Iako ga mnogi smatraju pretečom hokeja na travi, on se i danas igra u Velikoj Britaniji, Americi, Australiji, u nekim afričkim i južnoameričkim državama tako da se može nazvati najstarijim ekipnim sportom kojim se ljudi i danas bave.

Hokej na travi je ekipni sport koji ravnopravno igraju muškarci i žene, u kojem igrači svakog od dva tima pokušavaju da postignu pogodak udaranjem ili guranjem loptice palicom u protivnički gol. Zvanično ime ovog sporta u svetu je hokej i to je uobičajeno ime za njega u mnogim zemljama. Termin hokej na travi koristi se u zemljama gde se pod terminom hokej podrazumevaju druge forme hokeja. Hokej na travi se tradicionalno igrao na travnatim površinama po čemu je i dobio ime, međutim vremenom se prelazilo na veštačke travnjake, a od 1970. godine pa nadalje, hokej se igrao na veštačkim travnjacima položenim na pesku jer se time dobijalo na ubrzanju i dinamici igre. Poslednjih godina pesak je zamenjen vodom, čime se omogućava brži prenos lopte, a smanjio se i broj povređivanja igrača.

Hokej na travi je olimpijska disciplina koja se igra na pet kontinenata. Treći je sport na svetu po popularnosti i egzistira kao profesionalni, amaterski, školski, rekreativni sport i sport invalida. Ovaj olimpijski sport se igra štapom i lopticom na podlozi od veštačke trave. Teren je dimenzija 91,4 m x 55 m (100 x 60 jardi), a veličina golova je 2.14 m (7 stopa) visine i 3.66 m (12 stopa) širine. Ispred gola se nalazi polukružna linija na udaljenosti od 14.63 m (16 jardi), koja označava dozvoljenu zonu za šutiranje na gol. Teren je izdvojen na četvrtine linijama koje se nalaze na 22.90 m (25 jardi) od poslednje linije. Ekipe se sastoje od 16 igrača, od kojih su 10 igrača i jedan golman na terenu, a pet ostalih igrača je na klupi. Igraju se dva poluvremena od po 35 minuta između kojih je pauza od pet minuta (Forni, 2007). Igrači udaraju lopticu licem štapa ili delom drške koji se nastavlja na lice i pokušavaju da ubace lopticu u protivnički gol. Jedno od najvažnijih pravila odnosi se na to da je dozvoljeno igranje samo jednom stranom palice, koja ima jednu ravnu stranu. Dozvoljena je upotreba palice koja odgovara dešnjacima, odnosno kod kojih forhend udarac ide sa desna na levo. Bekhend udarac, obzirom da nije dozvoljeno udarati lopticu drugom stranom palice, izvodi se okretanjem palice oko svoje ose za približno 180 stepeni i zamahom sa leva na desno.

Danas hokej spada među najrasprostranjenije sportove u svetu sa 137 nacionalnih asocijacija, od kojih 43 u Evropi. U nekim zemljama kao što su Indija i Pakistan hokej je nacionalni sport, dok je u nekim kao što su Holandija, Nemačka, Argentina, itd. jedan od najpopularnijih. Hokej na travi na prošlom svetskom prvenstvu za žene u Londonu po broju prodatih ulaznica predstavlja najveće sportsko takmičenje za žene u istoriji.

Svetska hokejaška federacija (FIH) je globalna organizacija hokejaškog sporta. Ona organizuje takmičenja kao što je Svetsko prvenstvo, a Komitet za pravila FIH-a propisuje pravila hokeja. Hokejaške asocijacije su dalje organizovane preko kontinentalnih i nacionalnih federacija.

Mnoge zemlje imaju razvijena klupska takmičenja sa velikim brojem igrača u svim kategorijama i sa profesionalnim ligama. Hokejom se u svetu bavi ogroman broj igrača i svetska federacija predstavlja drugu najveće gransku sportsku asocijaciju prema broju nacionalnih asocijacija (posle fudbalske). Visok kvalitet igre raspoređen je podjednako, za razliku od većine sportova, po celom svetu i na svim kontinentima.

Cilj rada je bio da se istraži razvoj hokeja u Srbiji do danas i daju neke od preporuka za dalji razvoj hokeja na travi i dvoranskog hokeja u Srbiji.

Metod

Za prikupljanje relevantnih podataka korišćena je arhivska građa jugoslovenskog i srpskog saveza hokeja na travi, kao i evropske hokejaške federacije. Od metoda korišćena je analiza sadržaja.

