



# SPORTSKE NAUKE I ZDRAVLJE

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# SPORTSKE NAUKE I ZDRAVLJE

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siz@siz-au.com  
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Pan-European University "Apeiron"  
Pere Krece 13, 78000 Banja Luka,  
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*Ako činjenice ne odgovaraju teoriji,  
promijenite činjenice.*  
Albert Ajnštajn

*If the facts don't fit the theory,  
change the facts.*  
Albert Einstein

**Poštovani čitaoci,**

sa velikim zadovoljstvom vam predstavljamo novi broj Časopisa "Sportske nauke i zdravlje", gdje možete pročitati zanimljive radove autora iz zemlje i regiona. Možemo reći da je iza nas još jedna uspješna radna godina i ponosni smo da časopis izlazi već devetu godinu zaredom.

U novom broju časopisa možete pronaći radove o motivaciji učenika u nastavi fizičkog vaspitanja, procjeni mentalnog stanja takmičara u vrhunskom sportu, fizičkoj aktivnosti učenika u slobodno vrijeme, sprintu kod fudbalera u različitim nivoima takmičenja, uticaju određenih tretmana na status lokomotornog sistema, uticaju treninga na motoričke sposobnosti odbojkaša, te stavovima nastavnika o nadarenosti učenika.

Nadamo se da smo ovim brojem zadovoljili interesovanja šire čitalačke populacije i ujedno pozivamo sve kolege da u narednom periodu učestvuju u radu Časopisa, slanjem naučnih radova. Sve sugestije i komentari su dobrodošli i zahvaljujemo se svim dobronamjernim kolegama na saradnji.

Uredništvo će se zajedno sa vama truditi da još više poboljša kvalitet samog Časopisa.

Želimo svima srećnu i uspješnu novu 2020. godinu!

UREDNIŠTVO ČASOPISA

**Dear readers,**

It is our great pleasure to introduce you to the new issue of Sports Sciences and Health, where you can read interesting articles by authors from the country and the region. We can say that another successful working year is behind us and we are proud that the Journal has been published for the ninth year in a row.

In the new issue of the journal you can find papers on the motivation of students in physical education lessons, assessing the mental state of competitors in top sports, physical activity of students in leisure time, football players sprint at different levels of competition, the impact of certain treatments on the status of the locomotor system, the impact of training on motor skills of volleyball players, and teachers' attitudes about student talent.

We hope that with this issue we have satisfied the interests of the broader reading population and at the same time we invite all colleagues to participate in the work of the Journal in the coming period, by submitting scientific papers. All suggestions and comments are welcome and we thank all our kind colleagues for their cooperation.

The Editorial Board will work with you to further improve the quality of the Journal itself.

We wish everyone a happy and successful New Year 2020!

EDITORIAL BOARD OF THE JOURNAL

# PARTICIPATING IN KINESIOLOGY ACTIVITIES IN PRIMARY EDUCATION STUDENTS' FREE TIME

LEONA ROCA, MARKO BADRIĆ

Faculty of Education of the University of Zagreb, Republic of Croatia

## Correspondence:

Marko Badrić, Faculty of Education of the University of Zagreb, Republic of Croatia

marko.badric@ufzg.hr

**Abstract:** The objective of the research was to investigate to what extent students of first and second grades of primary school participate in physical activities in their free time. We are living in the age of sedentary lifestyle, which is becoming a problem of public health. 189 respondents took part in this research of which 93 girls and 96 boys aged 7 to 9. To assess the level of students' activity in their free time, a poll was used consisting of eight questions from the questionnaire "Fels physical activity questionnaire for children" (FPAQ). Based on queries from the questionnaire, indices were calculated from the area of sports (IS), free time (ISV; household chores (IKP) and total physical activity result (UTA). To assess body composition, anthropometric measures of height, mass, BMI and percentage of fat in the body were used. To assess those, we used the device for measuring physical composition – Omron BF500 Body Composition Monitor. Results indicate that 59.26% do not meet daily recommendations for participating in physical activities. As regards the difference in students' age, it is notable that second grade students are somewhat more physically active. Observing average results, it is clear that students were most physically active in their free time. The lowest values were recorded in the area of sports at school, (1.15), yet lower values were also obtained from sports club activities (2.06). It is evident that students of that age are minimally active during their PE classes and this is a segment where the number of physically active students can be increased. Increasing physical activity at school shall encourage students to participate in physical activity outside educational institutions.

**Key words:** obesity, free time, school, physical activity, students

## INTRODUCTION

World Health Organization (WHO, 2010) recommends that all young people aged 5 to 17 should participate in at least 60 minutes of moderate to intense physical activity every day, i.e. above three MET. One subjective way of assessing the intensity of physical activity is the metabolic equivalent of task (MET), also defined as the ratio between energy expenditure and rate of rest (Perez-Soto et al., 2018). Time spent in physical activity has great repercussions for the future health of children and youth. Insufficient physical activity in children and youth negatively affects the development of their abilities, skills and knowledge, as well as health status (Badrić and Ravlić, 2017). In recent years, promoting physical activity in adults and children has become important for social activities as well. Current policies and strategies for increasing physical activity with children have been promoting a multicomponent approach with various intervention aspects in different surroundings (Payne, Townsend and Foster, 2013). A healthy lifestyle learned from the earliest childhood remains present to adulthood (Karnik and Kanekar, 2012). Regular physical activity is the only acquired habit aiding in reducing the risk of obesity (Simon et al., 2014). Nowadays, young people tend to choose activities which do not require any physical effort at all, and due to latest technological achievements spend their time using a wide range of passive content. Using such passive content is detrimental, primarily for the health of a young person from his or her early days and neglecting a whole series of abilities which simply cannot be developed when participating in said activities (Badrić and Prskalo, 2011). Sadly, nowadays one is not able to independently create their free time, and global communication services act aggressively towards their consumers, overwhelming them with irrelevant information and thus alienating from independently organizing their free time, placing a person in a passive state (Badrić, Prskalo and Matijević, 2015). Among school obligations, work and leisure, children do have some free time, which, without proper guidance, is often misused. The school system does not provide enough physical activity through classes, which is why it is necessary for a child to participate in an organized or independent physical activity so as to reach the level required for health sustainability. (Badrić, 2011).

The objective of the research was to investigate to what extent students of first and second grades of primary school participate in physical activities in their free time and whether there are any differences as regards sex and age.

## METHODS

189 respondents took part in this research of which 93 girls and 96 boys aged 7 to 9. Respondent sample included students from three primary school from the town of Petrinja. All students were in perfect health at the time the research was carried out. All parents gave their written consent for students participating in the research. Measuring was conducted from the 28th of April to the 31st of May 2019. All research procedures were conducted within the scope of regular PE classes. Physical activity level was assessed using Fels physical activity questionnaire for children (Fels PAQ for children, Treuth, Hou, Young and Maynard, 2005), a standardized questionnaire used to assess the level of physical activity with children and teenagers aged 7 to 19. Physical activity level of a person is determined through three types of activities, namely sports, free time and household chores, thus assessing the total physical activity level. The sample of morphological variables comprised anthropometric measurements of height and mass. Height was measured using the anthropometer. The researched utilized a device for measuring bodily composition – Omron BF500 Body Composition Monitor. This is an instrument which determined the percentage of fat tissue via bioelectric impedance. It was used to measure body mass, body mass index and the percentage of fat in the body.

All variables had central and dispersive elements calculated: arithmetic mean (X), standard deviation (SD), minimum result (MIN), maximum result (MAX). Variable distribution normality was tested via the Kolmogorov-Smirnov test (K-S test). Differences in physical activity between students according to sex and age was determined using the Mann-Whitney U test. Statistical relevance was tested on the level of  $p < .05$ . Data processing was conducted using the programme STATISTICA version 13.4.0.14., TIBCO Software Inc.

## RESULTS

**Table 1.** Values of total level of physical activity for boys and girls in 1st and 2nd grades on a Likert scale

	Physical activity level %				
	1	2	3	4	5
total	0,53	1,06	57,67	37,04	3,70
boys		2,08	50,00	40,63	7,29
girls	1,08	0	65,59	33,33	0

(Treuth et al., 2005), 1, 2 and 3 insufficient physical activity level, 4 and 5 recommended physical activity level

Table 1 shows that the total level of physical activity for the subsample defined by sex did not meet the recommendations for (Treuth et al., 2005) participating physical activity. The total of 59.26% students do not meet the recommendations, and when observing results according to sex, 47.92% of boys meet the recommendation in relation to only 33.33% of girls. It should be emphasized that of the total percentage of girls, not one had the highest value of total physical activity.

**Table 2.** Values of total level of physical activity for boys and girls per grade on a Likert scale

Grade	Physical activity level %				
	1	2	3	4	5
1	1,16		60,47	32,56	4,65
2	0	0,97	55,34	40,78	2,91

(Treuth et al., 2005), 1, 2 and 3 insufficient physical activity level, 4 and 5 recommended physical activity level

Values in table 2 show the ratio of students of the defined subsample according to grade. It is clear that second-grade students are somewhat more active: 43.69% in relation to 37.21% of first-grade students.

**Table 3.** Descriptive indicators of morphological characteristics and variables of the questionnaire on the level of physical activity for the total number of respondents.

	N	AS	SD	Min	Max	K-S
Sports at school	189	1,15	0,36	1,00	2,00	$p < ,01$
Sports club	189	2,06	0,92	1,00	5,00	$p < ,01$

Perspiration during activity	189	2,42	1,99	0,00	5,00	p < ,01
Sports in free time	189	3,79	1,27	0,00	5,00	p < ,01
Sedentary in free time	189	2,70	1,15	1,00	5,00	p < ,01
Walking/cycling to school	189	3,01	1,60	0,00	5,00	p < ,01
Household chores	189	2,72	1,01	1,00	5,00	p < ,01
Perspiration during household chores	188	2,14	1,47	0,00	5,00	p < ,01

*N*= number of respondents; *AS*= arithmetic mean; *SD*= standard deviation; *MIN*= minimum result; *MAX*= maximum result; *K-S*=Kolmogorov-Smirnov normality test

The result of Kolmogorov-Smirnov test ( $KS=p < 0,01$ ) demonstrated that the distribution of questionnaire variable results as regards the level of physical activity differs from normal distribution in a statistically relevant level. Observing average results, it is clear that students were most physically active in their free time. They usually walk or cycle to school. The lowest values are recorded in the area of sports at school, (1.15), yet lower values were also obtained from sports club activities (2.06). Increased physical activity was also noticed when doing household chores (2.72).

**Table 4.** Descriptive indicators of physical activity index for boys and girls – total sample

	<b>N</b>	<b>AS</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>	<b>K-S</b>
Sport index	189	1,87	0,91	0,67	4,00	p < ,01
Free time index	189	3,40	1,00	0,00	5,00	p < ,01
Household chores index	189	2,43	0,97	0,50	5,00	p < ,01
Total physical activity	189	7,70	1,92	1,17	12,83	p < ,20

*N*= number of respondents; *AS*= arithmetic mean; *SD*= standard deviation; *MIN*= minimum result; *MAX*= maximum result; *K-S*=Kolmogorov-Smirnov normality test

Table 4 shows average values of physical activity index. Students are most active in their free time, when doing household chores and then during sports activities. Total physical activity averages UTA=7.70. This average result of total physical activity for girls does not enter the framework of recommended physical activity (according to Treuth et al., 2005), which is why it is safe to conclude that this sample of first- and second-grade students is on average insufficiently physically active.

**Table 5.** Differences in variables for assessing physical activity between boys and girls obtained by Mann – Whitney test

	<b>Boys</b>	<b>Girls</b>	<b>M-W test</b>
	<b>96</b>	<b>93</b>	
	<b>AS±SD</b>	<b>AS±SD</b>	
Height	133,22±7,29	131,83±7,41	0,22
Mass	31,65±7,72	30,28±8,04	0,08
Body mass index (BMI)	17,89±3,21	17,50±3,43	0,19
Percentage of fat	20,39±7,20	19,78±8,38	0,38
Sports at school	1,15±0,35	1,15±0,36	0,96
Sports club	2,22±1,01	1,89±0,79	0,02*
Perspiration during activity	2,78±2,17	2,04±1,73	0,02*
Sports in free time	3,95±1,19	3,62±1,33	0,13
Sedentary in free time	2,60±1,29	2,80±1,00	0,27
Walking/cycling to school	3,05±1,59	2,96±1,61	0,69
Household chores	2,68±1,07	2,76±0,95	0,34
Perspiration during household chores	2,30±1,63	1,98±1,28	0,35

\* statistical relevance level  $p < 0.05$ ; *AS*= arithmetic mean; *SD*= standard deviation;

Results shown in table 5 present the comparison of respondents according to sex. Boys are nominally somewhat taller (133,22±7,29) and have greater body mass (31,65±7,72) than girls, which is in line with referent values on the

level of the Republic of Croatia (Jureša et al., 2011). Furthermore, the values of body mass index are also in line with the referent values of that research. A non-parametric Mann-Whitney U-test was used to determine the differences. Statistically relevant differences were noticed in variables estimating participating in sports clubs and during sports activities, where boys ( $p=0.02$ ) are significantly more included in the segment than girls. In variables assessing free time and household chores no statistically significant differences have been determined.

**Table 6.** Differences in physical activity between boys and girls obtained by Mann – Whitney test

	Boys	Girls	
	96	93	
	AS±SD	AS±SD	M-W test
Sport index	2,05±1,00	1,70±0,78	0,00*
Free time index	3,50±0,99	3,29±1,01	0,12
Household chores index	2,49±1,06	2,36±0,85	0,54
Total physical activity	8,04±2,13	7,35±1,62	0,02*

\* statistical relevance level  $p<0.05$ ; AS= arithmetic mean; SD= standard deviation;

Results of differences in physical activity between students of defined subsamples according to sex are shown in table 6. Boys are statistically more relevantly physically more active in the area of sports and total physical activity. Studied subsamples in the areas of free time and household chores do not differ significantly and their values are nominally on the same level.

**Table 7.** Differences in variables for assessing physical activity and morphological variables between students according to grade obtained by Mann – Whitney test

	1st grade	2nd grade	
	86	103	
	AS±SD	AS±SD	M-W test
Height	128,66±6,15	135,77±6,73	0,00*
Mass	28,62±5,45	32,94±9,02	0,00*
Body mass index (BMI)	17,39±2,74	17,96±3,73	0,66
Percentage of fat	20,16±6,62	20,03±8,67	0,58
Sports at school	1,14±0,35	1,16±0,36	0,76
Sports club	2,08±0,94	2,04±0,91	0,89
Perspiration during activity	2,31±1,97	2,50±2,02	0,64
Sports in free time	3,85±1,37	3,74±1,19	0,31
Sedentary in free time	2,40±1,19	2,95±1,06	0,00*
Walking/cycling to school	2,94±1,65	3,06±1,56	0,63
Household chores	2,64±0,94	2,79±1,06	0,38
Perspiration during household chores	2,10±1,53	2,18±1,43	0,56

\* statistical relevance level  $p<0.05$ ; AS= arithmetic mean; SD= standard deviation;

Results presented in table 7 show that there are statistically relevant differences according to respondents' ages. Second-grade students are significantly taller ( $p=0,00$ ) and their body mass is bigger ( $p=0,00$ ), which is to be expected in line with the development of human organism, as they are older. Also, the non-parametric Mann-Whitney U-test has shown that there are statistically significant differences in the variable assessing to what extent children are sedentary in their free time. It is evident that second-grade students spend much more time sitting than their first-grade peers. ( $p=0,00$ ).



**Table 8.** Differences in physical activity according to grade obtained by Mann – Whitney test

	1st grade	2nd grade	
	86	103	
	AS±SD	AS±SD	M-W test
Sport index	1,84±0,92	1,90±0,91	0,55
Free time index	3,40±1,05	3,40±0,97	0,83
Household chores index	2,37±0,93	2,47±1,00	0,63
Total physical activity	7,61±2,00	7,77±1,87	0,45

AS= arithmetic mean; SD= standard deviation

Results of differences in physical activity between students of defined subsamples according to age are shown in table 6. Studied subsamples in the areas of sports, free time, household chores and total physical activity do not differ statistically and their values are nominally on the same level.

### DISCUSSION

When observing the results assessing the total physical activity of students, it is evident that almost 59% of the sample of first and second grade students fail to meet the recommendations according to Treuth et al. (2005). Moreover, 52% of boys and 67% of girls are not physically active, which is alarming considering the state of health in the population of children and youth. Research carried out by Kunješić (2015) obtained similar results, concluding that most children do not participate in physical activity in recommended daily dosage. Data obtained by research (Currie et al., 2012) conducted in 2009/2010, shows devastating results with a high percentage of insufficiently physically active children. Research by Badrić and Ravlić (2017), obtained higher results, i.e. that 84% of students have a moderate level of physical activity, in line with borderline values as regards meeting daily requirements for physical activity. Another research (Karakas et al. 2014), obtained significantly higher results, confirming that studied children are indeed physically active. Vidaković Samaržija and Mišigoj-Duraković (2016) established that almost 46% of boys and 30% of girls do meet recommended daily needs in terms of physical activity. Kovač et al. (2013) have reached the conclusion that most children meet the recommended values of at least 60 minutes of moderate and high-intensity physical activity per day.

Looking at obtained indices for assessing physical activity, it has been noted that studied students are most active in their free time, confirmed by Kunješić's research (2015). Furthermore, research results (Troiano, Berrigan, Dodd, Tilert, and McDowell 2008) indicate a higher level of physical activity with boys, while Vidaković Samaržija and Mišigoj-Duraković (2016) conclude that boys are more interested in sports than girls, hence more physically active in their free time. Jureša, Musil, Majer and Petrović (2010) obtained similar results in their research, adding that girls are more active than boy sin their free time. Moderate and high-intensity physical activity in free time provides a significant contribution to general health (Ischander et al., 2007).

The lowest values of physical activity are visible in the area of school sports (1.15), but lower values are also recorded for sports club activities (2.06). Increased physical activity is seen in doing household chores (2.72). Opposed to results obtained in this research, Kunješić's research (2015) shows both boys and girls have low values in doing household chores, and somewhat higher in the areas of school sports and sports clubs. Sulema Smolensky and Lai, (2006) as well as Swaminathan, Selvam, Thomas, Kurpad and Vaz (2011) point at low results in school sports, especially in the population of girls. Drop and low values as regards school sports are also confirmed bb research carried out by Sigmund et al. (2012).

Total physical activity averages UTA=7.70. This average result of total physical activity for girls fails to enter the normative framework of recommended physical activity (according to Treuth et al., 2005) and so it can be stated that this sample of first- and second-grade primary school students is on average insufficiently physically active. Kunješić's research (2015) had a bit higher index of total physical activity, yet still far from maximum value of total physical activity.

Physical activity at school has been reducing significantly, what due to the many hours spent sitting, what due to too much homework and studying requiring a specific time spent sitting at home (Petrić, 2011). Children spend most of their day sitting (National Heart Foundation of Australia, 2011) and it would be ideal if we could establish a balance between time spent doing physical activity and time spent sitting. Furthermore, teenage boys do more sports than girls (Guerra et al. 2006), also recorded in research carried out by Badrić and Ravlić (2017).

Differences between the two sexes only occur in the sports variable, in line with previous research, while other research segments showed no significant differences.

As regards differences in terms of age, second-grade students had statistically more significant results in morphological measures of height and body mass. Also, one statistically relevant difference occurred in the variable assessing sedentary behaviour in free time, leading to the conclusion that older students are more prone to sedentary activities than younger students. This fact proves that the negative trend of sedentary lifestyle increases with age.

## CONCLUSION

All previous research, as well as future research into this phenomenon of physical activity with children and youth point at the negative trend in participating in daily physical activity. Insufficient quantity of physical activity in this population is becoming a more and more prominent problem of public health. Physical activity of children in primary education must be primarily directed at the continued implementation of PE classes. It is evident that there is only a minimum of activity of students of that age in PE classes, which is why this segment needs to be the area where we should seek the increase in the number of physically active students. The need for physical activity should be developed from the earliest age. Increase in physical activity at school shall encourage student to participate in physical activity outside educational institutions.

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## UČESTVOVANJE U KINEZIOLOŠKIM AKTIVNOSTIMA U SLOBODNO VRIJEME UČENIKA OSNOVNOŠKOLSKOG UZRASTA

LEONA ROCA, MARKO BADRIĆ  
Edukacijski fakultet, Univerzitet u Zagrebu, Hrvatska

**Apstrakt:** Cilj istraživanja bio je istražiti u kojoj mjeri učenici prvih i drugih razreda osnovne škole u slobodno vrijeme učestvuju u fizičkim aktivnostima. Živimo u vrijeme sjedilačkog načina života, koji postaje problem javnog zdravlja. U ovom istraživanju učestvovalo je 189 ispitanika, od čega 93 djevojčice i 96 dječaka, uzrasta od 7 do 9 godina. Za procjenu nivoa aktivnosti učenika u njihovom slobodnom vremenu korištena je anketa koja se sastojala od osam pitanja iz upitnika „Osjećajni upitnik fizičke aktivnosti za djecu” (FPAQ). Na temelju pitanja iz upitnika izračunati su indeksi iz područja sporta (IS), slobodnog vremena (ISV), kućnih poslova (IKP) i ukupnog rezultata fizičke aktivnosti (UTA). Da bi se procijenio sastav tijela, antropometrijske mjere visine, težine, BMI i postotak masti u tijelu, korišten je uređaj za mjerenje fizičkog sastava - Omron BF500 Monitor tijela. Rezultati pokazuju da 59,26% ne ispunjava dnevne preporuke za učestvovanje u fizičkim aktivnostima. Što se tiče razlike u uzrastu učenika, primjetno je da su učenici drugog razreda malo fizički aktivniji. Posmatrajući prosječne rezultate, jasno je da su učenici bili najviše fizički aktivni u slobodno vrijeme. Najniže vrijednosti zabilježene su u području sporta u školi (1,15), dok su niže vrijednosti zabilježene i iz aktivnosti sportskih klubova (2,06). Očigledno je da su učenici tog uzrasta minimalno aktivni tokom nastave fizičkog vaspitanja i to je segment u kojem se broj fizički aktivnih učenika može povećati. Povećavanje fizičke aktivnosti u školi će podstaći učenike i na učestvovanje u fizičkim aktivnostima van obrazovnih ustanova.

**Ključne riječi:** gojaznost, slobodno vrijeme, škola, fizička aktivnost, učenici

## THE EFFECTS OF PROGRAMMED KINESIOLOGICAL TREATMENT ON CORRECTION OF KYPHOSIS AND FLAT FEET DEFORMITY IN PUPILS

BRANIMIR MIKIĆ<sup>1</sup>, SENAD BAJRIĆ<sup>2</sup>, IVANA ČERKEZ-ZOVKO<sup>1</sup>,  
MIRAN PEHAR<sup>1</sup>, ZORICA STANKOVSKA<sup>3</sup>

<sup>1</sup>FPMOZ- University in Mostar, Mostar BiH

<sup>2</sup>PanEuropean University "Apeiron", Banja Luka, BiH,

<sup>3</sup>Independent researcher, Skopje, North Macedonia

### Correspondence:

Branimir Mikić

FPMOZ – University in Mostar, Mostar, BiH

branutuzla@gmail.com

**Abstract:** The aim of this study was to determine the effects of programmed kinesiological treatment on transformation of postural spinal status in the sagittal plane - kyphosis and flat feet - pes planus, in IV to VI grade pupils (second triad of nine-year elementary school). The study was conducted on a 290 pupil sample.

Eight (8) variables were applied in the study to evaluate postural spine status - kyphosis and flat feet - pes planus. The research had a longitudinal character. The use of contingent tables shows the frequencies and the corresponding percentages increase the deformity of the spine - kyphosis and flat feet - pes planus.

The results of the study indicate the statistical significance of the percentage of deformity of the kyphosis and flat feet - pes planus. Changes in the arch of the feet and spine are mainly in the first stage of deformation, which also enabled the correction of the condition with the application of programmed kinesiological treatment.

Therefore, in the global assessment of the quality and justification of the use of programmed kinesiological treatment for one school year, we must state that it contributed to the improvement of the deformity of the kyphosis and the flat feet of the research sample of pupils.

**Keywords:** pupils, correction, postural status, kyphosis, pes planus.

### INTRODUCTION

Modern lifestyles, with all the dangers of morbid trias (insufficient movement, poor nutrition and stress), for children in development, longer lasting session at school and at home, excessive demands in the segment of intellectual workload require intervention in the direction

## EFEKTI PROGRAMIRANOG KINEZILOŠKOG TRETMANA NA KORIGIRANJE DEFORMITETA KIFOZE I RAVNOG STOPALA KOD UČENIKA

BRANIMIR MIKIĆ<sup>1</sup>, SENAD BAJRIĆ<sup>2</sup>, IVANA ČERKEZ-ZOVKO<sup>1</sup>,  
MIRAN PEHAR<sup>1</sup>, ZORICA STANKOVSKA<sup>3</sup>

<sup>1</sup>FPMOZ- Sveučilište u Mostaru, Mostar BiH

<sup>2</sup>Panevropski Univerzitet "Apeiron", Banja Luka, BiH

<sup>3</sup>Neovisni istraživač, Skopje, Sjeverna Makedonija

### Korespondencija:

Branimir Mikić

FPMOZ – Sveučilište u Mostaru, Mostar, BiH

branutuzla@gmail.com

**Apstrakt:** Cilj ovog istraživanja bio je da se utvrde efekti primjene programiranog kineziološkog tretmana na transformiranje posturalnog statusa kralježnice u sagitalnoj ravnini - kifoza i stopala – pes planus, kod učenika od IV do VI razreda (druge trijade devetogodišnje osnovne škole). Istraživanje je provedeno na uzorku od 290 učenika.

U istraživanju je primjenjeno osam (8) varijabli za procjenu posturalnog statusa kralježnice – kifoza i stopala – pes planus. Istraživanje je imalo longitudinalni karakter. Primjenom kontingencijskih tablica prikazane su frekvencije i pripadajući postotci pojave deformiteta kralježnice – kifoza i stopala – pes planus..

Dobijeni rezultati istraživanja ukazuju na statistički značajan postotak deformiteta kralježnice – kifoza i stopala – pes planus. Promjene na svodovima stopala i kralješnici su uglavnom u prvom stupnju deformacije, što je i omogućilo značajno korigiranje stanja uz primjenu programiranog kineziološkog tretmana.

Dakle, u globalnoj procjeni kvaliteta i opravdanosti primjene programiranog kineziološkog tretmana u trajanju od jedne školske godine, može se konstatirati da je isti doprinjeo poboljšanju stanja deformiteta kifoze i stopala istraživnog uzorka učenika.

**Ključne reči:** učenici, korigiranje, posturalni status, kifoza, pes planus.

### Uvod

Moderan način života, sa svim opasnostima morbidnog trijasa (nedovoljno kretanje, pogrešna ishrana i stres), kod djece u razvoju pojačan još dugotrajnim sjedenjem u školi, ali i kod kuće, te pretjeranim zahtjevima u segmentu intelektualnog opterećenja, zahtjeva dodat-

of prevention. It is a well-known fact that sports activities can be strong tool against the intellectual overload of students, and today we have pure physical deformity of children and thus the expansive appearance of deviant behavior in and out of school. The only question is, do we make enough use of this segment of activity?

The specificity of physical and health education stems not only from its goals and tasks, content of work, methods of work, methodological and organizational forms of work, but also from the fact that such teaching is basically a polyvalent process. That is why physical and health education teaching on the one hand is expected to influence the transformation of anthropological characteristics of students and on the other hand contributes to their upbringing and education.

Through the development of its species - phylogeny, man gradually evolved and finally reached a two-legged upright posture. This period lasted several millennia. This attainment is still the youngest and is definitely not finished, as indicated by the presence of postural disorders of the spine and feet (Mikić and Bjeković, 2004).

This is further evidence that we have not yet adapted to the new conditions of life. This undoubtedly leads to impaired adaptation and pathological manifestations, especially in developing children.

Proper postural position is taking less and less place in children's daily activities. Improper seating, standing, inadequate bed and sleeping cushion, various forms of movement activity as well as certain endogenous factors, systematically affect the spine, causing loads that often exceed the soft tissue tolerance zone of the spine, without causing major damage, but by cumulative action through repetitive and prolonged tissue positions and movements experience some deformation in terms of their morphology and function. There is a shortening or weakening of certain muscles, which leads to muscular imbalance, which is the main pattern for the appearance and development of poor posture, i.e. physical deformities (Kosinac, 1995).

The aim of this study is to determine the effects of programmed kinesiological treatment on the correction of spinal deformity - kyphosis and flat feet - pes planus in pupils of the second triad of nine-year elementary school (IV-VI grades).

## METHOD OF WORK

### *Sample of respondents*

The sample of respondents was defined by the population of pupils of IV, V and VI grades of primary

no interveniranje u pravcu prevencijskog ili, nikad nije kasno, i kurativnog dejstva gore pomenutih čimbenika. Poznata je činjenica, da upravo sportske aktivnosti mogu biti jaka protivteža intelektualnom preopterećenju učenika, pojavi danas tako čestih tjelesnih deformiteta djece i takoreći ekspanzivnoj pojavi devijantnog ponašanja u školi i van nje. Pitanje je samo, da li dovoljno koristimo ovaj segment aktivnosti?

Specifičnost nastave tjelesnog i zdravstvenog odgoja proizilazi ne samo iz njenih ciljeva i zadataka, sadržaja rada, metoda rada, metodičko-organizacijskih oblika rada, nego i iz činjenice što ta nastava u osnovi predstavlja polivalentan proces. Zato se od nastave tjelesnog i zdravstvenog odgoja s jedne strane očekuje da utječe na transformaciju antropoloških obilježja učenika, a s druge strane da doprinosi njihovom odgoju i obrazovanju.

Čovjek je kroz filogenezu postupno evoluirao i došao najzad do dvonožnog uspravnog stava. To razdoblje trajalo je nekoliko milenijuma. Ta tekovina je još uvijek najmlađa i definitivno nije završena, na šta ukazuje i prisutnost posturalnih poremećaja na kralješnici i stopalima (Mikić i Bjeković, 2004.).

To je još jedan od dokaza da se još uvek nismo adaptirali na novonastale uvjete života. To neosporno dovodi do slabljenja adaptiranja i patoloških pojava naročito kod djece u doba razvoja.

Pravilan posturalni položaj sve manje zauzima svoje mjesto u dječijim svakodnevnim aktivnostima. Nepravilna sjedenja, stajanja, neadekvatan krevet i jastuk za spavanje, različiti oblici kretnih aktivnosti kao i određeni endogeni čimbenici, sustavno djeluju na kralješnicu, čime izazivaju opterećenja koja često prelaze zonu tolerantnosti mekih tkiva kralješnice, ne ostvarujući veća oštećenja, ali kumulativnim djelovanjem kroz ponavljajuće i dugotrajne položaje i pokrete tkiva doživljavaju određeno deformiranje u pogledu svoje morfologije i funkcije. Dolazi do skraćanja ili slabljenja određene muskulature što samim tim dovodi do mišićnog disbalansa, koji predstavlja glavni uzrok za pojavu i razvoj lošeg držanja tijela, odnosno tjelesnih deformiteta (Kosinac, 1995.).

Cilj ovog istraživanja je utvrđivanje efekata programiranog kineziološkog tretmana na korigiranje deformiteta kralješnice - kifoze i ravnog stopala- pes planus učenika druge trijade devetogodišnje osnovne škole (IV-VI razreda).

## METOD RADA

### *Uzorak ispitanika*

Uzorak ispitanika definiran je populacijom učenika IV, V i VI razreda osnovnih škola, na području općina

schools in the municipalities of Kalesija, Živinice and Tuzla. The study was conducted on a sample of 290 pupils of the third triad of nine-year primary school. The sample of students is structured from 91 fourth-grade, 98 fifth-grade and 101 sixth-grade pupils.

### **Sample variables**

The measurement instrument for this study is composed of 8 variables to assess the postural status of the spine and the flat feet of the pupils.

#### **Variables to assess postural spine and flat feet status:**

1. KYPHOSIS - kyphosis (normal posture)
2. KYPHOS1 - kyphosis (first degree of deformity)
3. KYPHOS2 - kyphosis (second degree of deformity)
4. KYPHOS3 - kyphosis (third degree of deformity).
5. PESNOR - Normal foot status
6. PESPLA1 - lowered foot (first degree of deformity)
7. PESPLA2 - lowered foot (second degree of deformity)
8. PESPLA3 - lowered foot (third degree of deformity)

### **Measurement description**

To assess the deformity of the spine in the thoracic region, an ultrasound probe was performed, which included the assessment of the following variables: normal posture, kyphosis grade 1, kyphosis grade 2, kyphosis grade 3. The assessment of foot defects was performed using the Footdisc digital computer subgraph, which included the evaluation of the following variables: normal foot status, pes planus I, pes planus II, pes planus III.

### **DATA PROCESSING METHODS**

Using the contingency tables, the frequencies and the percentages of the occurrence of spinal deformities and flat feet were shown.

### **Applied corrective exercise program**

The corrective exercise program was implemented 3 times a week for two teaching hours, with an interval of one school year, with a recommendation and instruction that students under parental control take an additional two (2) terms at home.

In the introductory part of the lesson, all subjects worked together (heating and stretching) and were subsequently divided into groups depending on the physical deformities present.

Kalesija, Živinice i Tuzla. Istraživanje je provedeno na uzorku od 290 učenika II trijade devetogodišnje osnovne škole. Uzorak učenika je strukturiran od 91 učenika četvrtih razreda, od 98 učenika petih razreda i 101 učenika šestih razreda.

### **Uzorak varijabli**

Mjerni instrument za ovo istraživanje sastavljen je od 8 varijabli za procjenu posturalnog statusa kralježnice i stopala učenika.

#### **Varijable za procjenu posturalnog statusa kralježnice i stopala**

1. KIFOZNO – kifoza (normalno držanje tijela)
2. KIFOZ1 - kifoza (prvi stupanj deformiteta)
3. KIFOZ2 - kifoza (drugi stupanj deformiteta)
4. KIFOZ3 - kifoza (treći stupanj deformiteta).
5. PESNOR – normalan status stopala
6. PESPLA1 – spušteno stopalo (prvi stupanj deformiteta)
7. PESPLA2 – spušteno stopalo (drugi stupanj deformiteta)
8. PESPLA3 – spušteno stopalo (treći stupanj deformiteta)

### **Opis mjerenja**

Za procjenu deformiteta kralježnice u grudnom dijelu izvršena je primjenom ultra zvučne sonde što je podrazumijevalo procjenu sljedećih varijabli: normalno držanje tijela, kifoza 1. stupanj, kifoza 2. stupanj, kifoza 3. stupanj. Procjena deformiteta stopala izvršena je primjenom digitalne kompjuterske podografije Footdisc, što je podrazumijevalo procjenu sljedećih varijabli: *normalan status stopala, pes planus I, pes planus II, pes planus III.*

### **METODE OBRADE PODATAKA**

Primjenom kontigencijskih tablica prikazane su frekvencije i pripadajući postoci pojave deformiteta kralježnice i stopala ispitanika.

### **Primjenjeni program korektivnog vježbanja**

Primjenjeni program korektivnog vježbanja bio je sproveden 3 x sedmično u trajanju od dva nastavna sata, u vremenskom intervalu od jedne školske godine, preporukom i uputstvom da učenici pod kontrolom roditelja kući upražnjavaju još dodatna dva (2) termina.

U uvodno pripremnom dijelu sata, svi ispitanici su radili zajedno (zagrijavanje i strečing), a nakon toga su dijeljeni po grupama u zavisnosti od prisutnih tjelesnih deformiteta.

## Complexes of applied corrective exercises for particular deformities with volume and intensity of work.

### Flat feet

Lowered arches and flatness occur most commonly on the feet. The occurrence of these deformities is influenced primarily by the hereditary factor, as well as physical inactivity, obesity, inadequate footwear. The consequences are difficulties in walking and standing, pain in the legs and sometimes in the back. If it is not a matter of already formed deformities that would require orthopedic treatment, the physiatrist will recommend corrective gymnastics, playing sports and correcting bad posture habits.

### Flat foot correction exercises

We present only part of the flat foot correction program. The complete program consists of 10 exercises where each exercise is performed with 10 repetitions.

Here are the basic exercises for flat feet:

Red. broj / No.	Opis vježbe-način izvođenja / Exercise Description - Exercise Method	Broj serija / Number of series	Broj ponavljanja / Number of repetitions
1.	Iz sjedećeg položaja sa opruženim koljenima i zategnutim stopalima prema licu savijati prste / From sitting with knees stretched and feet stretched towards the face, bend your toes	10	10
2.	Savijenim prstima na jednoj nozi dodirivati koljeno druge noge i vraćati u početni položaj / With bent fingers on one leg, touch the knee of the other leg and return to the starting position	10	10
3.	Iz početnog položaja sa zategnutim stopalom savijati i opružati prste.....10 serija x 10 ponavljanja / From the initial position with the foot tightened bend and stretch the toes ..... 10 series x 10 reps	10	10
4.	Iz početnog položaja savijati i podizati prste / From the starting position, bend and lift your fingers	10	10
5.	Hodati na petama sa savijenim prstima / Walk on heels with bent toes	5	5 po/per 30m
6.	Hodati na prstima ispruženih (ukočenih) nogu u zglobu koljena / To walk on the toes of the extended (rigid) legs in the knee joint	5	5 po/per 30m
7.	Hodati u polučučnju na unutarnjim (konkavnim) rubovima stopala / To walk in a semi-skirmish at the inner (concave) edges of the feet	3	3 po/per 30m
8.	Hodati u polučučnju na vanjskim (konveksnim) rubovima stopala / To walk in a semi-skirmish at the outer (convex) edges of the feet	3	3 po/per 30m
9.	Hodati u čučnju na prstima sa osloncem ruku na koljena / Walk in a squat on your toes with your hands resting on your knees	2	3 po/per 30m
10.	U stojećem stavu prstima obje noge naizmjenično (palcem i dopalcem), privlačiti konopac ka sebi iz maksimalnog iskoraka (dužina konopca 3m) / In standing posture, fingers with both feet alternately (thumb and thumb), draw the rope towards you from maximum step (length of rope 3m)	5	5

### Kyphosis

Kyphotic poor posture (hunched back, shoulders bent forward), in preschool, if not corrected, may develop into kyphosis in the next few years. If it is not already formed deformities that would require orthopedic treatment, it is necessary to apply a program of corrective treatment with a targeted complex of exercises of corrective gymnastics, to increase overall physical activity and sports, in order to correct bad posture habits.

### Exercises to correct kyphotic posture

The following exercises for the correction of kyphotic poor posture were applied within the corrective exercise program:

## Kompleksi primjenjenih korektivnih vježbi za pojedine deformitete sa obimom i intenzitetom rada

### Ravna stopala

Na stopalima se najčešće javljaju spuštene svodovi i ravna stopala. Na pojavu ovih deformiteta utiče prije svega nasljedni faktor, kao i fizička neaktivnost, gojaznost, neadekvatna obuća. Posljedice su otežano hodanje i stajanje, bolovi u nogama a nekad i u krstima. Ako se ne radi o već formiranim deformitetima koji bi zahtijevali ortopedski tretman, fizijatar će preporučiti korektivnu gimnastiku, bavljenje sportom i korigovanje loših navika u držanju tijela.

### Vježbe za korekciju ravnih stopala

Predstavljamo samo dio programa za korekciju ravnih stopala. Potpun program se sastoji iz 10 vježbi gdje se svaka vježba izvodi sa 10 ponavljanja. Ovo je prikaz osnovnih vježbi za ravna stopala:

### Kifoza

Kifotično loše držanje (pogrbljena leđa, ramena povišena naprijed), u predškolskom uzrastu ako se ne koriguje može da preraste u kifozu u narednih nekoliko godina. Ako se ne radi o već formiranim deformitetima koji bi zahtijevali ortopedski tretman, neophodno je primijeniti program korektivnog tretmana sa ciljanim kompleksom vježbi korektivne gimnastike, pojačati uopšteno fizičku aktivnost i bavljenje sportom, kako bi korigovali loše navike u držanju tijela.