Rezultati sa diskusijom

Moderna igra hokeja nastala je u državnim školama u Engleskoj početkom 19. veka, tako da se u Londonu 1861. godine formira prvi muški hokej klub Blekhit (*Blackheat*), a 1886. osniva se Londonsko hokejaško udruženje. Englezi su ovaj sport doneli u Indiju, Pakistan, Australiju, gde je brzo stekao veliku popularnost, tako da su se prve međunarodne utakmice igrane već od 1895. godine. Početkom dvadesetog veka najmasovniji je u Indiji, Pakistanu i Avganistanu gdje je i nacionalni sport. Prvobitna pravila hokeja na travi dozvoljavala su i mešovite ekipe, odnosno da u istoj ekipi mogu igrati i muškarci i žene, pa je to uticalo na povećanje popularnosti ove igre (u nekim ženskim školama hokej na travi je bio obavezan predmet).

Postaje olimpijski sport za muškarce 1908. Na Olimpijadi u Londonu 2012. godine, hokej na travi bio je treći najgledaniji sport. Na Olimpijskim igrama 1928. Indija osvaja zlatnu medalju i dugi niz godina sa Pakistanom zadržavaju dominaciju na međunarodnim nastupima. Ova dominacija biva prekinuta uvođenjem terena sa veštačkom podlogom 1970. godine, čime hokej doživljava značajan preobražaj u pogledu povećanja brzine igre novim tehnikama i taktikama, koje su praćene i novim pravilima. Od sedamdesetih godina primat preuzimaju bogate zemlje poput Holandije, Nemačke i Austrije. Od 1971. godine održava se Svetski kup u hokeju na travi. Žene su se bavile ovim sportom već krajem 19. veka, ali tek od 1974. godine se održavaju takmičenja u ovom sportu u ženskoj konkurenciji u svetskom kupu, a na Olimpijskim igrama od 1980. godine.

U januaru 1896. Franjo Bučar je u časopisu Gimnastika objavio članak „Hockey na ledu“, čiji naslov ne odgovara njegovom sadržaju jer su u njemu opisani elementi tehnike i taktike igranja i pravila hokeja na travi. Iste godine Franjo Bučar je prikazao polaznicima kursa za učitelje gimnastike elemente tehnike i taktike hokeja na travi. Godine 1908. odigrana je prva utakmica u hokeju na travi između kluba „Šišmiš“ i „Concordia“. Tridesetih godina dvadesetog veka hokej počinje da se igra u Srbiji. Prva utakmica između hrvatskih i srpskih klubova odigrana je 1934. između Marathona iz Zagreba i HZMLJ iz Beograda. Godine 1936. u Zagrebu je osnovan Savez hokeja na travi tadašnje Jugoslavije i iste je godine učlanjen u FIH, međunarodni savez hokeja na travi (Radoslav, 1953).

Postoje zapisi da su 1948. godine studenti državnog instituta fiskulture (DIF) pokazno izučavali hokej na travi. Na inicijativu Fiskulturnog odbora Beograda i studenata DIF-a, 1949. formira se hokej klub „Čukarički“ gde je značajnu ulogu i pomoć pri osnivanju imao profesor Živko Vojinović koji je kasnije

obezbeđivao mladi igrački kadar. Prvi nastup HK „Čukarički“ bio je 1. i 2. maja 1949. godine protiv reprezentacije Zagreba, gde je „Čukarički“ igrao pod imenom reprezentacija Beograda.

Iste godine Fiskulturni Savez Omladine Jugoslavije iz Beograda, dekretom je naložio da se u Subotici oformi bar jedan klub hokeja na travi. Budući da je sportsko društvo „Spartak“ u to vreme imalo najviše selekcija i bilo najmasovnije, dekret je upućen na njihovu adresu. Sportsko društvo „Spartak“ je nalog predalo sportskom društvu „Električna Centrala“. Tako je 10.01.1949. formirano Sportsko društvo „Električna centrala“ sa četiri sekcije od kojih je jedna bila i hokejaška. Samo dve godine kasnije od osnivanja Hokej kluba „Električna Centrala“, osnovan je i ženski tim. Sportsko društvo „Električna Centrala“ promeniće ime 15.03.1959. godine u „Elektrovojvodina“. Tokom druge polovine 90-ih godina prošlog veka i prvih deset godina ovog veka ostvario je veoma zapažene rezultate. Danas klub nosi ime „Spartak Elektrovojvodina“. Tih godina u Subotici je bilo trinaest klubova (Pižuljica i sar., 1999).