### Vježbe za korekciju kifotičnog držanja tijela

U okviru primjenjenog programa korektivnog vježbanja primjenjene su sledeće vježbe za korekciju kifotičnog lošeg držanja tijela:

Red. broj / No.	Opis vježbe-način izvođenja / Exercise Description - Exercise Method	Broj serija / Number of series	Broj ponavljanja / Number of repetitions
1.	Iz sjedećeg položaja na strunjači, jedna noga ispružena, druga blago povijena sa stopalom do članka druge noge / From a sitting position on the mat, one leg extended, the other slightly bent with the foot to the other leg	10	10 sa zadržavanjem / with a holding time of 25-30s
2.	Iz sjedećeg položaja sa zategnutim laktovima unazad i stopalom opružene noge prema licu savijati se naprijed / From a sitting position with back elbows stretched back and feet extended towards the face, bend forward	10	10
3.	Iz ležećeg položaja na leđima istezati se istovremeno rukama na jednu i nogama na drugu stranu / From the supine position on the back, stretch at the same time with your arms to one side and your legs to the other	10	10
4.	Iz ležećeg položaja istezati ruke naprijed bez podizanja sa podloge / From the prone position, stretch your arms forward without lifting from the base	10	10
5.	Polusklekovi / Semi push ups	10	5
6.	Iz ležećeg položaja na stomaku podizati gornji dio tijela nazad uz opružanje i podizanje ruku / From the supine position on your stomach, lift your upper body back with your arms outstretched and lifted	10	10
7.	Iz ležećeg položaja sa šakama ispred glave, dlanovi su povezani i izvrnuti. Podizati što više glavu i ruke / From the prone position with the fists in front of the head, the palms are connected and twisted. Raise your head and hands as much as possible	10	10
8.	Iz sjedećeg položaja ispružiti nogu sa dlanovima upletenim na potiljku. Laktove pomjerati naprijed – nazad / From a sitting position, stretch your leg with your palms twisted to the nape of your neck. Move your elbows back and forth	10	10
9.	Klečati četveronoške. Naizmjenično podizati dlan jedne ruke i stavljati ga na potiljak, nastojeći lakat podizati što više / Kneeling four-legged. Alternately raise the palm of one hand and place it on the nape of the neck, trying to raise the elbow as much as possible	10	10
10.	U položaju četveronoške, ramena što više pomjerati unazad i dolje. Vježbu izvoditi u parovima, pri čemu se vježbači umjereno potiskuju u predjelu ramenog pojasa / In a four-legged position, move your shoulders back and down as much as possible. The exercise should be performed in pairs, with the workouts being moderately suppressed in the shoulder area	5	20s

**RESULTS AND DISCUSSION**

**Deformity analysis of kyphosis and flat feet of pupils**

Spinal deformity analysis (kyphosis) - initial measurement. The results of the analysis of spinal deformity-kyphosis are presented in table 1. 290 pupils were divided into three sub-samples groups, namely grades IV, V and VI of primary school.

From table 1, where the frequencies and the associated percentages of deformity - kyphosis are shown, it is evident that in the entire examined sample of students, 199 students or 69% of the tested sample have a normal spine position. Regarding the percentage of this deformity in the tested sample, we can state that the first degree of deformity is 68 students or 23% of the tested sample, the second degree is 20 pupils or 7% of the tested sample and the third degree is 3 students or 1% of the tested sample.

**Table 1.** Contingency table of frequency of distribution of spinal deformity (kyphosis) by sub-samples-students initial measurement

**REZULTATI I DISKUSIJA**

**Analiza deformiteta kralježnice (Kifoza) – inicijalno mjerenje**

U tablici 1, prikazani su rezultati analize deformiteta kralježnice–kifoza. Analizi je podvrgnuto 290 učenika podijeljenih u tri subuzorka, i to IV, V i VI razred osnovne škole.

Iz tablice 1, gdje su prikazane frekvencije i pripadajuć postotci deformiteta – kifoza, vidljivo je da kod cjelokupnog ispitivanog uzorka učenika normalan položaj kralježnice ima 199 učenika ili 69% ispitivanog uzorka. U pogledu postotka zastupljenosti ovog deformiteta na ispitivanom uzorku može se konstatirati da prvi stupanj deformiteta ima 68 učenika ili 23% ispitivanog uzorka, drugi stupanj 20 učenika ili 7% ispitivanog uzorka i treći stupanj 3 učenika ili 1% ispitivanog uzorka.

**Tablica 1.** Kontingencijska tablica frekvencije distribucije deformiteta kralježnice (kifoza) po subuzorcima-učenici inicijalno mjerenje

KIFOZA / KYPHOSIS	UZORAK ISPITANIKI - UČENICI / SAMPLE OF RESPONDENTS - PUPILS				
		IV	V	VI	UKUPNO / TOTAL
KIFOZNO / KYPHOSIS	F	65	68	66	199
	%	<b>71</b>	<b>69</b>	<b>65</b>	<b>69</b>
KIFOZ 1 / KYPHOS 1	F	20	22	26	68
	%	<b>22</b>	<b>22</b>	<b>26</b>	<b>23</b>
KIFOZ 2 / KYPHOS 2	F	6	6	8	20
	%	<b>7</b>	<b>7</b>	<b>8</b>	<b>7</b>
KIFOZ 3 / KYPHOS 3	F	-	2	1	3
	%	<b>0</b>	<b>2</b>	<b>1</b>	<b>1</b>
UKUPNO / TOTAL	F	91	98	101	290
	%	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>



**Spinal deformity analysis (kyphosis) - final measurement**

The results of the analysis of spinal deformity-kyphosis are presented in table 2. 290 students were divided into three sub-samples groups, namely grades IV, V and VI of primary school.

From table 2, where the frequencies and the corresponding percentages of deformity - kyphosis are shown, 238 students or 82% of the tested sample have a normal spine position in the entire study sample. With regard to the percentage of this deformity in the tested sample, we can state that the first degree of deformity has 37 students or 13% of the tested sample, the second degree 12 pupils or 4% of the tested sample and the third degree 3 students or 1% of the tested sample.

The results obtained are within the average given previous studies in which 30% to 55% of students of this age have this deformity (Jovovic, 1994; Paušić et al., 2006; Bogdanovic et al., 2008; Protic-Gava and et al., 2010; Hodžić et al., 2010; Bajrić et al., 2012).

**Table 2.** Contingency table of frequency of distribution of spinal deformity (kyphosis) by sub-samples - pupils final measurement

KIFOZA / KYPHOSIS		UZORAK ISPITANIKA – UČENICI / SAMPLE OF RESPONDENTS - PUPILS			
		RAZRED / CLASS			UKUPNO / TOTAL
		IV	V	VI	
KIFOZNO / KYPHOSIS	F	79	80	79	238
	%	<b>87</b>	<b>82</b>	<b>78</b>	<b>82</b>
KIFOZ 1 / KYPHOS 1	F	9	12	16	37
	%	<b>10</b>	<b>12</b>	<b>16</b>	<b>13</b>
KIFOZ 2 / KYPHOS 2	F	3	4	5	12
	%	<b>3</b>	<b>4</b>	<b>5</b>	<b>4</b>
KIFOZ 3 / KYPHOS 3	F	-	2	1	3
	%	<b>0</b>	<b>2</b>	<b>1</b>	<b>1</b>
UKUPNO / TOTAL	F	91	98	101	290
	%	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

**Postural deformity analysis of the flat foot (pes planus) - initial measurement**

The results of postural deformity analysis of the postural flat foot-pes planus are presented in table 3. 290 students were divided into three sub-samples groups, namely grades IV, V and VI of primary school.

From table 3, where the frequencies and associated percentages of postural deformity of the flat foot - pes planus are shown, it is evident that in the whole study sample of students, the 178 students or 61% of the test sample has normal foot. With regard to the percentage of this deformity in the tested sample, we can state that

**Analiza deformiteta kralježnice (kifoza) – finalno mjerenje**

U tablici 2, prikazani su rezultati analize deformiteta kralježnice–kifoza. Analizi je podvrgnuto 290 učenika podijeljenih u tri subuzorka, i to IV, V i VI razreda osnovne škole.

Iz tablice 2, gdje su prikazane frekvencije i pripadajući postoci deformiteta - kifoza vidljivo je da kod cjelokupnog ispitivanog uzorka učenika normalan položaj kralježnice ima 238 učenika ili 82% ispitivanog uzorka. U pogledu postotka zastupljenosti ovog deformiteta na ispitivanom uzorku može se konstatirati da prvi stupanj deformiteta ima 37 učenika ili 13% ispitivanog uzorka, drugi stupanj 12 učenika ili 4% ispitivanog uzorka i treći stupanj 3 učenika ili 1% ispitivanog uzorka.

Dobiveni rezultati su u granicama prosjeka s obzirom na prethodna istraživanja u kojima 30% do 55% učenika ovog uzrasta ima ovaj deformitet (Jovović, 1994.; Paušić i sur., 2006.; Bogdanović i sur., 2008.; Protić-Gava i sur., 2010.; Hodžić i sur., 2010.; Bajrić i sur., 2012.).

**Tablica 2.** Kontingencijska tablica frekvencije distribucije deformiteta kralježnice (kifoza) po subuzorcima - učenici finalno mjerenje

**Analiza deformiteta posturalnog statusa stopala (Pes planus) – inicijalno mjerenje**

U tablici 3, prikazani su rezultati analize deformiteta posturalnog statusa stopala–pes planus. Analizi je podvrgnuto 290 učenika podijeljenih u tri subuzorka, i to IV, V i VI razreda osnovne škole.

Iz tablice 3, gdje su prikazane frekvencije i pripadajući postoci deformiteta posturalnog statusa stopala – pes planus vidljivo je da kod cjelokupnog ispitivanog uzorka učenika normalno stopalo ima 178 učenika ili 61% ispitivanog uzorka. U pogledu postotka zastupljenosti ovog deformiteta na ispitivanom uzorku može se konstatirati

the first degree of deformity is 86 students or 30% of the tested sample, the second degree is 23 students or 8% of the tested sample and the third degree is 3 students or 1% of the tested sample.

**Table 3.** Contingency table of frequency of distribution of postural foot status by sub-samples - students initial measurement

STOPALA PES PLANUS / FOOT PES PLANUS		UZORAK ISPITANIKA – UČENICI / SAMPLE OF RESPONDENTS - PUPILS			
		RAZRED / CLASS			UKUPNO / TOTAL
		IV	V	VI	
PESNOR	F	56	60	62	178
	%	<b>62</b>	<b>61</b>	<b>61</b>	<b>61</b>
PESPLA 1	F	26	28	32	86
	%	<b>29</b>	<b>29</b>	<b>32</b>	<b>30</b>
PESPLA 2	F	7	9	7	23
	%	<b>8</b>	<b>9</b>	<b>7</b>	<b>8</b>
PESPLA 3	F	2	1	0	3
	%	<b>1</b>	<b>1</b>	<b>0</b>	<b>1</b>
UKUPNO / TOTAL	F	91	98	101	290
	%	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

**Postural deformity analysis of the flat foot (Pes planus) - final measurement**

The results of postural deformity analysis of the postural flat foot-pes planus are presented in table 4. 290 students were divided into three sub-samples groups, namely grades IV, V and VI of primary school.

From table 4, where the frequencies and associated percentages of postural deformity of the foot - pes planus are shown, it is evident that, in the entire study sample, the 242 students or 83% of the test sample has normal foot. Regarding the percentage of this deformity in the tested sample, we can state that the first degree of deformity is 36 students or 13% of the tested sample, the second degree is 10 students or 3% of the tested sample and the third degree is 2 pupils or 1% of the tested sample.

**Table 4.** Contingency table of frequency of distribution of postural foot status by sub-samples - final measurement

STOPALA PES PLANUS / FOOT PES PLANUS		UZORAK ISPITANIKA – UČENICI / SAMPLE OF RESPONDENTS - PUPILS			
		RAZRED / CLASS			UKUPNO / TOTAL
		IV	V	VI	
PESNOR	F	77	84	81	242
	%	<b>85</b>	<b>86</b>	<b>80</b>	<b>83</b>
PESPLA 1	F	9	10	17	36
	%	<b>10</b>	<b>10</b>	<b>17</b>	<b>13</b>
PESPLA 2	F	3	4	3	10
	%	<b>3</b>	<b>4</b>	<b>3</b>	<b>3</b>
PESPLA 3	F	2	0	0	2
	%	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>
UKUPNO / TOTAL	F	91	98	101	290
	%	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

da prvi stupanj deformiteta ima 86 učenika ili 30% ispitivanog uzorka, drugi stupanj 23 učenika ili 8% ispitivanog uzorka i treći stupanj 3 učenika ili 1% ispitivanog uzorka.

**Tablica 3.** Kontingencijska tablica frekvencije distribucije posturalnog statusa stopala po subuzorcima - učenici inicijalno mjerenje

**Analiza deformiteta posturalnog statusa stopala (Pes planus) – finalno mjerenje**

U tablici 4, prikazani su rezultati analize deformiteta posturalnog statusa stopala–pes planus. Analizi je podvrgnuto 290 učenika podijeljenih u tri subuzorka, i to IV, V i VI razreda osnovne škole.

Iz tablice 4, gdje su prikazane frekvencije i pripadajući postoci deformiteta posturalnog statusa stopala – pes planus vidljivo je da kod cjelokupnog ispitivanog uzorka učenika normalno stopalo ima 242 učenika ili 83% ispitivanog uzorka. U pogledu postotka zastupljenosti ovog deformiteta na ispitivanom uzorku može se konstatirati da prvi stupanj deformiteta ima 36 učenika ili 13% ispitivanog uzorka, drugi stupanj 10 učenika ili 3% ispitivanog uzorka i treći stupanj 2 učenika ili 1% ispitivanog uzorka.

**Tablica 4.** Kontingencijska tablica frekvencije distribucije posturalnog statusa stopala po subuzorcima – finalno mjerenje

This research has found that there is a statistically significant percentage of deformity of the feet of students in grades IV through VI of primary school, which is in line with the research (Kosinac, 1995; Restović et al., 2008; Hodžić et al., 2008; Stević et al. Pelemiš, 2008; Bogdanović et al., 2010; Mikić et al., 2010; Mihajlović et al., 2010).

It is evident that the percentage of foot deformity increases with the age of the children, which is certainly associated with different loads (length of sitting, standing, overweight, improper footwear). What is encouraging is that the highest number of deformities is at the first-level level, which provides the opportunity for successful correction.

**Changes in postural status of the spine and foot in students initial -final measurement**

**Table 5.** Contingency table of the frequency of distribution of spinal deformity (kyphosis) in students initial - final measurement

KIFOZA / KYPHOSIS	UZORAK ISPITANIKA / SAMPLE OF RESPONDENTS		
	UČENICI-inic. / PUPILS-initial	UČENICI-fin. / PUPILS-final	
KIFOZNO / KYPHOSIS	F	199	238
	%	<b>69</b>	<b>82</b>
KIFOZ 1 / KYPHOS 1	F	68	37
	%	<b>23</b>	<b>14</b>
KIFOZ 2 / KYPHOS 2	F	20	12
	%	<b>7</b>	<b>4</b>
KIFOZ 3 / KYPHOS 3	F	3	3
	%	<b>1</b>	<b>1</b>
UKUPNO / TOTAL	F	290	290
	%	<b>100</b>	<b>100</b>
POSTOTAK RAZLIKE IZMEĐU INICIJALNOG I FINALNOG MJERENJA / PERCENTAGE DIFFERENCE BETWEEN INITIAL AND FINAL MEASUREMENT	%	<b>(91) 31%</b>	<b>(52) 19%</b>

Based on the insights in table 5, we can conclude that the kinesiological treatment performed produced statistically significant differences between the initial and final spinal deformity (kyphosis) at the level of 12%.

**Table 6.** Contingency table of frequency of foot deformity distribution in students - initial - final measurement

PES PLANUS	UZORAK ISPITANIKA / SAMPLE OF RESPONDENTS		
	UČENICI-inic. / PUPILS-initial	UČENICI-fin. / PUPILS-final	
PESNOR	F	178	242
	%	<b>61</b>	<b>83</b>
PESPLA 1	F	86	36
	%	<b>30</b>	<b>13</b>
PESPLA 2	F	23	10
	%	<b>8</b>	<b>3</b>
PESPLA 3	F	3	2
	%	<b>1</b>	<b>1</b>

Ovim istraživanjem je utvrđeno da postoji statistički značajan postotak deformiteta stopala učenika od IV do VI razreda osnovne škole, što je u skladu sa istraživanjima (Kosinac, 1995.; Restović i sur., 2008.; Hodžić i sur., 2008.; Stević i Pelemiš, 2008.; Bogdanović i sur., 2010.; Mikić i sur., 2010.; Mihajlović i sur., 2010.).

Evidentno je da se postotak deformiteta stopala povećava sa starošću djece, što je sigurno povezano sa različitim opterećenjima (dužina sjedenja, stajanja, prekomjerna težina, nepravilna obuća). Ono što je ohrabrujuće je da je najveći broj deformiteta na razini prvog stupnja što pruža mogućnost uspješnog korigiranja.

**Promjene stanja posturalnog statusa kralješnice i stopala kod učenika inicijalno -finalno mjerenje**

**Tablica 5.** Kontingencijska tablica frekvencije distribucije deformiteta kralješnice (kifoza) kod učenika inicijalno - finalno mjerenje

Na osnovu uvida u tablici 5, može se konstatirati da je provedeni kineziološki tretman proizveo statistički značajne razlike između inicijalnog i finalnog stanja deformiteta kralješnice (kifoza) na razini od 12%.

**Tablica 6.** Kontingencijska tablica frekvencije distribucije deformiteta stopala kod učenika - inicijalno - finalno mjerenje

UKUPNO / TOTAL	F	290	290
	%	100	100
POSTOTAK RAZLIKE IZMEĐU INICIJALNOG I FINALNOG MJERENJA / PERCENTAGE DIFFERENCE BETWEEN INITIAL AND FINAL MEASUREMENT	%	(112) 39%	(48) 17%

Based on the insights in table 6, we can conclude that the performed kinesiological treatment produced statistically significant differences between the initial and final condition of the foot deformity - pes planus at the level of 22%. It is evident that the results of the presence of spinal and foot deformity after the kinesiological treatment (tables 5 and 6) were significantly better and that the kinesiological treatment significantly contributed to the correction of the postural spine (kyphosis) and flat foot (pes planus), especially in the first and the second degree of deformity. Apparently, the kinesiological treatment produced more significant effects on the correction of foot deformity - pes planus (22%), compared to spinal deformity (kyphosis) (12%).

## CONCLUSION

The aim of this study is to determine the effects of programmed kinesiological treatment on the correction of postural spine status - kyphosis and flat feet - pes planus, in grades IV to VI pupils (second triad of nine-year elementary school). By looking at the results of detection of the presence of postural deformities before the beginning of the application of programmed kinesiological treatment, we can conclude that the presence of all three degrees of deformity in the treated segments of postural status were recorded. Using the contingency tables, the frequencies and associated percentages of spinal deformity - kyphosis and flat feet - pes planus are shown. Looking at the results of detection of postural disorders after the completion of programmed kinesiological treatment, we can conclude that there was a significant improvement in the postural status of the subjects, since the observed deformities decreased significantly compared to the initial assessment of the postural status of the spine - kyphosis and flat foot - pes planus. Apparently, the kinesiological treatment produced more significant effects on the correction of foot deformity - pes planus (22%), compared to spinal deformity (kyphosis) (12%). The obtained results indicate a statistically significant percentage of spinal deformity (kyphosis) and longitudinal and transverse arch of the flat foot - pes planus. Changes in the spine and arches of the feet are mainly in the first stage of deformation, which enabled the correction of the condition with the application of programmed kinesiological treatment in children of this age. It has also been

Na osnovu uvida u tablici 6, može se konstatirati da je provedeni kineziološki tretman proizveo statistički značajne razlike između inicijalnog i finalnog stanja deformiteta stopala – pes planus na razini od 22%. Evidentno je da su dobiveni rezultati stanja prisutnosti deformiteta kralješnice i stopala nakon provedenog kineziološkog tretmana (tablici 5 i 6), značajno bolji i da je provedeni kineziološki tretman značajno doprinjeo korigiranju posturalnog statusa kralješnice (kifoza) i ravnog stopala (pes planus) posebno u prvom i drugom stupnju deformiteta. Očigledno je da je primjenjeni kineziološki tretman proizveo značajnije efekte na korigiranje deformiteta stopala – pes planus (22%), u odnosu na deformitet kralješnice (kifoza) (12%).

## ZAKLJUČAK

Cilj ovog istraživanja je utvrđivanje efekata primjene programiranog kineziološkog tretmana na korigiranje posturalnog statusa kralješnice - kifoza i stopala – pes planus, učenika i učenica od IV do VI razreda (druge trijade devetogodišnje osnovne škole).

Uvidom u rezultate detekcije stanja prisutnosti posturalnih deformiteta prije početka same primjene programiranog kineziološkog tretmana, može se konstatirati da je evidentirano prisustvo sva tri stupnja deformiteta u tretiranim segmentima posturalnog statusa.

Primjenom kontingencijskih tablica prikazane su frekvencije i pripadajući postoci pojave deformiteta kralješnice - kifoza i stopala – pes planus učenika

Uvidom u rezultate detekcije stanja prisutnosti posturalnih poremećaja nakon završetka primjene programiranog kineziološkog tretmana, može se konstatirati da je evidentirano znatno poboljšanje posturalnog statusa ispitanika, jer su se praćeni deformiteti znatno smanjili u odnosu na početnu ocjenu posturalnog statusa kralješnice - kifoza i ravnog stopala – pes planus.

Očigledno je da je primjenjeni kineziološki tretman proizveo značajnije efekte na korigiranje deformiteta stopala – pes planus (22%), u odnosu na deformitet kralješnice (kifoza) (12%).

Dobiveni rezultati istraživanja ukazuju na značajan procenat korigiranih deformiteta kralješnice (kifoza) i uzdužnog i poprečnog svoda stopala – pes planus. Promjene na kralješnici i svodovima stopala su uglavnom u prvom stupnju deformacije, što je omogućilo korekciju

proven that through the proper cooperation of teachers, parents and medical staff, it can be very effective in reducing the incidence of these deformities as well as in the growth and development of children of this age.

stanja uz primjenu programiranog kineziološkog tretmana u radu sa djecom ovog uzrasta.

Također je, dokazano da se kroz pravilnu suradnju nastavnika, roditelja i medicinskog osoblja može vrlo učinkovito djelovati na smanjenje učestalosti ovih deformiteta kao i na rast i razvitak djece ovog uzrasta.

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## ELITE ATHLETES' ASSESSMENT OF MENTAL STATE FOR COMPETITION IN INDIVIDUAL AND TEAM SPORTS

MARIJANA MLADENVIĆ

College of Sports and Health, Belgrade, Serbia

### Correspondence:

Marijana Mladenović

College of Sports and Health, Belgrade, Serbia

[marijana.mladenovic@gmail.com](mailto:marijana.mladenovic@gmail.com)

**Abstract:** Pre-competition mental state is an important component of a sports outcome. In terms of the type of sport, the results of pre-competition state research differ depending on the methodology used. The aim of this paper was to determine mental states for elite sports competitions in one individual (shooting) and one team sport (handball). The research involved 41 elite athletes of both genders (11 males and 30 females) aged 16 to 34, who were members of the senior national shooting ( $N_1=24$ ) and senior national handball ( $N_2=17$ ) teams of Serbia. The applied instruments included the CSAI-2 and the CA test. Data processing involved descriptive statistics and variance analysis. The results indicate significant differences between athletes in individual and team sport, in favour of team sport athletes. Elite shooters show more cognitive anxiety, they are more prone to mental perception of pain, fear, and reliance on habits and automatism in competitions. Elite handball players showed significantly higher values on scales of desirable mental state for training and competition.

**Keywords:** psychological assessment, elite sport, competition, CA method, CSAI-2.

### INTRODUCTION

Psychological assessment for competitions traditionally relies on personality inventories which seek to determine character traits or the characteristics of an athlete's mental state for competition. What is usually examined is whether an athlete possesses an anxiety trait and to what extent, as well as whether they express a smaller or larger amount of cognitive or somatic anxiety prior to a competition (Spielberger et al. 1983; Martens, Vealey & Burton, 1990). Those psychological variables are very significant factors for success in elite sport.

The research on psychological differences between athletes in individual and team sport also covered other

## PROCENA MENTALNOG STANJA ZA TAKMIČENJE VRHUNSKIH SPORTISTA U INDIVIDUALNOM I KOLEKTIVNOM SPORTU

MARIJANA MLADENVIĆ

Visoka sportska i zdravstvena škola, Beograd, Srbija

### Korespondencija:

Marijana Mladenović

Visoka sportska i zdravstvena škola, Beograd, Srbija

[marijana.mladenovic@gmail.com](mailto:marijana.mladenovic@gmail.com)

**Apstrakt:** Psihičko stanje pred takmičenje važna je komponenta sportskog ishoda. U odnosu na tip sporta, rezultati istraživanja predtakmičarskih stanja, razlikuju se u zavisnosti od primenjene metodologije. Cilj ovog rada bio je da utvrdi psihička stanja za takmičenje vrhunskih sportista iz jednog individualnog sporta (streljaštvo) i jednog kolektivnog sporta (rukomet). U istraživanju je učestvovao 41 vrhunski sportista, oba pola (11 muškaraca i 30 žena), starosti 16 do 34 godine, koji su bili članovi seniorske streljačke ( $N_1=24$ ) i rukometne ( $N_2=17$ ) reprezentacije Srbije. Primenjeni instrumenti bili su CSAI-2 i metod asocijacije bojama (CA). Podaci su obrađeni deskriptivnom statistikom i analizom varijanse. Rezultati pokazuju da postoje značajne razlike između sportista u individualnom i kolektivnom sportu, koji idu u prilog sportistima iz kolektivnog sporta. Vrhunski strelci značajnije su kognitivno anksiozni, više podložni psihičkom doživljaju bola, straha i oslanjanju na navike i automatizam na takmičenju. Vrhunski sportisti u rukometu pokazali su značajno više vrednosti na merama poželjnog psihičkog stanja za trening i takmičenje.

**Ključne reči:** psihološka procena, vrhunski sport, takmičenje, CA metod, CSAI-2

### Uvod

Psihološka procena za takmičenje tradicionalno se oslanja na inventare ličnosti koji nastoje da utvrde crte ličnosti ili karakteristike mentalnog stanja sportiste za takmičenje. Obično se ispituje da li sportista i u kojoj meri poseduje crtu anksioznosti, kao i da li u situacijama pred takmičenje poseduje manju ili veću količinu kognitivne ili somatske anksioznosti (Spielberger et al. 1983; Martens, Vealey & Burton, 1990). Te psihološke varijable veoma su značajne za uspešnost u vrhunskom sportu.

Ispitivanja psiholoških karakteristika i razlika između sportista u individualnom i kolektivnom sportu odno-

personality features. For example, significant differences are revealed in psychological skills and motivation for success in performance (Pluhar et al, 2019). Feelings of social acceptance, skill development and coaching influence are more emphasized in team sports. Individual sports involve greater focus on the development of concentration ability and mental strength. The lack of social support in individual sport emphasizes the development of personal responsibility and self-reliance (Boone & Leadbeater, 2006). The negative psychological aspects that develop with respect to the social context specific to both individual and team sports, make team sports more stressful as a result of competition outcomes, team dynamics and coaching approaches in team sports. Individual sport athletes proved to be significantly prone to developing feelings of shame and greater internal attribution of responsibility for failure, which may lead to depressive symptoms. Vulnerability to the development of depression in elite athletes has proven to already exist at the junior competition level (Nixdorf et al, 2016). Anxiety, as the most commonly studied personality trait in elite sport, has been shown to be significantly more prevalent in individual sports where performance depends on a referee's decision. These athletes feel immense pressure to differentiate themselves from the competition in the pursuit of perfection.

The research of differences in terms of mental states of athletes in individual and team sports were mostly focused on determining differences in anxiety as a mental state. The results mostly underline that cognitive and somatic anxiety scores prior to a competition showed statistically significant difference between individual and team sports. Higher results of pre-competition cognitive and somatic anxiety were found in individual sports (Han et al, 2006; Hanton et al, 2008), although one meta-analysis on the connection between cognitive anxiety, competitive self-confidence and sport performance showed no significant differences between athletes in individual and team sports (Woodman & Hardy, 2003).

Inconsistency in the results of psychological research of pre-competition mental states in individual and team sports is ascribed to different methodology. Time distance between the psychological assessment and competition is also important.

Another factor that must be taken into account is the fact that traditional psychological 'paper-pen' methodology does not always provide relevant data for a simple reason: athletes may report to be in an adequate mental state even though they are not (Mladenović, 2016). Athletes are not always necessarily aware of their real

silu su se i na druge personalne karakteristike. Pokazalo se, na primer, da postoje razlike u pogledu psiholoških veština i motivacije za uspehom (Pluhar et al, 2019). U kolektivnim sportovima izraženija je osetljivost na prihvatanje okoline, razvoj veština i uticaj trenera. U individualnim sportovima veći je fokus na razvoju sposobnosti koncentracije i mentalne snage. Izostanak socijalne podrške u individualnom sportu ističe u prvi plan razvoj lične odgovornosti i oslanjanje na sebe (Boone & Leadbeater, 2006). Negativni psihološki aspekti koji se razvijaju s obzirom na socijalni kontekst specifičan za kolektivne i individualne sportove, odnosi se na veći doživljaj stresa koji se povezuje sa ishodom takmičenja, grupnu dinamiku i pristup trenera u timskim sportovima. Kod sportista iz individualnih sportova pokazalo se da je značajan negativan psihološki faktor razvoj osećaja krivice i unutrašnje atribucije odgovornosti za neuspeh, što je značajno povezano sa razvojem depresivne simptomatologije. Vulnerabilnost na razvoj depresije kod vrhunskih sportista, pokazalo se da postoji već na juniorskom uzrastu (Nixdorf et al, 2016). Anksioznost kao najčešće ispitivana crta ličnosti u vrhunskom sportu, pokazalo se da je značajno više prisutna u individualnim sportovima kod kojih uspešnost zavisi od procene sudija. U tim slučajevima sportisti lakše podlegnu pritisku da moraju da budu bolji od konkurencije kako bi ostvarili visoke ciljeve.

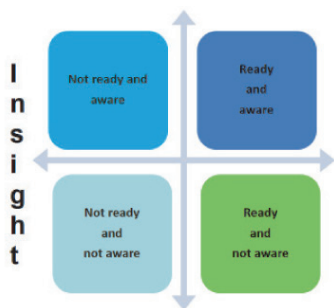
Ispitivanje razlika u pogledu psihičkih stanja sportista u kolektivnim i individualnim sportovima najčešće su se odnosila na utvrđivanje razlika u pogledu anksioznosti kao mentalnog stanja. Rezultati takvih istraživanja pretežno ukazuju na statistički značajne razlike u količini kognitivne i somatske anksioznosti. Sportisti iz individualnih sportova više doživljavaju anksioznost kao predtakmičarsko stanje, nego sportisti iz timskih sportova (Han et al, 2006; Hanton et al, 2008). Međutim, jedna meta-analiza o povezanosti kognitivne anksioznosti, takmičarskog samopouzdanja i postignuća u takmičarskom sportu, ukazala je da nema značajnih razlika između sportista iz individualnih i kolektivnih sportova (Woodman & Hardy, 2003).

Nekonzistentost rezultata psiholoških istraživanja mentalnih stanja pred takmičenje u individualnim i kolektivnim sportovima, pripisuje se različitoj metodologiji, a od značaja je i vremenska distanca između trenutka sprovođenja ispitivanja i održavanja takmičenja.

Dodatni faktor koji treba uzeti u obzir je i činjenica da tradicionalna psihološka "papir - olovka" metodologija ne donosi uvek verodostojne podatke iz jednostavnog razloga što sportista može da saopšti da je u adekvatnom psihičkom stanju iako zapravo nije (Mladenovic,

competitive mental state and they may believe to possess a higher degree of self-control of activation and anxiety level than they actually do. Coaches may wrongly conclude that in such cases, athletes have been using psychological manipulation and deliberately reporting to be in a more optimal competitive mental state than they really are, just to be a part of the performing team.

Athletes differ in their degree of awareness of their actual competitive mental state (Mladenović, 2018). In general, athletes can be mentally ready or unready for a competition, and they may or may not be aware of the fact whether they are or are not mentally ready for a competition (Picture 1). An athlete can be mentally ready for a competition and have conscious insight into his mental readiness. A different situation occurs when an athlete is mentally ready for a competition, but for some reason, he believes at the conscious and rational level, that he is not ready to compete (for example, a lack of self-confidence, increased concern and anxiety related to the outcome of the competition). The following two situations occur when an athlete is not mentally ready for a competition, for whatever reason. In one version of this situation, an athlete is consciously and rationally aware of this fact, and in the other version – even though he is generally not mentally ready to compete – at his conscious level he believes he is (which happens in situations when an athlete is highly motivated to compete, even though he is not ready enough for the competitive situation).

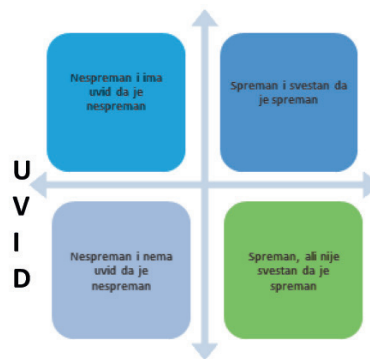


Picture 1. Mental readiness for sports competition and level of conscious psychological insight (Mladenović, 2018)

Research suggests that self-assessing one's own mental state at the conscious level is not necessarily accurate. Some neuroscience studies point out the complexity of the relation between the conscious and the unconscious, suggesting that the "authority" of the conscious is overrated (Damasio, 2010; Damasio & Carvalho, 2013). An athlete truly wants to be in the best mental state and give his best at a competition, but in a large number of situations there seems to be something within preventing

2016). Sportisti ne moraju uvek da budu svesni svog realnog psihičkog stanja za takmičenje i mogu da veruju da poseduju veći stepen samokontrole nivoa aktivacije i anksioznosti, nego što to objektivno jeste. Treneri mogu pogrešno da zaključe da je u tim slučajevima reč o psihološkoj manipulaciji od strane sportista i da sportista namerno saopštava da je u optimalnijem psihičkom stanju za takmičenje nego što zapravo jeste, samo da bi bio u sastavu ekipe na terenu.

Sportisti se razlikuju prema stepenu svesnog uvida u aktuelno psihičko stanje za takmičenje (Mladenović, 2018). Generalno, sportisti mogu da budu psihički spremni ili nespremni za takmičenje i mogu da imaju ili da nemaju svestan psihološki uvid da jesu ili nisu psihički spremni za takmičenje (Slika 1). Sportista može da bude psihički spreman za takmičenje i da ima svestan uvid u svoju mentalnu spremnost. Druga situacija postoji kad je sportista psihički spreman za takmičenje, ali iz nekog razloga, na svesnom i racionalnom nivou smatra da nije spreman da se takmiči (npr. trenutni nedostatak samopouzdanja, pojačana zabrinutost i anksioznost za ishod takmičenja). Sledeće dve situacije postoje kada sportista iz bilo kog razloga nije psihički spreman za takmičenje. U jednoj varijanti ove situacije sportista ima svestan i racionalan uvid u to, a u drugoj varijanti – iako suštinski nije psihički spreman da se takmiči, na svesnom nivou veruje da jeste (što se događa u situacijama kada je sportista visoko motivisan da se takmiči iako nije u sportskom i/ili psihološkom smislu dovoljno spreman za takmičarsku situaciju).



Slika 1. Psihička spremnost za takmičenje i nivo svesnog psihološkog uvida (Mladenović, 2018)

Istraživanja sugerišu da procena sopstvenog psihičkog stanja na svesnom nivou ne mora da bude tačna. Neka istraživanja u neuronauci sugerišu da je odnos između svesnog i nesvesnog složen, kao i da je 'nadležnost' svesnog precenjena (Damasio, 2010; Damasio & Carvalho, 2013). Sportista istinski želi da bude u najbo-



him from doing so. During a psychological testing using traditional personality inventories, or in a conversation prior to a competition, an athlete may report to be in an optimal mental state for the competition, without that actually being the case. And that is not because athletes want to deceive the coach to place them in the start lineup at a competition, but because they consciously believe they are mentally ready for the competition. Competition as a sort of a stressful situation provokes reaction not only at the conscious and rationally controlled level, but also mental states and reactions that are not controlled by the conscious self. A very significant research-related and practical question concerns the assessments of an athlete's overall mental state prior to a competition: the conscious and available for introspection, as well as the unconscious.

A significant contribution to the assessment of the unconscious mental state was made by a Swiss psychologist Max Lüscher (1971). In the mid-20<sup>th</sup> century, Lüscher presented a colour test as a projective technique that measures unconscious mental states (Lüscher, 1971). Unlike other projective techniques, such as the Rorschach test, which are mostly used as assessment instruments in clinical psychology, the Lüscher colour test is a widely used psychological instrument for non-clinical population (Stone, 2003; Singg & Whiddon, 2000). Three decades ago, while using the Lüscher test, Czech psychologist Jiri Simonek came up with an idea to connect colours with words. Uncensored automatic associations that an observed colour triggers in a perceiver are possible to channel in a certain direction by associating a word to a colour. The Colour Association Method (CA) came as a result of Simonek's work and research (Simonek, Bohonek & Simonek, 2012).

Considering the inconsistency of the research results on differences in competitive mental states among athletes in individual and team sports, the aim of this research was to determine the pre-competition mental state of elite athletes in a team sport (handball) and an individual sport (shooting), using one traditional personal inventory (CSAI-2) and one new method of psychological assessment: the color association (CA) projective test.

## METHOD

### *Instruments*

Two instruments were used for the research: CSAI-2 and the CA method.

Competitive State Anxiety Inventory II, or CSAI-2, measures cognitive anxiety, somatic anxiety and competi-

tion. U psihickom stanju i pokaže svoje najbolje izvođenje na takmičenju, ali u velikom broju situacija, kao da ga nešto iznutra 'sabotira' u tome. U situaciji psihološkog testiranja klasičnim personalnim inventarima ili u razgovoru pred takmičenje, sportista može da saopšti da je u optimalnom psihološkom stanju za takmičenje, a da zapravo to nije slučaj. I to ne zato što želi da obmane trenera da bi bio u startnoj postavi na takmičenju, već zato što na svesnom nivou doživljava da je psihološki spreman za takmičenje. Takmičenje kao svojevrsna stresna situacija provocira reagovanje ne samo sa svesnog i racionalno kontrolisanog nivoa, već i psihicka stanja i reakcije koje nisu pod svesnom kontrolom. Veoma značajno istraživačko i praktično pitanje tiče se dijagnostike celokupnog mentalnog stanja sportiste pred takmičenje: svesnog i dostupnog introspekciji, kao i nesvesnog.

Značajan doprinos proceni nesvesnog psihickog stanja dolazi od Švajcarskog psihologa Maksa Lišera (Lüscher, 1971). Sredinom prošlog veka Lišer je prezentovao test boja kao projektivnu tehniku koja meri nesvesna psihicka stanja (Lüscher, 1971). Za razliku od drugih projektivnih tehnika, poput Roršahovog testa koje su uglavnom korišćene kao dijagnostički instrumenti u kliničkoj psihologiji, Lišerov test boja široko je korišćen psihološki instrument procene na nekliničkoj populaciji (Stone, 2003; Singg & Whiddon, 2000). Pre tri decenije, češki psiholog Jirži Šimonek, radeći sa Lišerovim testom, došao je na ideju da spoji boje sa rečima. Necenzurisane automatske asocijacije koje u opažaču izaziva posmatrana boja, moguće je kanalisati u određenom smeru, tako što se reč asociira sa bojom. Tako je nastao Metod asocijacije bojama – CA test (Simonek, Bohonek & Simonek, 2012).

Imajući u vidu nedoslednost dosadašnjih rezultata istraživanja razlika u psihickim stanjima za takmičenje sportista iz individualnih i kolektivnih sportova, cilj ovog istraživanja bio je da utvrdi psihicko stanje pred takmičenje vrhunskih sportista u kolektivnom (rukomet) i individualnom sportu (streljaštvo), koristeći jedan tradicionalni personalni inventar ličnosti (CSAI-2) i jedan novi metod psihološke dijagnostike: projektivni test asocijacije bojama (CA).

## METHOD

### *Instrumenti*

U istraživanju su korišćena dva instrumenta: CSAI-2 i CA metod.

Competitive State Anxiety Inventory II, ili CSAI-2, meri kognitivnu anksioznost, somatsku anksioznost

tive self-confidence (Martens, Vealey & Burton, 1990). It consists of three subscales. The first subscale measures the extent of athletes' concern about their performance prior to a competition, whether they doubt themselves, fear failure or bad performance, whether they are concerned about disappointing important people (cognitive anxiety). The second subscale measures the extent of somatic anxiety symptoms: body tension and tight stomach, nervousness, agitation, palpitation, sweaty palms, dry throat, wet and cold hands, etc. The third subscale determines the level of self-confidence and belief in good performance, achievement of goals, stress relief and acceptance of challenge. Each subscale involves 9 items. In each subscale the result can range from the minimum of 9 and maximum of 36 points. Higher scores indicate higher presence of cognitive anxiety, somatic anxiety and self-confidence.