Zatim se osniva HK „BASK“ 1953. Osoba koja je imala veliki uticaj pri osnivanju kluba je bio Nikola Simić, sin predratnog bankara, koji je pre rata igrao hokej u Francuskoj i bio je prvi trener HK „BASK“. 1954. osniva se i prvi ženski hokejaški klub „Čukarički“. Ovaj primer sledili su i drugi klubovi u Beogradu i Srbiji, pre svih „BASK“ iz Beograda, „Zorka“ iz Subotice i „Tehnolog“ pri sportskom aktivu Hemijske škole u Beogradu. Na taj način stvorena je potrebna konkurencija za ligaško takmičenje. U Hrvatskoj je već postojalo nekoliko klubova. U sezoni 1955/1956. formirana je Savezna liga u kojoj se takmičilo za naslov prvaka Jugoslavije u ženskom hokeju. Ženska ekipa HK „BASK“ dvanaest puta je osvojila prvenstvo Srbije u dvoranskom hokeju i osam puta prvenstvo Srbije u hokeju na travi. Od 1958. u Beogradu postoji šest klubova hokeja na travi i to: Čukarički, Bask, Železnik, Tehnolog, Jugoslavija i Jugostroj. Sledi i osnivanje drugih klubova: Zvezda (1954), Toplana (1958), Zorka (1963), Subotica-trans (1963), Subotičanka (1965), Fidelinka (1966), 29. novembar (1966.), Student (1967.) i Elektrovojvodina (1967). Od 1968. i tokom 80-ih godina u prvenstvu Jugoslavije su postojale dve lige, „Zapad“ Hrvatska i Slovenija i „Istok“ Srbija sa klubovima iz Subotice, Beograda, Novog Sada i Pančeva. Subotica je učestvovala sa devet klubova u tom prvenstvu. U prvenstvu SFRJ, dominaciju sve do 1967. imaju hrvatski klubovi, a 1968. prvenstvo osvaja HK Subotičanka i do 1991. biva jedanaest puta prvak, kada prestaje da se odigrava prvenstvo Jugoslavije. Najznačajniji uspeh jugoslovenske reprezentacije je osvajanje prvog mesta na VIII Mediteranskim sportskim igrama, 1979. u Splitu.

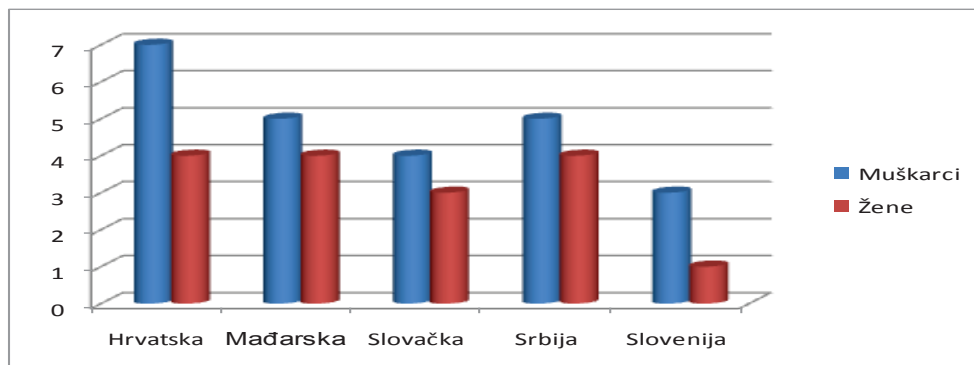
Prvenstvo Jugoslavije u hokeju na travi je najviše takmičenje u hokeju na travi u Kraljevini Jugoslaviji i kasnije u SFR Jugoslaviji. Prvo zvanično prvenstvo u Kraljevini Jugoslaviji održano je 1935. godine i igrano je do početka Drugog svetskog rata. A u SFRJ igra se od 1949. godine, pa sve do raspada Jugoslavije 1991.

Prvenstvo Srbije u hokeju na travi je najviše takmičenje u hokej na travi u Republici Srbiji. Prvenstvo se igra od 1991. godine odnosno od raspada SFRJ. Od 1991. do 2003. nosi naziv Prvenstvo SR Jugoslavije, a od 2003. do 2006. Prvenstvo Srbije i Crne Gore. Nakon raspada Srbije i Crne Gore takmičenje nosi sadašnji naziv. Ligom upravlja Savez hokeja na travi Srbije. U periodu od 1991. do 2013. prvenstvo deset puta osvaja „Zorka Subotica“, sedam puta „Spartak Elektrovojvodina“, dva puta „Sveti Đorđe“, po jednom „Trikoteks Subotica“, „Čukarički“ i „Elektrovojvodina“ Novi Sad.

Trenutna situacija u Evropi i Srbiji može se sagledati brojem klubova i igrača, ali i brojem terena kojih u nekim evropskim zemljama poput Srbije nema.