The Colour Association method (CA) is a projective technique based on the Lüscher colour test (Lüscher, 1971). The CA measures an athlete's self-perception based on parameters named *pain, effort, fear, tiredness, injury*, readiness for a *match* and *training*, the capacity to take *risks* in a competitive situation and the athlete's tendency to rely on *habits* and automatism in competitions. Today, the Colour Association test has a form of a computer software. It consists of inputs which contain eight colours (red, blue, green, yellow, grey, black, brown, purple) in the shape of a sphere, creating a circle. At the beginning and the end of the testing, the examinee picks all the colours, one after another, according to their current preference. In addition to colours, other inputs also contain a word in the middle of the circle, and the examinee picks three colours that they currently associate with the given word. The test generates another two measures. One is operationalized as a relation between psychological volition and the organism's bodily reality in a competitive situation. Therefore, a complete domination of the organism's bodily reality and physical state is at one end of the continuum, while the other end contains complete domination of will and overcoming the bodily reality by investing mental effort. The other measure is operationalized as a total of mental energy at a given moment, which conditions the possibility of activation and involvement into the current activity. It is actually a measure of motivation and volition in a competitive situation. The values of all parameters in the CA test range from zero to 100 (Mladenović, 2015).

### Sample

The sample consisted of 41 elite athlete in individual (shooting) and team sport (handball). Their age range was from 16 to 34 years of age (11 males and 30 females). The subsample of examinees from the individ-

i takmičarsko samopouzdanje (Martens, Vealey & Burton, 1990). Sastoji se od tri subskale. Prva subskala meri koliko su sportisti pred nastup na takmičenju zabrinuti za svoje izvođenje, da li sumnjaju u sebe, da li se plaše neuspeha, slabe igre, da neće razočarati važne osobe (kognitivna anksioznost). Druga subskala meri koliko su kod sportista izraženi simptomi somatske anksioznosti: napetost u telu i stomaku, nervoza, uzrujanost, lupanje srca, znojenje ruku, sušenje grla, vlažne i hladne ruke itd. Treća subskala utvrđuje nivo samopouzdanja i sigurnosti da će nastup biti dobar, da će se postići ciljevi, osloboditi napetosti i prihvatiti izazov. Svaka subskala ima po 9 ajtema. Rezultat po subskalama može se teorijski kretati od minimalnih 9 do maksimalnih 36 poena. Viši skorovi su indikator većeg prisustva kognitivne anksioznosti, somatske anksioznosti i samopouzdanja.

Metod asocijacije bojama (CA) je projektivna tehnika zasnovana na Lišerovom testu boja (Lüscher, 1971). CA meri samopercepciju sportiste na parametrima nazvanim *bol, napor, strah, umor, povreda*, spremnost za *takmičenje* i *trening*, kapacitet da se preduzme *rizik* u situaciji takmičenja i tendencija da se sportista oslanja na *navike* i automatizme na takmičenju. Test asocijacije bojama danas je u formi kompjuterskog softvera. Sastoji se od inputa koji sadrže osam boja (crvena, plava, zelena, žuta, siva, crna, braon, ljubičasta), sferičnog oblika, koje su poredane u krug. Na početku i na kraju testiranja ispitanik bira sve boje redom, prema trenutnoj preferenciji. Ostali inputi, pored boja sadrže i jednu reč u sredini kruga, a ispitanik bira tri boje koje se u nameću kao trenutna asocijacija zadatoj reči. Test generiše još dve mere. Jedna je operacionalizovana kao odnos između voljnog psihološkog momenta i telesne realnosti organizma u situaciji takmičenja. Pa tako, na jednom kraju tog kontinuuma, nalazi se potpuna dominacija telesne realnosti i fizičkog stanja organizma, a na drugom kraju je potpuna dominacija volje i prevazilaženja telesne realnosti ulaganjem mentalnog napora. Druga mera operacionalizovana je kao ukupnost psihičke energije u datom momentu, što uslovljava mogućnost aktivacije i uključivanja u trenutnu aktivnost. Reč je zapravo o motivaciono voljnom momentu u takmičarskoj situaciji. Vrednosti svakog parametra na testu CA kreću se od nula do 100 (Mladenović, 2015).

### Uzorak

Uzorak se sastojao od 41 vrhunskog sportiste u individualnom (streljaštvo) i kolektivnom (rukomet) sportu. Ispitanici su bili starosti od 16 do 34 godine, oba pola (11 muškaraca i 30 žena). Poduzorak ispitanika iz indivi-

ual sport involved members of men and women senior national shooting team of Serbia ( $N_1=24$ ), while the sub-sample of athletes from the team sport comprised members of women's senior national handball team of Serbia ( $N_2=17$ ).

### Procedure

As part of the psychological preparation for major international competitions in 2016 and 2017, the examinees underwent psychological testing with CSAI-2 and the CA test. With the athletes' consent, the data acquired in these tests is used anonymously and for scientific and research purposes.

### Statistical analysis

Descriptive statistics and analysis of variance (ANOVA) were applied in the statistical program SPSS, version 20. Mean values, Standard Deviations, Minimum and Maximum values were calculated for each CA test variable (mental balance, overall mental energy, risk, effort, pain, fear, tiredness, injury, training, match, habits) and CSAI-2 inventory (cognitive and somatic anxiety, competitive self-confidence). The statistical significance of the differences between mean values in individual and team sport was examined using analysis of variance.

### RESULTS

Table 1 presents the results of descriptive statistics in the CA test, Table 2 presents the results of descriptive statistics in the CSAI-2 test. The differences between athletes in individual sport (shooting) and team sport (handball) are shown in Table 3.

**Table 1.** Mean (M), standard deviations (SD), minimum and maximum value in the Colour Association test for elite shooters ( $N_1=24$ ) and elite handball players ( $N_2=17$ )

		N	AS	SD	Min	Max
<b>CA1</b>	$N_1$	24	46.27	31.88	2.47	94.89
	$N_2$	17	61.90	11.05	45.67	89.10
	Total	41	52.75	26.34	2.47	94.89
<b>CA2</b>	$N_1$	24	44.55	26.05	5.00	88.00
	$N_2$	17	48.10	6.68	36.57	60.70
	Total	41	46.02	20.27	5.00	88.00
<b>CA3</b>	$N_1$	24	47.95	11.95	30.71	70.17
	$N_2$	17	45.68	9.79	27.33	63.33
	Total	41	47.01	11.03	27.33	70.17

dualnog sporta obuhvatio je članove muške i ženske streljačke reprezentacije Srbije ( $N_1=24$ ), dok je poduzorak sportista iz kolektivnog sporta činila ženska seniorska rukometna reprezentacija Srbije ( $N_2=17$ ).

### Procedura

U sklopu psihološke pripreme za velika međunarodna takmičenja tokom 2016. i 2017. godine, ispitanici su bili podvrgnuti psihološkom testiranju instrumentima CSAI-2 i CA testom. Uz pristanak sportista podaci iz ovih testova koriste se anonimno i u naučno-istraživačke svrhe.

### Statistička obrada podataka

Podaci su obrađeni primenom deskriptivne statistike i analizom varijanse (ANOVA) u statističkom programu SPSS 20. Za svaku varijablu na CA testu (mentalna ravnoteža, sveukupna mentalna energija, bol, napor, strah, umor, povreda, takmičenje, trening, rizik, navike) i upitniku CSAI-2 (kognitivna anksioznost, somatska anksioznost, takmičarsko samopouzdanje) izračunavana je aritmetička sredina i standardna devijacija, minimalne i maksimalne vrednosti. Značajnost razlika aritmetičkih sredina između sportista u kolektivnom i individualnom sportu proveravana je analizom varijanse.

### REZULTATI

Rezultati deskriptivne statistike na CA testu prikazani su u Tabeli 1, rezultati deskriptivne statistike na testu CSAI-2 prikazani su u Tabeli 2, dok su razlike između sportista u individualnom sportu (streljaštvo) i kolektivnom sportu (rukomet) prikazani su u Tabeli 3.

**Tabela 1.** Aritmetičke sredine (AS), standardne devijacije (SD), minimalne (Min) i maksimalne vrednosti (Max) varijabli na CA testu, kod vrhunskih sportista u streljaštvu ( $N_1=24$ ) i rukometu ( $N_2=17$ )

<b>CA4</b>	$N_1$	24	45.25	14.91	20.78	67.96
	$N_2$	17	49.74	10.34	33.67	66.67
	Total	41	47.11	13.25	20.78	67.96
<b>CA5</b>	$N_1$	24	47.92	17.41	20.80	85.02
	$N_2$	17	36.96	14.46	16.67	66.00
	Total	41	43.37	16.97	16.67	85.02
<b>CA6</b>	$N_1$	24	49.10	17.73	23.69	86.91
	$N_2$	17	37.72	14.07	18.67	68.67
	Total	41	44.38	17.09	18.67	86.91

<b>CA7</b>	N <sub>1</sub>	24	50.60	15.92	15.76	81.17
	N <sub>2</sub>	17	53.68	15.26	38.33	94.00
	Total	41	51.88	15.53	15.76	94.00
<b>CA8</b>	N <sub>1</sub>	24	51.10	18.03	28.01	87.44
	N <sub>2</sub>	17	44.09	14.32	26.67	79.67
	Total	41	48.20	16.77	26.67	87.44
<b>CA9</b>	1	24	54.10	14.31	19.56	83.22
	2	17	67.05	22.05	31.00	100.00
	Total	41	59.47	18.81	19.56	100.00

CA1: mental balance; CA2: overall mental energy; CA3: risk; CA4: effort; CA5: pain; CA6: fear; CA7: tiredness; CA8: injury; CA9: training; CA10: match; CA11: habits.

**Table 2.** Mean (M), standard deviations (SD), minimum and maximum value on the CSAI-2 measures for elite shooters (N<sub>1</sub>=24) and elite handball players (N<sub>2</sub>=18)

<b>CA10</b>	1	24	53.60	13.84	21.32	84.89
	2	17	64.23	20.50	32.67	100.00
	Total	41	58.01	17.50	21.32	100.00
<b>CA11</b>	1	24	49.42	17.74	25.71	87.55
	2	17	39.15	14.03	20.00	68.33
	Total	41	45.16	16.91	20.00	87.55

CA1: mentalna ravnoteža; CA2: sveukupna mentalna energija; CA3: rizik; CA4: napor; CA5: bol; CA6: strah; CA7: umor; CA8: povreda; CA9: trening; CA10: takmičenje; CA11: navike.

**Tabela 2.** Aritmetičke sredine (AS), standardne devijacije (SD), minimalne (Min) i maksimalne vrednosti (Max) varijabli na CSAI-2 kod vrhunskih sportista u streljaštvu (N<sub>1</sub>=24) i rukometu (N<sub>2</sub>=17)

		N	AS	SD	Min	Max
<b>Csai-k</b>	1	24	16.08	5.90	9.00	27.00
	2	17	12.44	3.16	9.00	21.00
	Total	41	14.52	5.19	9.00	27.00
<b>Csai-s</b>	1	24	15.24	4.88	10.00	30.00
	2	17	14.05	4.99	9.00	26.00
	Total	41	14.74	4.90	9.00	30.00
<b>Csai-sc</b>	1	24	28.60	4.12	18.00	36.00
	2	17	29.94	5.75	18.00	36.00
	Total	41	29.16	4.85	18.00	36.00

Csai-k: cognitive anxiety; Csai-s: somatic anxiety; Csai-sc: self-confidence

Csai-k: kognitivna anksioznost; Csai-s: somatska anksioznost; Csai-sc: samopouzdanje

As indicated in Table 3, statistically significant differences between elite shooters and elite handball players were obtained through one measurement in the CSAI-2 test and several parameters of the CA test.

Kako pokazuje Tabela 3, statistički značajne razlike između vrhunskih sportista u streljaštvu i rukometu, dobjene su na jednoj meri testa CSAI-2 i nekoliko parametara CA testa.

**Table 3.** Differences between elite shooters and elite handball players on the variables of the Colour Association test and CSAI-2.

**Tabela 3.** Značajnost razlika između vrhunskih sportista u streljaštvu i rukometu na varijablama testa CA i CSAI-2.

	Razlike	Suma kvadrata / Sum of Squares	Stepeni slobode / DF	Srednja vrednost kvadrata / Mean Square Value	F	Nivo značajnosti / Sig.
<b>CA1</b>	između grupa / Between Groups	2428,727	1	2428,727	3,738	0,060
	unutar grupa / Within Groups	25336,608	39	649,657		
	Total	27765,335	40			
<b>CA2</b>	između grupa / Between Groups	124,719	1	124,719	0,298	0,588
	unutar grupa / Within Groups	16325,279	39	418,597		
	Total	16449,997	40			

<b>CA3</b>	između grupa / <i>Between Groups</i>	50,995	1	50,995	0,412	0,525
	unutar grupa / <i>Within Groups</i>	4823,025	39	123,667		
	Total	4874,020	40			
<b>CA4</b>	između grupa / <i>Between Groups</i>	200,740	1	200,740	1,147	0,291
	unutar grupa / <i>Within Groups</i>	6825,606	39	175,016		
	Total	7026,347	40			
<b>CA5</b>	između grupa / <i>Between Groups</i>	1195,426	1	1195,426	4,514	0,040
	unutar grupa / <i>Within Groups</i>	10327,998	39	264,820		
	Total	11523,424	40			
<b>CA6</b>	između grupa / <i>Between Groups</i>	1288,174	1	1288174	4,828	0,034
	unutar grupa / <i>Within Groups</i>	10405,788	39	266,815		
	Total	11693,962	40			
<b>CA7</b>	između grupa / <i>Between Groups</i>	94,368	1	94,368	0,385	0,539
	unutar grupa / <i>Within Groups</i>	9562,921	39	245,203		
	Total	9657,290	40			
<b>CA8</b>	između grupa / <i>Between Groups</i>	488,842	1	488,842	1,772	0,191
	unutar grupa / <i>Within Groups</i>	10760,543	39	275,911		
	Total	11249,385	40			
<b>CA9</b>	između grupa / <i>Between Groups</i>	1669,046	1	1669,046	5,209	0,028
	unutar grupa / <i>Within Groups</i>	12496,608	39	320,426		
	Total	14165,654	40			
<b>CA10</b>	između grupa / <i>Between Groups</i>	1124,176	1	1124,176	3,937	0,054
	unutar grupa / <i>Within Groups</i>	11136,920	39	285,562		
	Total	12261,096	40			
<b>CA11</b>	između grupa / <i>Between Groups</i>	1048,925	1	1048,925	3,935	0,054
	unutar grupa / <i>Within Groups</i>	10395,409	39	266,549		
	Total	11444,334	40			
<b>csaik</b>	između grupa / <i>Between Groups</i>	136,198	1	136,198	5,603	0,023
	unutar grupa / <i>Within Groups</i>	972,278	40	24,307		
	Total	1108,476	41			
<b>csais</b>	između grupa / <i>Between Groups</i>	14,682	1	14,682	0,603	0,442
	unutar grupa / <i>Within Groups</i>	997,504	41	24,329		
	Total	1012,186	42			
<b>csaisp</b>	između grupa / <i>Between Groups</i>	18,916	1	18,916	0,799	0,377
	unutar grupa / <i>Within Groups</i>	970,944	41	23,682		
	Total	989,860	42			

*CA1: mental balance; CA2: overall mental energy; CA3: risk; CA4: effort; CA5: pain; CA6: fear; CA7: tiredness; CA8: injury; CA9: training; CA10: match; CA11: habits.*

*Csai-k: cognitive anxiety; Csai-s: somatic anxiety; Csai-sc: self-confidence*

Considerably higher values for cognitive anxiety were obtained for elite shooters ( $M=16.08$ ;  $SD=5.09$ ), than for elite players in the team sport - handball ( $M=12.44$ ;  $SD=3.16$ ). Significant differences turned out to exist between elite shooters and elite handball players on the CA measurements for *pain, fear, training, match*

*CA1: mentalna ravnoteža; CA2:sveukupna mentalna energija; CA3: rizik; CA4: napor; CA5: bol; CA6: strah; CA7: umor; CA8: povreda; CA9: trening; CA10: takmičenje; CA11: navike.*

*Csai-k: kognitivna anksioznost; Csai-s: somatska anksioznost; Csai-sc: samopouzdanje*

Značajno više vrednosti na meri kognitivne anksioznosti dobijene su za vrhunske strelce ( $AS=16,08$ ;  $SD=5,09$ ), nego za vrhunske sportiste u kolektivnom sportu - rukometu ( $AS=12,44$ ;  $SD=3,16$ ). Pokazalo se da postoje značajne razlike između vrhunskih sportista u streljaštvu i rukometu na CA merama *bol, strah, trening, takmičenje*

and relying on *habits*. Shooters showed statistically significantly higher Mean values on the CA parameter for *pain* ( $M=47.92$ ;  $SD=17.42$ ), *fear* ( $M=49.1$ ;  $SD=17.74$ ), relying on *habits* ( $M=49.42$ ;  $SD=17.74$ ) than the members of the national handball team (*pain*:  $M=36.96$ ;  $SD=14.47$ ; *fear*:  $M=37.73$ ;  $SD=14.07$ ; *habits*:  $M=39.16$ ;  $SD=14.03$ ). Elite athletes in the team sport – handball, showed significantly higher scores on the CA parameters for *training* ( $M=67.06$ ;  $SD=22.05$ ) and *match* ( $M=64.24$ ;  $SD=20.50$ ), when compared to elite shooters (*training*:  $M=54.11$ ;  $SD=14.32$ ; *match*:  $M=53.61$ ;  $SD=13.85$ ).

## DISCUSSION AND CONCLUSION

In psychological research that sought to identify differences between athletes in individual and team sports, the emphasis was mainly on differences in personality traits. The results of some research studies indicate that athletes from individual sports are more self-aware and care more about their personal autonomy, while athletes from team sports are more cooperative and with more prominent sociotropy (Nia & Besharat, 2010). It was also revealed that athletes in individual sports score higher on traits such as positivity, perseverance, resilience, self-efficacy, and self-esteem (Laborde et al, 2016). The explanation for the differences regarding positive personality traits in favour of athletes from individual sports lies in individual responsibility for the sporting outcome, which requires the development of adequate personality traits. In terms of motivational characteristics, the main motivation drives for individual sport athletes are set goals, while athletes from team sports put intrinsic motivation and enjoyment in the chosen sport first. Potential differences in mental health risk were also identified. Athletes in individual sports are at greater risk of developing depressive symptoms (Pluhar et al, 2019).

When it comes to mental states in sports psychology, anxiety has traditionally been considered to be a 'leitmotif' of a psychological state in competition that impedes sports achievement, although different theoretical approaches and instruments are used to measure competitive anxiety (Spielberger et al. 1983; Hanin, 1999; Martens et al, 1990; Wilson, Raglin & Harger, 2000). There are different ways of measuring anxiety: physiological, cognitive, and behavioural, but a predominant opinion in sports psychology is that the least intrusive one is the use of self-report questionnaires (Raglin, 1992). It is believed that even subsequent testing of pre-competitive anxiety can provide valid measures of an athlete's mental state prior to and during a competition (Hanin, 1997; Wilson et al, 2000). Some authors believe that it would be better to use specific instru-

i i oslanjanje na *navike*. Strelci su pokazali statistički značajno više vrednosti aritmetičkih sredina na CA parametru *bol* ( $AS=47,92$ ;  $SD=17,42$ ), *strah* ( $AS=49,1$ ;  $SD=17,74$ ), oslanjanje na *navike* ( $AS=49,42$ ;  $SD=17,74$ ) nego članovi rukometne selekcije (*bol*:  $AS=36,96$ ;  $SD=14,47$ ; *strah*:  $AS=37,73$ ;  $SD=14,07$ ; *navike*:  $AS=39,16$ ;  $SD=14,03$ ). Vrhunski sportisti u timskom sportu, rukometu, pokazali su značajno više skorove CA parametrima *trening* ( $AS=67,06$ ;  $SD=22,05$ ) i *takmičenje* ( $AS=64,24$ ;  $SD=20,50$ ), u odnosu na sportiste u streljaštvu (*trening*:  $AS=54,11$ ;  $SD=14,32$ ; *takmičenje*:  $AS=53,61$ ;  $SD=13,85$ ).