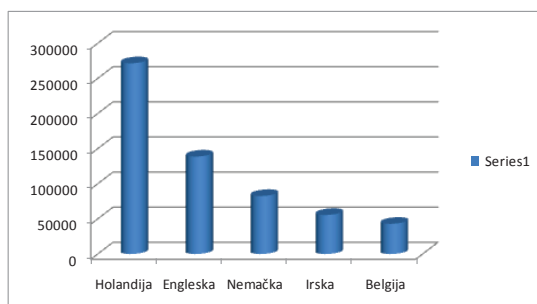
Uvidom u Grafikon 1. možemo uočiti da u zemljama centralnog regiona Evropske Hokejaške Federacije po statističkim podacima iz 2016. postoji mali broj aktivnih klubova u muškoj i ženskoj konkurenciji koji su uključeni u sistem nacionalnog prvenstava. Najveći broj muških klubova je u Hrvatskoj i to sedam, zatim slede Mađarska i Srbija sa po pet, Slovačka sa četiri i Slovenija sa tri. U ženskoj konkurenciji slika je malo drugačija, tako da su Hrvatska, Mađarska i Srbija sa po četiri, Slovačka sa tri i

Slovenija sa jednim, dok se u Bosni i Hercegovini, Crnoj Gori i Makedoniji, hokej na travi nikada nije igrao niti razvio. Pokušano je 2006. i 2007. godine da hokej zaživi u Makedoniji. Nakon svih planova, dogovora, održan je seminar od strane Evropskog razvojnog koordinatora (CDO – Continental Development Officer) Normana Hughesa i Antonia Antonova za dvadeset studenata fakulteta fizičke kulture u Skoplju. Plan je bio da oni šire hokej po Makedoniji, kako bi se oformilo bar pet klubova koji su uslov da se osnuje Makedonski savez hokeja na travi. Nakon toga, Makedonski savez je trebalo učlaniti u EHF – Evropsku hokejašku federaciju kako bi se Makedonski klubovi i reprezentacija mogli uključiti u različita takmičenja (Balkanski kup, Kup prvaka i slično). Sve što je učinjeno ostalo je samo na papiru, bez ijednog aktivnog kluba do današnjih dana.

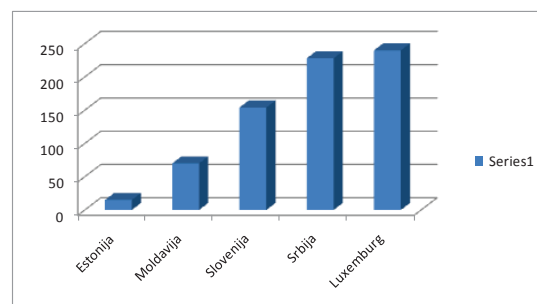


Grafikon 1. Broj muških i ženskih klubova u zemljama centralnog regiona Evropske Hokejaške Federacije iz 2016.

Uvidom u Grafikon 2. možemo konstatovati da je od 43 nacionalna saveza u Evropi najbrojniji Holandski sa 271629 aktivnih igrača. Na drugom mestu je Engleski sa 138807 igrača. Zatim slede Nemački sa 82609 igrača, Irski sa 55650 i na petom mestu Belgijski sa 43000 igrača. Ono što je interesantno da se u tri najbrojnija saveza broj članova povećavao i to: Holandija je 2012. imala 238895 igrača, taj broj se 2014. povećao na 251909 i rast je nastavljen i 2016. sa 271629 igrača. Nešto manji priraštaj je bio u Engleskoj koja je 2012. imala 115165 igrača, 2014. broj je povećan na 120404 i 2016. broj je povećan na 138807. Slična je situacija i u Nemačkoj koja je na kraju 2012. imala 77280, na kraju 2014. imala je 81750 igrača i 2016. povećala na 82609 igrača. Posle ovih pet, sledi Francuska sa 29210 igrača, Škotska sa 20869 igrača, Španija sa 19000, Vels sa 18128 igrača i Turska sa 7964 igrača (FIH 2018).