## DISKUSIJA I ZAKLJUČAK

U psihološkim istraživanjima koja su nastojala da utvrde razlike između sportista u individualnim i kolektivnim sportovima, uglavnom je naglasak bio na razlikama u crtama ličnosti. Rezultati nekih istraživanja ukazuju da su sportisti iz individualnih sportova samosvesniji i važnija im je lična autonomija, dok su sportisti iz kolektivnih sportova saradljiviji i sa istaknutijom sociotropijom (Nia & Besharat, 2010). Takođe se pokazalo da sportisti iz individualnih sportova pokazuju više skorove na crtama kao što su pozitivnost, istrajnost, rezilijentnost, samo-efikasnost i samopoštovanje (Laborde et al, 2016). Objašnjenje za razlike u pogledu pozitivnih crta ličnosti u korist sportista iz individualnih sportova nalazi se u individualnoj odgovornosti za sportski ishod, što zahteva razvijanje adekvatnih crta ličnosti. U pogledu motivacionih karakteristika, sportistima iz individualnih sportova glavni motivacioni pokretači su postavljeni ciljevi, dok se kod sportista iz kolektivnih sportova u prvi plan postavlja intrinzička motivacija i uživanje u izabranom sportu. Utvrđene su i potencijalne razlike u pogledu rizika po mentalno zdravlje. Sportisti iz individualnih sportova pod većim su rizikom da razviju depresivne simptome (Pluhar et al, 2019).

Kada je reč o psihičkim stanjima u sportskoj psihologiji tradicionalno se smatra da je anksioznost 'lajt motiv' psihološkog stanja na takmičenju koji ometa sportsko postignuće, iako se teorijski pristupi i instrumenti kojima se meri takmičarska anksioznost razlikuju (Spielberger et al. 1983; Hanin, 1999; Martens et al, 1990; Wilson, Raglin & Harger, 2000). Postoje različiti načini merenja anksioznosti, fiziološki, kognitivni i bihevioralni, ali u sportskoj psihologiji je dominirao stav da je najmanje intruzivno koristiti 'self-report' upitnike (Raglin, 1992). Smatra se da čak i naknadno testiranje predtakmičarske anksioznosti može da pruži validne mere o psihičkom stanju sportiste pre i tokom takmičenja (Hanin, 1997; Wilson et al, 2000). Neki autori smatraju da je bolja opcija koristiti specifične instrumente namenjene ispitiva-

ments designed to test anxiety in sport than questionnaires of generalized anxiety (Weinberg & Gould, 1999).

A meta-analysis examining the association between cognitive anxiety, competitive self-esteem, and sports performance showed that there were no differences related to the type of sport (Woodman & Hardy, 2003). However, over the past few decades, researchers across the globe have constantly sought to identify differences in the pre-competitive states of elite athletes from individual and team sports. Athletes from individual sports proved to be at higher risk of developing anxiety symptoms and may experience significantly more pre-competitive anxiety (Pluhar et al, 2019). Other studies indicate that there is no significant difference in somatic anxiety in team sports in relation to the athlete's position on the team (e.g., defensive or offensive player) or amount of contact with the opponent (Allie, Larson & DeBeliso, 2018). Some authors suggest that significant differences may occur in relation to the type of individual sport (Sanioglu, Ulker & Sanioglu Tanis, 2017).

It could be argued that, on the one hand, athletes in individual sports have more opportunity to develop more positive and stable personality traits, while on the other hand, the competitive context in individual sports can provoke inadequate mental states. Research studies also point to the need to introduce new methods in the assessment of pre-competition mental states due to the interplay of psychological and physiological levels of functioning in a stressful pre-competitive situation. Thus, it was proven that when considering certain physiological parameters, athletes from individual sports show greater inclination to succumb to a stressful competitive situation (Radzi, Yusof & Zakaria, 2013).

This research took into account not only the conscious self-perception of mental readiness for competition, as measured by traditional psychological questionnaires, but also the unconscious perception of the stress in a competitive context. A new assessment method was used - the colour association (CA) method. Applying of the CA method indicated significant differences between athletes in individual sport (shooting) and team sport (handball) on a number of psychological parameters. An earlier study, which also used the CA method, found that there were individual differences in the mental state during competition in athletes from the same individual sport (kayaking). Taking into account the Damasio's thesis (Damasio, 2010) that a person is not always conscious of their current mental state, and pursuing the most adequate strategy of psychological preparation of elite athletes for international competitions, that study also implemented CSAI-2 and the Colour Association method

nju anksioznosti u sportu, nego upitnike generalizovane anksioznosti (Weinberg & Gould, 1999).

Meta-analiza koja je ispitala povezanost kognitivne anksioznosti, takmičarskog samopouzdanja i sportskog izvođenja, pokazala je da nema razlika u odnosu na tip sporta (Woodman & Hardy, 2003). Međutim, istraživači širom sveta tokom proteklih par decenija kontinuirano nastoje da utvrde razlike u predtakmičarskim stanjima vrhunskih sportista iz individualnih i kolektivnih sportova. Pokazalo se da su sportisti iz individualnih sportova pod većim rizikom da razviju simptome anksioznosti i da mogu značajno više da doživljavaju anksioznost kao predtakmičarsko stanje (Pluhar et al, 2019). Neka druga istraživanja pokazuju da u kolektivnim sportovima ne postoje značajne razlike u pogledu somatske anksioznosti u odnosu na poziciju sportiste u ekipi (npr, defanzivni ili ofanzivni igrači) ili količinu kontakta sa protivnikom (Allie, Larson & DeBeliso, 2018), dok neki autori navode da mogu postojati značajne razlike i u odnosu na vrstu individualnog sporta (Sanioglu, Ulker & Sanioglu Tanis, 2017).

Moglo bi se reći da koliko su sa jedne strane sportisti u individualnim sportovima više u prilici da razvijaju pozitivnije i stabilnije crte ličnosti, toliko sa druge strane takmičarski kontekst u individualnim sportovima može da bude provokativan za neadekvatna psihička stanja. Istraživanja takođe ukazuju i na potrebu uvođenja novih metoda u procenu psihičkih stanja pred takmičenje usled isprepletanosti psihološkog i fiziološkog nivoa funkcionisanja u stresnoj predtakmičarskoj situaciji. Pa tako, pokazalo se da kada se uzmu u obzir i neki fiziološki parametri, pokaže se da postoji veća vulnerabilnost sportista iz individualnih sportova da podlegnu stresnoj takmičarskoj situaciji (Radzi, Yusof & Zakaria, 2013).

U ovom istraživanju uzeta je u obzir ne samo svesna samopercepcija psihičke spremnosti za takmičenje, merena tradicionalnim psihološkim upitnicima, već i nesvesna percepcija stresnosti takmičarskog konteksta. U tom cilju korišćen je jedan novi psihodijagnostički metod – metod asocijacije bojama (CA), koji je dodatno ukazao na postojanje značajnih razlika između sportista u individualnom sportu (streljaštvo) i kolektivnom sportu (rukomet) na nizu psiholoških parametara. U jednom ranijem istraživanju u kojem je takođe korišćen CA metod, pokazalo se da postoje i značajne individualne razlike u mentalnom stanju na takmičenju kod sportista iz istog individualnog sporta (kajaka). Polazeći od Damasiove teze (Damasio, 2010) da osoba nije uvek svesna svog aktuelnog psihičkog stanja i tragajući za najadekvatnijom strategijom psihološke pripreme vrhunskih sportista za interan-

(CA). The aim was to gain insight into the mental state of athletes in major international competitions. The sample involved only two athletes, members of the Serbian senior national kayak team. Every day for 26 days, in days immediately before and during the 2014 European and World Canoe Sprint Championships, the athletes did the CSAI-2 and CA tests (Mladenovic & Trunic, 2015). The CSAI-2 results were similar for both athletes: a low level of cognitive and somatic anxiety and a relatively high level of competitive self-confidence. The data collected by the CA method indicated difference in the athletes' mental state. One of the athletes showed higher mental resilience, which means higher scores on the *match* and *training* parameters and lower values of the *fear* and *pain* parameters. The other athlete scored lower on the *match* and *training* parameters and had high values of the *pain* and *fear* parameters. The data obtained by the CA test were more congruent to the athletes' observed behaviour and made a better contribution to the development of an adequate strategy of the athletes' psychological preparation.

This research showed that in terms of the adequacy of the pre-competitive mental state, athletes in team sports enjoy a psychological advantage. The members of women's national handball team of Serbia showed statistically significantly higher scores on psychological parameters that measure positive mental state for a competitive situation (CA measures "readiness for training and competition") compared to athletes from the individual sport (national shooting team of Serbia). On the other hand, elite athletes in individual sport (Serbian shooting team) showed more intrapersonal sensitivity to potential distractors in a competitive situation (CA parameters "self-perception of fear and pain, reliance on habits and automatisms" and higher levels of cognitive anxiety on the CSAI-2).

The drawback of this research is that the number of examinees of both genders is not even, and that it involved a relatively small sample of examinees with a wide age span.

Given that competitive mental state is a complex psycho-physiological response to the stressfulness of the competitive context, it is important that future research in sports psychology uses not only personal inventories, which are based on the conscious introspection of the athlete, but also other methods. The Colour Association (CA) method used in this research may provide a contribution to the new methodology, as it points to the importance of unconscious perception of competition. Unconscious perception may be more accurately associated with actual mental readiness for competition, and that is not only of theoretical but also of practical importance in elite sport.

cionalna takmičenja, u toj studiji primenjivani su CSAI-2 i Metod asocijacije bojama (CA). Cilj je bio da se istraži psihičko stanje sportista na velikim međunarodnim takmičenjima. Uzorak je činilo samo dvoje sportista, članova kajakaške reprezentacije Srbije. Svakog dana, tokom dvadesetšest dana, u danima neposredno pre i tokom Evropskog i Svetskog prvenstva u kajaku 2014. godine, sportisti su popunjavali CSAI-2 i CA test (Mladenovic & Trunic, 2015). Rezultati na CSAI-2 ukazivali su na slične rezultate kod jednog i drugog sportiste: nizak nivo kognitivne i somatske anksioznosti i relativno visok nivo takmičarskog samopouzdanja. Podaci prikupljeni CA metodom ukazivali su na različitost psihičkog stanja sportista. Jedan sportista pokazivao je veću mentalnu rezilijentnost. To znači više skorove na parametrima *takmičenje* i *trening* i niske vrednosti parametara *strah* i *bol*. Drugi sportista pokazao je niske vrednosti na parametrima *takmičenje* i *trening* i visoke vrednosti na parametrima *bol* i *strah*. Podaci prikupljeni CA testom bili su više kongruentni opserviranom ponašanju sportista i bolje su doprineli razvoju adekvatne strategije psihološke pripreme tih sportista.

U ovom istraživanju pokazalo se da u pogledu adekvatnosti predtakmičarskog psihičkog stanja postoji psihološka prednost koja je na strani sportista iz kolektivnog sporta. Članovi ženske rukometne selekcije Srbije pokazali su statistički značajno više rezultate na psihološkim parametrima koji mere pozitivno psihičko stanje za takmičarsku situaciju (CA mere "spremnost za trening i takmičenje") u odnosu na sportiste iz individualnog sporta (streljačka reprezentacija Srbije). Sa druge strane, vrhunski sportisti u individualnom sportu (streljačka reprezentacija Srbije) pokazali su više intrapersonalne senzitivnosti na potencijalne distraktore u takmičarskoj situaciji (CA parametri "samopercepcija straha i bola, oslanjanje na navike i automatizme" i viši nivo kognitivne anksioznosti na CSAI-2 testu).

Nedostatak ovog istraživanja je neujednačenost ispitanika prema polu i relativno mali uzorak ispitanika uz širok raspon godina starosti.

S obzirom da je mentalno stanje za takmičenje složen psiho-fiziološki odgovor na stresnost takmičarskog konteksta, od značaja je da buduća istraživanja u sportskoj psihologiji koriste ne samo personalne inventare, koji se zasnivaju na svesnoj introspekciji sportiste, već i druge metode. Prilog novoj metodologiji može da pruži i metod asocijacije bojama (CA), korišćen u ovom istraživanju, koji ukazuje na značaj nesvesne percepcije takmičenja koja može autentičnije biti povezana sa realnom psihičkom spremnošću za takmičenje, što je ne samo od teorijskog, već i od praktičnog značaja u vrhunskom sportu.



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## TEACHERS ATTITUDES ON SPORTS TALENT IN PRIMARY SCHOOL PUPILS TRANSFERRING FROM CLASS TO SUBJECT TEACHING

OSMO BAJRIĆ<sup>1</sup>, SLOBODAN GORANOVIĆ<sup>2</sup>, SENAD BAJRIĆ<sup>1</sup>

<sup>1</sup>Faculty of Sports Sciences, Pan-European University Apeiron, Banja Luka, Bosnia and Herzegovina,

<sup>2</sup>Faculty of Physical Education and Sports, University of Banja Luka, Bosnia and Herzegovina

### Correspondence:

Prof. dr Osmo Bajrić

Faculty of Sports Sciences, Pan-European Apeiron University, Banja Luka, Bosnia and Herzegovina

osmo.s.bajric@apeiron-edu.eu

**Abstract:** The study was conducted on a sample of 102 respondents (teachers / professors) employed in the elementary schools of the Zenica-Doboj Canton, Federation of Bosnia and Herzegovina. The main objective of the research is to determine the teachers / professors views on sport talent and any differences in attitudes on the students who pass from class to subject teaching, in activities that engage the student in terms of gender, working status, age and level of education of teachers. The total number of respondents was 102 teachers / professors permanently employed in the elementary school of the Zenica-Doboj Canton of the Federation of BiH.

A five-level Likert scale questionnaire was used as a measuring instrument in the research, in which each statement has 5 answers (completely disagree, disagree, don't have opinion / neutral, agree, completely agree). The questionnaire contains 4 indicators for declaring the sporting talents of children-students, as well as questions related to gender, job / position, age and level of education.

LSD Post Hoc tests of success were applied for determination of the statistically significant differences between these group of subjects, the results of the test and analysis of the variation of the different groups.

The results obtained indicate that there are no statistically significant differences in the attitudes of teachers / professors or sports talents (above-average achievements) in activities that engage the student in terms of gender, working status, age and level of education.

**Keywords:** Attitudes, respondents, sports talent

## STAVOVI NASTAVNIKA O SPORTSKOJ NADARENOSTI UČENIKA OSNOVNE ŠKOLE KOJI PRELAZE IZ RAZREDNE U PREDMETNU NASTAVU

OSMO BAJRIĆ<sup>1</sup>, SLOBODAN GORANOVIĆ<sup>2</sup>, SENAD BAJRIĆ<sup>1</sup>

<sup>1</sup>Fakultet sportskih nauka, Panevropski univerzitet „Apeiron“, Banja Luka, Bosna i Hercegovina,

<sup>2</sup>Fakultet za fizičko vaspitanje i sport Univerziteta u Banja Luci, Banja Luka, Bosna i Hercegovina

### Korespondencija:

Prof. dr Osmo Bajrić

Fakultet sportskih nauka, Panevropski univerzitet „Apeiron“ Banja Luka, Bosna i Hercegovina

osmo.s.bajric@apeiron-edu.eu

**Apstrakt:** Istraživanje je provedeno na uzorku od 102 ispitanika (nastavnika/profesora) zaposlenih u osnovnim školama Zeničko-dobojskog kantona Federacije Bosne i Hercegovine. Osnovni cilj istraživanja je utvrđivanje stavova nastavnika/profesora o nadarenosti i eventualne razlike u stavovima o nadarenosti učenika koji prelaze iz razredne u predmetnu nastavu, u aktivnostima kojima se učenik bavi s obzirom na spol, radni status, starosnu dob i stepen obrazovanja ispitanika. Ukupan uzorak ispitanika činilo je 102 ispitanika-nastavnika/profesora stalno zaposlenih u osnovnim školama Zeničko-dobojskog kantona Federacije BiH.

Kao mjerni instrumenat u istraživanju je primijenjen anketni upitnik petostepene Likertove skale u kojem svaka tvrdnja ima 5 odgovora (uopšte se ne slažem, ne slažem se, nemam mišljenje/neutralan sam, slažem se, potpuno se slažem). Anketni upitnik je sadržavao 4 indikatora za procjenu sportske nadarenosti djece-učenika, kao i pitanja koja se odnose na spol, radno mjesto/poziciju, starosnu dob i stepen obrazovanja ispitanika.

Za utvrđivanje statistički značajnih razlika između grupa ispitanika primijenjeni su rezultati t-testa i analiza varijanse različitih grupa sa LSD Post Hoc testovima poređenja.

Dobijeni rezultati ukazuju na to da nema statistički značajna razlika u stavovima nastavnika/profesora o sportskoj nadarenosti (iznadprosječnih postignuća) u aktivnostima kojima se učenik bavi s obzirom na spol, radni status, starosnu dob i stepen obrazovanja ispitanika.

**Ključne reči:** stavovi, nastavnici/profesori, sportska nadarenost

## INTRODUCTION

Talent is a phenomenon that has long attracted the attention of professionals involved in its manifestation, as well as how to approach the process of education in gifted children. It is a phenomenon that is very difficult to define precisely. A large number of different approaches and definitions can be found in the available literature, so today there are about 140 different definitions of the term talent in the scientific world. Cvetković-Lay (2006) defines talent as a system of traits that enable a child to consistently achieve above-average results in one or more activities that he or she engages in. According to Lazarević (2001), the oldest and most widespread understanding of giftedness-talent “comes from the psychometric definition of intelligence. From the observation that human ability to cope in different types of problems is distributed according to the bell curve (most have average success, and the same number of below-average and above-average individuals), the ability to measure intelligence ability emerged. Čudina-Obradović (1990; 1991) defines giftedness as a general intellectual, creative ability, as a productive-creative ability, as a set of specific abilities, as the ability to use thought processes, and as area-specific intelligence and creativity. Koren (1989) believes that talent determines a set of traits (abilities, motivations, and creativity) that enables an individual to achieve a distinctly above-average result in some domain of human activity, and that a product can be recognized as a new and original contribution to the field.

Lewis Terman, the creator of Education for talented, defined talent as “1% top measured achievements in measuring intelligence as measured by the Stanford-Binet scale for intelligence or other comparable means.” (according to Yahnke Walker, 2008: 16). For Marlanda (1972), “gifted and talented children are those who are identified by professionally qualified persons and who, due to their extraordinary abilities, are capable of excellence.

Joseph Renzulli says talent it is an interaction of three basic groups of human characteristics of above-average general ability, a high degree of commitment to the task, and a high degree of creativity. Authors like R.F. De Haan and R.J. Havighurst consider that gifted “is every child who has a certain ability that is more pronounced and that can help it contribute more to the well-being and quality of the society in which it lives.” (Krulj, Arsić, 2008: 348). The definitions of giftedness are constantly expanding, so more and more factors are examined and taken into account when determining

## Uvod

Nadarenost je fenomen koji već dugo vremena zaočuplja pažnju stručnjaka koji se bave njenim manifestovanjem kao i načinom pristupa procesu vaspitanja i obrazovanja nadarene djece. To je fenomen, pojava koju je vrlo teško precizno definisati. U dostupnoj literaturi može se naći veliki broj različitih pristupa i definicija, tako da se danas u naučnom svijetu koristi oko 140 različitih definicija pojma nadarenosti. Cvetković-Lay (2006) nadarenost definiše kao sistem osobina, koje omogućavaju djetetu da dosljedno postiže natprosječne rezultate u jednoj ili više aktivnosti kojima se bavi. Prema Lazareviću (2001), najstarije i najrasprostranjenije shvatanje nadarenosti “proizlazi iz psihometrijske definicije inteligencije. Iz opažanja da se ljudska sposobnost snalaženja u različitim tipovima problema raspoređuje prema zvonastoj krivoj (najviše ima prosječno uspješnih, a podjednak broj ispodprosječnih i iznadprosječnih pojedinaca) proizašla je mogućnost mjerenja sposobnosti inteligencije“.

Čudina-Obradović (1990; 1991) nadarenost definiše kao opštu intelektualnu, kreativnu sposobnost, kao produktivno-kreativnu sposobnost, kao skup specifičnih sposobnosti, kao sposobnost upotrebe misaonih procesa, te kao područno-specifičnu inteligenciju i kreativnost. Koren (1989), smatra da nadarenost određuje sklop osobina (sposobnosti, motivacije i kreativnosti) koji omogućuje pojedincu da postiže izrazito natprosječan rezultat u nekom domenu ljudske djelatnosti, a da se proizvod može prepoznati kao nov i originalan doprinos toj oblasti.

Amerikanac Lewis Terman, tvorac obrazovanja za nadarene, definisao je nadarenost kao „1% vrhunskih izmjerenih postignuća pri mjerenju inteligencije mjereno Stanford-Binet skalom za inteligenciju ili nekim drugim usporedivim sredstvom.“ (prema Yahnke Walker, 2008, str. 16). Za Marlanda (1972), „nadarena i talentovana djeca su ona koja su identifikovana od strane profesionalno kvalifikovanih osoba i koja su zbog izvanrednih sposobnosti sposobna za visoka postignuća.“ Veoma važnim smatra prilagođavanje obrazovnih programa i pristupa podučavanju njihovim sposobnostima, kako bi mogli definisati područja u kojima bi najviše mogli pridonijeti sebi i društvu.

Joseph Renzulli za nadarenost kaže da je to interakcija tri osnovne grupe ljudskih karakteristika natprosječne opšte sposobnosti, visoki stepen posvećenosti zadatku, i visoki stepen kreativnosti.

Autori poput R.F. De Haan i R.J. Havighurst smatraju nadarenim „svako dijete koje ima izvjesnu sposobnost jače izraženu i koja mu može pomoći da više doprinese blagostanju i kvalitetu društva u kome živi.“ (Krulj, Arsić, 2008, str. 348).

giftedness. Neskovic (2003) interprets talent as a creative ability that does not separate from the field of human activity, from his actions that are new, useful and constantly superior, when achievements are constantly significant in any field of human activity and in any social direction. In order for talent to be able to demonstrate above-average achievement, an individual would need to have exceptional potential in a particular area, which would allow him or her to develop his or her abilities to that degree. The large number of scientific research findings indicates that all gifted children have some abilities specially developed. It is these specially developed specific abilities that enable them to achieve above-average results in various activities (Cvetković - Lay, 2006). Thus, analyzing the above definition, it can be concluded that parents, educators and school staff can, based on the knowledge that individual children constantly achieve exceptional and above-average results in the activities they engage in, classify them as gifted children and accordingly to that develop methods and forms of work with these children.

In the context of the possibility that talent can be positive and sports talent that is natural talent in sports at different levels, from those individuals who do not yet participate, to elite competitors (Sturza-Milić, 2008a). "Talent in sports is," says Malina (2010, according to Choh, 2016: 2), "a combination of natural biomotor skills, creativity and intrinsic motivations. Especially gifted children have several characteristics in common, such as: gifted children have similar behaviors, the environment is key to realizing their talents, if talent is not adequately stimulated, motivation is lost, gifted children explore the world and the environment in a different way from their new peers, needs are different, working with them is a great challenge but also a great effort for parents, teachers and coaches. Gifted children deserve gifted coaches and teachers (Adžić, 2011). The issue of identifying gifted children for sports is especially urgent, according to Choh (2016), because gifted children have, as a rule, demonstrated natural abilities in several areas. Sport is just one possible commitment. Sporting practice raises a number of questions, among which are the following: 1. Is early inclusion of gifted children or children in general, in certain sports, generally beneficial? 2. Is early specialization helpful? There are no clear answers to sports practice. (Choh, 2016). The research in this paper was conducted with the success of determining teacher / professor attitudes about giftedness and possible differences in attitudes about giftedness of students transitioning from class to sub-

Definicije nadarenosti se neprekidno proširuju, tako da se sve više faktora ispituje i uzima u obzir prilikom utvrđivanja nadarenosti. Nešković (2003), nadarenost tumači kao stvaralačku sposobnost koja se ne odvaja od područja čovjekove djelatnosti, od njegovih postupaka koji su novi, korisni i stalno superiorni, kada su postignuća konstantno značajna u bilo kojoj oblasti ljudske aktivnosti i u bilo kom društvenom pravcu. Da bi se nadarenost mogla iskazati u natprosječnom dostignuću, pojedinac bi morao u određenoj oblasti imati izuzetan potencijal, koji bi mu omogućio da svoje sposobnosti razvije do tog stepena. Veliki broj rezultata naučnih istraživanja ukazuju na činjenicu da sva nadarena djeca imaju neke sposobnosti posebno razvijene. Upravo te posebno razvijene specifične sposobnosti im omogućavaju postizanje iznadprosječnih rezultata u različitim aktivnostima (Cvetković – Lay, 2006). Prema tome, analizirajući navedenu definiciju može se zaključiti da roditelji, vaspitači i zaposleni u školi mogu, na osnovu saznanja da pojedina djeca konstantno postižu izuzetne i natprosječne rezultate u aktivnostima kojima se bave, svrstati ih u nadarenu djecu i u skladu sa tim razraditi metode i oblike rada.

U kontekstu opšte nadarenosti može se posmatrati i sportska nadarenost koja se smatra kao prirodna nadarenost prisutna u sportu na različitim nivoima izvođenja, od onih pojedinaca koji još ne učestvuju, pa sve do elitnih takmičara (Sturza-Milić, 2008a). „Talentovanost u sportu je“, smatra Malina (2010, u Čoh, 2016, str.2 ) „kombinacija nadprosječnih biomotoričkih sposobnosti, kreativnosti i unutrašnje motivacije. Posebno nadarena djeca imaju nekoliko zajedničkih svojstava. Posebno nadarena djeca imaju nekoliko zajedničkih svojstava kao što su: nadarena djeca su sličnog ponašanja; okolina je ključna za realizaciju njihove nadarenosti; ako nadarenost nije adekvatno potaknuta, gubi se motivacija; nadarena djeca doživljavaju svijet i okolinu na drugačiji način od njihovih vršnjaka; njihove potrebe su drugačije, rad sa njima je veliki izazov, ali i veliki napor za roditelje, učitelje i trenere. Nadarena djeca zaslužuju nadarene trenere i učitelje (Adžić, 2011).

Posebno je aktuelna problematika identifikacije nadarene djece za sport, smatra Čoh (2016) iz razloga što nadarena djeca po pravilu pokazuju natprosječne sposobnosti na više područja. Sport je samo jedno od njihovih mogućih opredeljenja. Sportska praksa otvara brojna pitanja, između kojih se izdvajaju: 1. Da li je rano uključivanje nadarene djece ili djece uopšte, u pojedine sportive, opšte korisno? 2. Da li je rana specijalizacija korisna? Sportska praksa nema sasvim jasnih odgovora (Čoh, 2016).

Istraživanje u ovom radu je sprovedeno sa ciljem utvrđivanja stavova nastavnika/profesora o nadarenosti i

ject teaching, in activities that engage the student in terms of gender, working status, age and level of education of respondents.

## METHOD OF WORK

### *Sample of respondents*

The sample consisted of teachers and physical education teachers in primary schools in the Zenica-Doboj Canton of the Federation of Bosnia and Herzegovina (Maglaj, Tešanj, Doboj Jug, Žepče and Zavidovići). The total number of teachers / professors surveyed was 102, of which 82 were classroom teachers and 20 were physical education teachers.

### *Sample variables*

The measuring instruments used in the survey represented the survey questionnaire and the rating scale. The Attitude Assessment Questionnaire was constructed according to a Likert scale model with each statement marked by five modalities (1-completely disagree, 2-disagree, 3-don't have opinion / neutral, 4-agree, 5-completely agree.). The survey questionnaire included general data on respondents (gender, job / position, age, education level) and 4 indicators of student talent with a talent rating scale.

### *Statistical data processing*

The obtained data were processed in two stages. The first stage is to quantify the results and categorize the respondents according to the frequencies of the respective variables. In the second phase, statistical data processing was performed. First, basic descriptive statistical parameters for all variables of talent were calculated and determined. From the measures of central tendency the arithmetic mean (AS) and from the measures of variability the standard deviation (St. Dev.) were calculated. To determine statistically significant differences between groups of subjects, t-test results and analysis of variance of different groups with LSD Post Hoc comparison tests were applied.

### *Research process flow*

Teacher surveys were conducted during April and May 2017. Respondents (teachers / professors) were given clear and precise instructions on how to answer, unclear statements and questions (questionnaire and rating scale).

Scale of indicators of interpretation of sports talent

The content of the Indicator's Scale of Knowledge and Interpretation of Sports Talent related to:

eventualne razlike u stavovima o nadarenosti učenika koji prelaze iz razredne u predmetnu nastavu, u aktivnostima kojima se učenik bavi s obzirom na spol, radni status, starosnu dob i stepen obrazovanja ispitanika.

## METOD RADA

### *Uzorak ispitanika*

Uzorak ispitanika činili su nastavnici razredne nastave i profesori fizičkog vaspitanja osnovnih škola sa području Zeničko-dobojskog kantona Federacije Bosne i Hercegovine (Maglaj, Tešanj, Doboj Jug, Žepče i Zavidovići). Ukupan broj ispitanika nastavnika/profesora iznosio je 102 i to 82 nastavnika razredne nastave i 20 profesora fizičkog vaspitanja.

### *Uzorak varijabli*

Mjerni instrumenti koji su korišteni u istraživanju predstavljali su anketni list i skala procjene. Anketni list za procjenu stavova konstruisan je po modelu Likertove skale pri čemu je svaka tvrdnja označena sa pet modaliteta ( 1-uopšte se ne slažem, 2-ne slažem se, 3-nemam mišljenje/neutralan sam, 4-slažem se, 5-potpuno se slažem.). Anketni list je obuhvatao opšte podatke o ispitanicima (spol, radno mjesto/poziciju, starosnu dob, stepen obrazovanja) i 4 indikatora o nadarenosti učenika sa skalom za procjenu nadarenosti.

### *Statistička obrada podataka*

Dobijeni podaci obrađivani su u dvije faze. Prva faza je kvantifikovanje rezultata i kategorizacija ispitanika prema frekvencijama odgovarajućih varijabli. U drugoj fazi je izvršena statistička obrada podataka. Prvo su izračunati i utvrđeni osnovni deskriptivni statistički parametri za sve varijable nadarenosti. Od mjera centralne tendencije izračunata je aritmetička sredina (AS), a od mjera varijabilnosti standardna devijacija (St. Dev.). Za utvrđivanje statistički značajnih razlika između grupa ispitanika primijenjen je t-test i analiza varijanse različitih grupa sa *LSD Post Hoc* testovima poređenja.

### *Tok istraživanja*

Anketiranje nastavnika je realizovano tokom aprila i maja mjeseca 2017. godine. Ispitanicima (nastavnici/profesori) su data jasna i precizna uputstva o načinu davanja odgovora, nejasnih tvrdnji i pitanja (anketni upitnik i skala procjene).

Skala pokazatelja tumačenja sportske nadarenosti Sadržaj skale pokazatelja poznavanja i tumačenja sportske nadarenosti odnosio se na:

- talent 1 - above average ability,
- talent 2 - above-average achievement in the student's activities,
- talent 3 - motivational student trait,
- talent 4 - overall above average development in relation to peers

## RESULTS AND DISCUSSION

### *Sample structure*

A total of 102 respondents (teachers / professors) participated in the survey.

In relation to gender:

- 80 female respondents (teachers / professors) or 78.40%
- 22 male respondents (teachers / professors) or 21.60%.

In relation to work status / workplace:

- 82 classroom teachers or 80.40%
- Professor of Physical Education in the subject teaching 20 or 19.60%

Respondents by age were divided into four categories:

- Under 25 years 4 respondents (teachers / professors) or 3.90%,
- from 26-35 years of age 17 respondents (teachers / professors) or 16.70%,
- from 36-45 years 59 respondents (teachers / professors) or 57.80%
- from 46-55 years 22 respondents (teachers / professors) or 21.60%.

By education level:

- 68 college degree (teachers / professors) or 66.70%
- 25 university degree (teachers / professors) or 24.50%
- Master or PhD 9 respondents (teachers / professors) or 8.80%.

Table 1 presents the measures of central tendency, measures of variability and frequency distribution of characteristics interpreting talent. The calculated arithmetic mean (AS) of all indicators is 3.99 and shows that the interpretation of student's talent by the teacher / professor is very good. A standard deviation value (St. Dev.) of 0.88 indicates that the scattering of the results around the arithmetic mean is very small, which also confirms the coefficient of variability (CV) of 22.06% and thus the good homogeneity of the results obtained for this sample of respondents.

Based on the results obtained (Table 1), it is evident that the majority of respondents consider talent is

- nadarenost 1 - iznadprosječna sposobnost,
- nadarenost 2 - iznadprosječno postignuće u aktivnostima kojima se učenik bavi,
- nadarenost 3 - motivaciona učenikova karakteristika,
- nadarenost 4 - opšta iznadprosječnost u razvoju u odnosu na vršnjake.

## REZULTATI I DISKUSIJA

### *Struktura uzorka*

U istraživanju je učestvovalo ukupno 102 ispitanika (nastavnika/profesora).

U odnosu na spol:

- 80 ženskih ispitanika (nastavnika/profesora) ili 78,40%
- 22 muška ispitanika (nastavnika/profesora) ili 21,60%.

U odnosu na radni status/radno mjesto:

- Nastavnika razredne nastave 82 ili 80,40%
- Profesora fizičkog vaspitanja u predmetnoj nastavi 20 ili 19,60%

U odnosu na starosnu dob ispitanici su podijeljeni u četiri kategorije:

- Do 25 godina 4 ispitanika (nastavnika/profesora) ili 3,90%,
- od 26-35 godina starosti 17 ispitanika (nastavnika/profesora) ili 16,70%,
- od 36-45 godina 59 ispitanika (nastavnika/profesora) ili 57,80%
- od 46-55 godina 22 ispitanika (nastavnika/profesora) ili 21,60%.

Prema stepenu obrazovanja:

- Visoka stručna sprema 68 ispitanika (nastavnika/profesora) ili 66,70%,
- Viša stručnom spremom je 25 ispitanika (nastavnika/profesora) ili 24,50%,
- Master ili doktor nauka ima 9 ispitanika (nastavnika/profesora) ili 8,80%.

U tabeli 1 prikazane su mjere centralne tendencije, mjere varijabilnosti i distribucije frekvencije obilježja tumačenja nadarenosti. Izračunata aritmetička sredina (AS) svih indikatora iznosi 3,99 i pokazuje da je tumačenje nadarenosti od strane nastavnika/profesora veoma dobro. Vrijednost standardne devijacije (St. Dev.) od 0,88 ukazuje da je rasipanje rezultata oko aritmetičke sredine veoma malo, što potvrđuje i koeficijent varijabilnosti (CV) od 22,06% a time i dobru homogenost dobivenih rezultata za ovaj uzorak ispitanika.

Na osnovu dobivenih rezultata (tabela 1) vidljivo je da većina ispitanika smatra da je nadarenost iznadprosječ-

above average ability of pupils. No opinion has 12.70% of respondents, while 4.90% of the professors disagree or strongly disagree with the stated statement.

Most respondents (81.40%) believe that talent is an above-average achievement in activities in which the student deals with. 10.80% of the respondents disagree with this statement, and 7.80% respondents do not have an opinion.

Respondents are in the majority (80.40%) of the opinion that talent is a motivational characteristic of a student. 8.80% of teachers / professors were neutral, and 10.80% gave negative answers (disagree and completely disagree).

84.30% of the respondents agree with the attitude that talent is a general above average in relation to peers. No opinion has 11.80% of respondents, while 3.90% teachers / professors do not agree that talent is a general above-average in relation to peers. Therefore, according to the results of the research, it can be concluded that talent is a general above-average in relation to peers, since there were the most positive answers for this claim.

**Table 1.** Measures of central tendency, variability and frequency distribution of characteristics interpretation of giftedness

Indikator / Indicator	N	AS	St. Dev.	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)
Nadarenost / Talent 1	102	4,01	,79	1,00	3,90	12,70	57,80	24,50
Nadarenost / Talent 2	102	3,97	1,01	3,90	6,90	7,80	51,0	30,40
Nadarenost / Talent 3	102	3,90	,98	3,90	6,90	8,80	55,90	24,50
Nadarenost / Talent 4	102	4,08	,74	0,00	3,90	11,80	56,80	27,50
		3,99	,88	2,2	5,4	10,28	55,38	26,65

**Legend:** N-total number of respondents; AS-arithmetic mean; St. Dev.-standard deviation; talent 1 - Above average ability; talent 2 - above-average achievement in the student's activities; talent 3 - student motivational trait; talent 4 - A general above-average in development relative to peers.

Table 2 shows the results of the t-test of interpretation of sports talents in relation to the gender of the respondents.

The value of  $t = -,328$  and its Sig. importance = ,744 shows that there is no statistically significant difference in the attitudes of teachers / professors with regard to their gender in the perception of interpretation of talent. The results obtained indicate that there is no statistically significant difference in the attitudes of teachers / professors regarding the interpretation of above-average achievements (talent / sport talent) in the activity being examined with respect to the gender of the respondents.

na sposobnost. Bez stava (mišljenja) je 12,70% ispitanih, dok se 4,90% nastavnika/profesora ne slaže ili uopšte ne slaže s navedenom tvrdnjom.

Većina ispitanika (81,40%) smatra da je nadarenost iznadprosječno postignuće u aktivnostima u kojima se učenik bavi. Sa navedenom tvrdnjom se ne slaže 10,80% ispitanika, a bez mišljenja je 7,80% ispitanih.

Ispitanici su u većini (80,40%) stava da je nadarenost motivaciona učenikova karakteristika. Neutralno je 8,80% nastavnika/profesora, a 10,80% je dalo negativne odgovore (ne slažem se i uopšte se ne slažem).

Sa stavom (tvrdnjom) da je nadarenost opšta iznadprosječnost u razvoju u odnosu na vršnjake se slaže i potpuno slaže 84,30% ispitanika. Bez mišljenja je 11,80% ispitanika, dok se 3,90% nastavnika/profesora ne slaže da je nadarenost opšta iznadprosječnost u odnosu na vršnjake. Dakle, prema rezultatima istraživanja može se izvesti zaključak da je nadarenost opšta iznadprosječnost u odnosu na vršnjake, obzirom da je za ovu tvrdnju bilo najviše pozitivnih odgovora.

**Tabela 1.** Mjere centralne tendencije, varijabilnosti i distribucije frekvencije obilježja tumačenje nadarenosti

**Legenda:** N-ukupan broj ispitanika; AS-aritmetička sredina; St. Dev.-standardna devijacija; nadarenost 1 - iznadprosječnu sposobnost; nadarenost 2 - iznadprosječno postignuće u aktivnostima kojima se učenik bavi; nadarenost 3 - motivaciona učenikova karakteristika; nadarenost 4 - opšta iznadprosječnost u razvoju u odnosu na vršnjake.

U tabeli 2 prikazani su rezultati t-testa tumačenja sportske nadarenosti u odnosu na spol ispitanika.

Vrijednost  $t = -,328$  i njegova značajnost Sig. = ,744 ukazuju na to da ne postoji statistički značajna razlika u stavovima nastavnika/profesora s obzirom na njihov spol u percepciji tumačenja nadarenosti. Dobiveni rezultati ukazuju na to da ne postoji statistički značajna razlika u stavovima nastavnika/profesora o tumačenju iznadprosječnih postignuća (nadarenosti/sportske nadarenosti) u aktivnostima kojima se učenik bavi s obzirom na spol ispitanika.

**Table 2.** Interpretation of giftedness - comparison by gender (t-test)

Parametri / parametre	Spol / gender	N	AS	St. Dev.
Nadarenost / Talent	Ž	80	3,98	,54
	M	22	4,02	,48

**Legend:** N-total number of respondents; AS-arithmetic mean; St. Dev.-standard deviation; Diff. AS-difference arithmetic means; F and significance - Leven's test of equality of variances; t-values. and Significance - the value of the t-test and its significance.

Table 3 shows the results of the t-test of interpretation of sports talent in relation to the work status / work place of the respondents. The value of t = ,979 and its significance of Sig. = ,330 indicate that there is no statistically significant difference in the attitudes of teachers / professors with regard to work status / workplace in the perception of interpreting talent. Based on the results obtained, it can be seen that there is no statistically significant difference in the teachers / professors' views on the interpretation of above-average achievements (giftedness / athletic giftedness) in the activities that the student engages with regard to the work status / work place of the respondents.

**Table 3.** Interpretation of giftedness – comparison by work status (t-test)

Parametri / parametre	Spol / sex	N	AS	St. Dev.
Nadarenost / Talent	Nastavnici	82	4,02	,48
	Profesori	20	3,89	,68
	/ Teachers Professors			

**Legend:** N-ukupan broj ispitanika; AS-arithmetic mean; St. Dev.-standard deviation; Diff. AS-difference arithmetic means; F and significance - Leven's test of equality of variances; t-values. and Significance - the value of the t-test and its significance.

Table 4 shows the results of the F-test of interpretation of sports talent in relation to the age of the respondents. The value of the F-test, 384, and its significance (Sig., 765) show that there is no statistically significant difference between teachers / professors views in the perception of interpreting talent with respect to their age.

**Table 4.** Talent interpretation - Comparison by age (F-test)

Parametre	N	df	F	Sig.
Talent	102	3	,384	,765

**Legend:** N-total number of respondents; df - number of degrees of freedom; F and Sig.- the value of the F-test and its significance.