Grafikon 2. Zemlje sa najvećim brojem igrača



Grafikon 3. Zemlje sa najmanjim brojem igrača

Sasvim drugu sliku dobijamo uvidom u Grafikon 3., gde se Srbija nalazi među pet od 43 zemlje Evrope sa najmanjim brojem aktivnih igrača. Najmanji broj od svega petnaest igrača ima Estonija. Sledi Moldavija sa 70 igrača. Treće mesto sa najmanjim brojem igrača od svega 154 pripada Sloveniji. Srbija sa

228 je na četvrtom mestu sa najmanjim brojem igrača i sledi Luxemburg sa 240. Mali aktivni broj igrača od svega 290 je u Armeniji. Zatim Finskoj 300, Švedskoj 345, Malti 348 i Kipru 370. Od zemalja Jugoistočne Evrope gde pripada i Srbija, najveći broj klubova i 7964 igrača ima Turska, zatim sledi Bugarska koja je za pet godina osnovala 25 klubova i sada je sa 3020 igrača. Ono što je evidentno da je najveći pad u broju igrača u Rusiji sa 5077 u 2012. godini na 3650 u 2016. Slična situacija je i u Ukrajini koja je sa 3070 igrača u 2014 već 2016. imala samo 1674 igrača. Sve navedeno se može pripisati materijalno-prostornim uslovima tj. finansijskim situacijama u nacionalnim savezima koji ne mogu da obezbede lokacije i adekvatne, sada veštačke podloge za terene.

U poslednjih godina u Srbiji su se desili mali pomaci u okviru formiranja novih klubova. U Bosilegradu je osnovan klub HK „Mladost“, u Subotici HK „Spartak“. Na pedagoškom Fakultetu u Jagodini 8.2.2018. formiran je HK „Sreten Adžić“ od studenata Fakulteta, koji od jeseni 2017. učestvuje u prvenstvu Srbije. Sve je počelo 16.6.2017. kada je prof Živorad Marković bio gost profesorima Antoniju Antonovom na Nacionalnoj sportskoj akademiji „Vasil Levski“. U oktobru 2017. prof Antonov uzvraća posetu uz predavanje i pokazni trening, ujedno Fakultetu poklanja palice i lopte. Od tada hokej postaje studentima najinteresantniji vid aktivnosti. Jagodina je 3.11.2017. bila domaćin Forumu za razvoj hokeja Jugoistočne Evrope na kome učestvuju predstavnici sedam zemalja. Prof Marković je upoznao predstavnike šta je do tada učinjeno i predstavio plan razvoja hokeja na Univerzitetu. Razvoj hokeja na Univerzitetu planiran je u nekoliko faza: Prva faza - formiranje muške i ženske ekipe na Fakultetu i promocija na učiteljjadi u Somboru u maju 2017. Prva faza realizovana. Druga faza - posete učiteljskim fakultetima u Srbiji, gde bi se održalo predavanje, praktični prikaz i podelila oprema (komplet palica sa loptama). Na Učiteljjadi 2018. uvrstiti hokej u sistem takmičenja. Treća faza - prezentacija hokeja na Kragujevačkom Univerzitetu. Na KUPU Rektora 2018. prikaz hokeja, a 2019. uvrstiti ga kao sport na KUPU Rektora i pokušaj formiranja lige. Četvrta faza - akreditovati program stalnog stručnog usavršavanja za učitelje i profesore fizičkog vaspitanja. Peta faza - poseta fakultetima sporta i fizičkog vaspitanja u Leposaviću, Nišu, Beogradu i Novom Sadu. Realizacija 2019/2020. Nakon pete faze sa hokejom bi bili upoznati studenti učiteljskih i pedagoških fakulteta (7 fakulteta), studenti Kragujevačkog Univerziteta (12 fakulteta), studenti fakulteta sporta i fizičkog vaspitanja (4 fakulteta), učitelji, nastavnici i profesori osnovnih i srednjih škola centralne Srbije. Navedeno bi uslovalo formiranje Univerzitetske lige 2019/2020. i eventualno međuuniverzitetske 2020/2021.

Zaključak

Hokej na travi nikada, a ni sada nije imao adekvatne uslove kao što su to imali drugi sportovi. Razvitak hokeja u Srbiji mogu da pokrenu samo entuzijasti koji čuvaju ovaj sport od gašenja i zaborava uz pomoć studenata i profesora fakulteta sporta i fizičkog vaspitanja u Srbiji. Osnovne smernice razvoja Hokeja na travi u Srbiji prezentovane su na Forumu zemalja Jugoistočne Evrope održanog 2017. u Jagodini i prihvaćene od EHF.

Napomena: Rad je realizovan u okviru projekta „Efekti primenjene fizičke aktivnosti na lokomotorni, metabolički, psiho-socijalni i vaspitni status populacije R Srbije“ pod brojem III47015, a kao deo potprojekta „Efekti primenjene fizičke aktivnosti na lokomotorni, metabolički, psiho-socijalni i vaspitni status školske populacije R Srbije“ koji se finansira od strane Ministarstva za prosvetu, nauku i tehnološki razvoj R Srbije – Ciklus naučnih projekata 2011-2018.

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