**Tabela 2.** Tumačenje nadarenosti – upoređivanje po spolu (t-test)

Razl. / Diff. AS	F	Znač. / sign.	t-vrijedn. / t-value	Znač. / Sign.
-,04	,174	,677	-,328	,744

**Legenda:** N-ukupan broj ispitanika; AS-aritmetička sredina; St. Dev.-standardna devijacija; Razl. AS-razlika aritmetičkih sredina; F i znač.- Levenov test jednakosti varijansi; t-vrijed. i Znač.- vrijednost t-testa i njegova značajnost.

U tabeli 3 prikazani su rezultati t-testa tumačenja sportske nadarenosti u odnosu na radni status/radno mjesto ispitanika. Vrijednost t = ,979 i njegova značajnost Sig. = ,330 ukazuju na to da ne postoji statistički značajna razlika u stavovima nastavnika/profesora s obzirom na radni status/radno mjesto u percepciji tumačenja nadarenosti. Na osnovu dobijenih rezultata vidljivo je da ne postoji statistički značajna razlika u stavovima nastavnika/profesora o tumačenju iznadprosječnih postignuća (nadarenosti/sportske nadarenosti) u aktivnostima kojima se učenik bavi s obzirom na radni status/radno mjesto ispitanika.

**Tabela 3.** Tumačenje nadarenosti – upoređivanje po radnom statusu (t-test)

Razl. AS / Diff. AS	F	Znač. / Sig.	t-vrijedn.	Znač. / Sig.
,13	1,632	,204	,979	,330

**Legenda:** N-ukupan broj ispitanika; AS-aritmetička sredina; St. Dev.-standardna devijacija; Razl. AS-razlika aritmetičkih sredina; F i Znač.- Levenov test jednakosti varijansi; t-vrijed. i Znač.- vrijednost t-testa i njegova značajnost.

U tabeli 4 prikazani su rezultati F-testa tumačenja sportske nadarenosti u odnosu na starosnu dob ispitanika. Vrijednost F-testa ,384 i njegova značajnost (Sig. ,765) pokazuju da ne postoji statistički značajna razlika između stavova nastavnika/profesora u percepciji tumačenja nadarenosti s obzirom na njihovu starosnu dob.

**Tabela 4.** Tumačenje nadarenosti - upoređivanje obzirom na dob (F-test)

Parametri	N	df	F	Sig.
Nadarenost	102	3	,384	,765

**Legenda:** N-ukupan broj ispitanika; df- broj stepena slobode; F i Sig.- vrijednost F-testa i njegova značajnost.



Table 5 shows the results of the LSD Post Hoc test.

An analysis of the results presented in Table 5 shows that there is no statistically significant difference in teachers / professors views on the interpretation of sport talent (interpretation of above-average achievement) in the activities that a student engages in with regard to their age.

**Table 5.** Interpretation of talent- Age Comparison (LSD Post Hoc Test)

Dob / Age	MD	St. E	Sig.
do 25 godina 26-35 godina / <25years 26-35			
36-45 godina	,202	,293	,492
46-55 godina	,179	,273	,513
	,278	,287	,334
Dob 26-35 godina do 25 godina / Age 26-35 years <25			
36-45 godina	-,202	,293	,492
46-55 godina	,023	,145	,874
	,076	,170	,656
Dob 36-45 godina do 25 godina / Age 36-45 years <25			
26-35 godina	-,179	,273	,513
46-55 godina	,023	,145	,874
	,099	,132	,453
Dob 46-55 godina do 25 godina / Age 46-55 years <25			
26-35 godina	-,278	,287	,334
36-45 godina	-,076	,170	,656
	-,099	,132	,453

**Legend:** MD - difference of arithmetic means; St.E- standard error; Sig.- statistical significance; \* - there is a statistically significant difference at the significance level  $p < 0.05$

Table 6 shows the results of the F-test and its statistical significance. The value of the F-test (,384) and its significance (Sig., 615) shows that there is no statistically significant difference between teachers / professors with respect to educational attainment in the perception of interpreting talent.

**Table 6.** Interpretation of talent - Comparison of Education Levels (F-test)

parametre	N	df	F	Sig.
Talent	102	2	,384	,615

**Legend:** N-total number of respondents; df- number of degrees of freedom; F and Sig.- the value of the F-test and its significance

Table 7 shows the results of the LSD Post Hoc test. The analysis of the results of the Post Hoc test did not identify statistically significant differences between the groups of respondents (teachers / professors) in terms of their level of education in the perception of interpretation of talent. Therefore, it can be stated that there is no statistically significant difference in teachers attitudes towards interpreting above-average achievement (talent/sport talent) in the activities that the student engages in with the level of education of the respondents.

U tabeli 5 prikazani su rezultatai LSD Post Hoc testa.

Analizom rezultata prikazanih u tabeli 5, može se vidjeti da ne postoji statistički značajna razlika u stavovima nastavnika/profesora o tumačenju sportske nadarenosti (tumačenje iznadprosječnih postignuća) u aktivnostima kojima se učenik bavi u odnosu na njihovu dobnu starost.

**Tabela 5.** Tumačenje nadarenosti – upoređivanje obzirom na starosnu dob (LSD Post Hoc testa)

Dob / Age	MD	St. E	Sig.
do 25 godina 26-35 godina / <25years 26-35			
36-45 godina	,202	,293	,492
46-55 godina	,179	,273	,513
	,278	,287	,334
Dob 26-35 godina do 25 godina / Age 26-35 years <25			
36-45 godina	-,202	,293	,492
46-55 godina	,023	,145	,874
	,076	,170	,656
Dob 36-45 godina do 25 godina / Age 36-45 years <25			
26-35 godina	-,179	,273	,513
46-55 godina	,023	,145	,874
	,099	,132	,453
Dob 46-55 godina do 25 godina / Age 46-55 years <25			
26-35 godina	-,278	,287	,334
36-45 godina	-,076	,170	,656
	-,099	,132	,453

**Legenda:** MD – razlika aritmetičkih sredina; St.E- standardna greška; Sig.- statistička značajnost; \*- postoji statistički značajna razlika na nivou značajnosti  $p < 0,05$

U tabeli 6 prikazani su rezultati F-testa i njegova statistička značajnost. Vrijednost F-testa (,384) i njegova značajnost (Sig., 615) pokazuju da ne postoji statistički značajna razlika između nastavnika/profesora s obzirom na stepen njihovog obrazovanja u percepciji tumačenja nadarenosti.

**Tabela 6.** Tumačenje nadarenosti - upoređivanje obzirom na stepen obrazovanja (F-test)

Parametri	N	df	F	Sig.
Nadarenost	102	2	,384	,615

**Legenda:** N-ukupan broj ispitanika; df- broj stepena slobode; F i Sig.- vrijednost F-testa i njegova značajnost

U tabeli 7 prikazani su rezultati LSD Post Hoc testa. Analizom rezultata Post Hoc testa nisu utvrđene statistički značajne razlike između grupa ispitanika (nastavnika/profesora) obzirom na njihov stepen obrazovanja u percepciji tumačenja nadarenosti. Prema tome, može se konstatovati da ne postoji statistički značajna razlika u stavovima nastavnika o tumačenju iznadprosječnih postignuća (nadarenosti/sportske nadarenosti) u aktivnostima kojima se učenik bavi u odnosu na stepen obrazovanja ispitanika.

**Table 7.** Comparison of Significance of Differences by Level of Education (LSD Post Hoc Test)

Stepen obrazovanja / Level od education	Razlike AS / Diff AS	St. E	Sig.
Viša stručna sprema / Visoka stručna sprema / College education / University education	,118	,123	,338
Magistar/doktor nauka / Master/PhD	-,128	,204	,533
Višoka stručna sprema / Viša stručna sprema / University education / College education	,118	,123	,338
Magistar/doktor nauka / Master/PhD	-,009	,186	,960
Magistar/doktor nauka / Viša stručna sprema / Master/PhD / College education	,128	,204	,533
Visoka stručna sprema / University education	,009	,186	,960

**Legend:** Differences AS - difference of arithmetic means; St. E - standard error; Sig. - statistical significance \* - there is a statistically significant difference at the significance level  $p < 0.05$

Considering the results of the research, it can be concluded that there is no statistically significant difference in the attitudes of teachers / professors regarding the interpretation of above-average achievements (talents / sports talents) in the activities that the student engages in by gender, workplace, age and education level of the respondents. Past research indicates that sports gifted children need to adapt a curriculum that will motivate and encourage their giftedness and values, but this does not imply isolation from a peer group of similar interests and psychophysical abilities (Cvetković - Lay, Sekulić - Majurec, 1998; Raič et al. 1998; Djordjic, 2004; Trancle and Cushion, 2006). The fact that there is very little significant research on the phenomenon of giftedness implies the need for a systematic study of this problem (Stojaković, 2009). Rajovic (2009) points out that the problem of identifying talent is, in general, a very difficult job and that a generally accepted strategy or model on the basis of which talent could be properly identified has not yet been offered. The same author believes that developing talent depends almost entirely on the proper functioning of the family, school and community (environment).

### CONCLUSION

Analyzing the data obtained in this research, it can be concluded that teachers working with children in classroom teaching and physical education teachers working with children in the subject teaching have similar attitudes when it comes to the perception of the interpretation of sports-gifted/talented children-students. The results indicate that there are no statistically significant differences between teachers / professors in the perception of interpretation of sporting talent in relation to gender, working position, age and level of education. However, the main problem remains with defining the methodology for identifying gifted children, which might offer some new research into this issue.

Obviously, it is necessary to leave the framework of the current system of work that is focused on the aver-

**Tabela 7.** Upoređivanje značajnosti razlika obzirom na stepen obrazovanja (LSD Post Hoc testa)

Stepen obrazovanja / Level od education	Razlike AS / Diff AS	St. E	Sig.
Viša stručna sprema / Visoka stručna sprema / College education / University education	,118	,123	,338
Magistar/doktor nauka / Master/PhD	-,128	,204	,533
Višoka stručna sprema / Viša stručna sprema / University education / College education	,118	,123	,338
Magistar/doktor nauka / Master/PhD	-,009	,186	,960
Magistar/doktor nauka / Viša stručna sprema / Master/PhD / College education	,128	,204	,533
Visoka stručna sprema / University education	,009	,186	,960

**Legenda:** Razlike AS - razlika aritmetičkih sredina; St. E - standardna greška; Sig. - statistička značajnost \* - postoji statistički značajna razlika na nivou značajnosti  $p < 0,05$

Imajući u vidu dobijene rezultate istraživanja može se konstatovati da ne postoji statistički značajna razlika u stavovima nastavnika/profesora o tumačenju iznadprosječnih postignuća (nadarenosti/sportske nadarenosti) u aktivnostima kojima se učenik bavi u odnosu na spol, radno mjesto, starosnu dob i stepen obrazovanja ispitanika. Dosadašnja istraživanja ukazuju da sportski nadarenoj djeci treba prilagoditi nastavni plan i program koji će motivisati i podsticati njihovu nadarenost i vrijednosti, ali to ne podrazumijeva izdvajanje iz vršnjačke grupe sličnih interesovanja i psihofizičkih sposobnosti (Cvetković - Lay, Sekulić - Majurec, 1998; Raič i sar. 1998; Đorđić, 2004; Trancle i Cushion, 2006). Činjenica da je kod nas vrlo malo značajnijih istraživanja fenomena nadarenosti, to nameće potrebu sistematskog proučavanja ovog problema (Stojković, 2009). Rajović (2009), ističe da je problem identifikacije nadarenosti uopšte veoma težak posao i da još uvijek nije ponuđena opšte prihvaćena strategija ili model na osnovu kojih bi se na pravi način mogla identifikovati nadarenost. Isti autor smatra da razvijanje nadarenosti gotovo u potpunosti zavisi od pravovremenog djelovanja porodice, škole i društvene zajednice (okruženja).

### ZAKLJUČAK

Analizirajući dobijene podatke u ovom istraživanju, može se zaključiti da nastavnici razredne nastave koji rade sa djecom u razrednoj nastavi i profesori fizičkog vaspitanja koji rade sa djecom u predmetnoj nastavi imaju slične stavove kada je u pitanju percepcija tumačenja sportski nadarene djece-učenika. Rezultati ukazuju da između nastavnika/profesora nema statistički značajnih razlika u percepciji tumačenja sportske nadarenosti u odnosu na spol, radnu poziciju, starosnu dob i stepen obrazovanja. Međutim, ostaje glavni problem definisanja metodologije identifikacije nadarene djece, a što bi mogla ponuditi neka nova istraživanja ove problematike.

Očigledno je da treba napustiti okvire dosadašnjeg sistema rada koji je „okrenut” prosječnom učeniku i koji

age student and does not include early identification of gifted children and their better quality treatment in terms of motivation and creating better conditions for the development of psychophysical abilities.

ne obuhvata ranu identifikaciju nadarene djece i njihov kvalitetniji tretman u smislu motivacije i stvaranja boljih uslova za razvijanje psihofizičkih sposobnosti.

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# THE EFFECTS OF PLYOMETRIC TRAINING ON MOTOR SKILLS OF TOP VOLLEYBALL PLAYERS

SLAVKO DRAGOSAVLJEVIĆ<sup>1</sup>, NEBOJŠA MITROVIĆ<sup>2</sup>,  
DALIBOR STEVIĆ<sup>2</sup>

<sup>1</sup>Elementary school "Jovan Jovanović Zmaj", Srbac

<sup>2</sup>University in Eastern Sarajevo, Faculty of Education

## Correspondence:

Slavko Dragosavljević

Elementary school "Jovan Jovanović Zmaj", Srbac  
tk.srbac@hotmail.com

# EFEKTI PLIOMETRIJSKOG TRENINGA NA MOTORIČKE SPOSOBNOSTI VRHUNSKIH ODBOJKAŠA

SLAVKO DRAGOSAVLJEVIĆ<sup>1</sup>, NEBOJŠA MITROVIĆ<sup>2</sup>,  
DALIBOR STEVIĆ<sup>2</sup>

<sup>1</sup>JU OŠ „Jovan Jovanović Zmaj“, Srbac

<sup>2</sup>Univerzitet u Istočnom Sarajevu, Pedagoški fakultet

## Korespondencija:

Slavko Dragosavljević

JU OŠ „Jovan Jovanović Zmaj“, Srbac  
tk.srbac@hotmail.com

**Abstract:** The plyometric method is ranked among the most commonly used methods for fitness volleyball training. It leads to the development of explosive strength and reactive velocity of the muscular system based on improving the CNS response and the power required to absorb the stress when landing. The study was of longitudinal type, involving two measurements, an initial measurement for all subjects to determine the initial level of motor ability, and a final measurement where the effects of the experimental program were studied after a programmed experimental process to develop specific motor skills of the analyzed sample of subjects. The entire study was conducted on a sample of 72 senior subjects, which were divided into two sub-samples, one sub-sample comprised of the experimental group and the other comprising the control group. The primary objective of the research was to test the influence and effect of special treatment of kinesiological activities based on plyometric exercises on the motor skills of the subjects.

**Keywords:** Volleyball, plyometric training, the effects of programmed exercise.

## INTRODUCTION

Management of training technology primarily refers to the problem of management during the transformative process of sports training and is based on the fact that when bringing athletes from the initial (initial, current) state to some newly formed (transitive, final) state, which is generally higher level, it results in the adaptation of athletes to conditions that consist of constantly changing and directing towards achieving the greatest possible sports performance in a certain time interval (Fratric, 2012). This approach to optimizing technological training process requires the establishment of relations, on one hand, modeled sports ac-

**Apstrakt:** Pliometrijska metoda je rangirana među najčešće korišćenim metodama za kondicione vežbe u odbojki. Ona dovodi do razvijanja eksplozivne snage i reaktivne brzine mišićnog sistema zasnovanih na poboljšanju reakcije CNS-a i snage koja je potrebna za apsorbovanje stresa prilikom doskoka. Istraživanje je bilo longitudinalnog karaktera, gde su se podrazumevala dva merenja, inicijalno merenje da se utvrdi početni nivo motoričkih sposobnosti, i finalno merenje gde su se ispitivali efekti uticaja eksperimentalnog programa nakon programiranog eksperimentalnog procesa za razvijanje specifičnih motoričkih sposobnosti analiziranog uzorka ispitanika. Celokupno istraživanje je sprovedeno na uzorku od 72 ispitanika seniorskog uzrasta, koji su podeljeni na dva subuzorka, jedan subuzorak koji su činili ispitanici eksperimentalne grupe i drugi koji su činili ispitanici kontrolne grupe. Primarni cilj istraživanja je bio proveriti uticaja i efekta posebnog tretmana kinezioloških aktivnosti zasnovanih na pliometrijskim vežbama na motoričke sposobnosti ispitanika eksperimentalne grupe

**Ključne reči:** Odbojka, pliometrijski trening, efekti programiranog vežbanja.

## Uvod

Upravljanje trenažnom tehnologijom prvenstveno se odnosi na problem upravljanja u toku transformacionog procesa sportskog treninga i zasniva se na tome, da se prilikom dovođenja sportista iz inicijalnog (početnog, trenutnog) stanja u neko novoformirano (tranzitivno, finalno) stanje, koje je po pravilu na višem nivou, ostvaruje prilagođavanje sportista uslovima koji se sastoje u neprekidnom menjanju i usmeravanju u pravcu postizanja što većeg sportskog učinka u određenom vremenskom intervalu (Fratric, 2012). Ovakav pristup optimizaciji tehnologije trenažnog procesa zahteva uspostavljanje re-

tivities through constructed situational equation specifications, and on the other hand, the implementation of more efficient operationalization and organization of training activities based on diagnosis, planning, programming and implementation of control transformational processes of anthropological characteristics of athletes in achieving high sports creativity (Malacko, 2005). Muscle strength is important for most sports games at the moment. In volleyball, the achieved level of explosive strength is of fundamental importance. Explosive power is the most important part of the skills of most players. It enables such activity of the player during the game that he is not only at the required height of the task and with the required strength, but also at the right moment. The maximum use of explosive force in vertical, horizontal and lateral movements of volleyball players is very difficult. The ratio of explosive power and technically tactical level of the players is particularly obvious when we look at the activities of players on the net, the attack from the field and first serve. Power use during the game is determined by the fact that using maximum power lasts from 0.5 to 0.7 seconds; however, most explosive movements significantly reduce time. For this reason, optimal use and transformation of the resulting maximum muscle strength into the "explosiveness" of the major lower extremity muscle groups participating in the jump require special training and energy. According to Vechoshanski (1995), this type of training should be clearly aimed at activating the adaptive mechanism of a sport organism that responds to the needs of specific sport activity. Appropriate choice of training methods, exercises and individual intensity and volume of training are among the key aspects of player strength training and strength training programs. The plyometric method is ranked among the most commonly used methods for fitness volleyball exercises. It leads to the development of explosive power and reactive velocity of the muscular system based on improving the CNS response and the power required to absorb the stress when landing. The method is based on the contraction of muscles, which gives a response to rapid growth, mainly caused by kinetic energy during deceleration phases of movement. In addition to the contractile and elastic muscle attributes, there can be an improvement in muscle proprioception and stretching tolerance. The advantage of this type of training is that it increases functional strength and allows the muscles to achieve greater levels of strength than maximum willpower. The plyometric method also reduces the inhibition of muscle reflexes, increases the sensitivity of Golgi tendon organs, improves the sensitivity of muscle spindles, increases muscle tension, and at the same time, it can reduce the risk of injury (Bompa, & Carrera, 2005; Boyle, 2004; Chu, 1998; Gambetta, 1999; Potač &

lacija, s jedne strane, modelovanih sportskih aktivnosti putem konstruisane situacione jednačine specifikacije, a sa druge strane, primenu što efikasnije operacionalizacije i organizacije trenažnih aktivnosti na osnovama dijagnostikovanja, planiranja, programiranja i sprovođenja kontrole transformacionih procesa antropoloških karakteristika sportista u postizanju visokog sportskog stvaralaštva (Malacko, 2005). Snaga mišića je veoma važna za većinu sportskih igara. U odbojci, postignuti nivo eksplozivne snage je od fundamentalne važnosti. Ona omogućava igračima tokom igre da oni budu ne samo na potrebnoj visini zadatka i uz potrebnu snagu, već i u pravom trenutku. Maksimalno iskorišćenje eksplozivne snage u vertikalnim, horizontalnim i bočnim kretanjima odbojkaša je veoma teško. Odnos eksplozivne snage i tehničko - taktičkog nivoa igrača naročito je očigledan kada posmatramo aktivnosti igrača na mreži, napad sa polja i prve serve. Korišćenje snage tokom igre određuje činjenica da upotreba maksimalne snage traje od 0.5 do 0.7 sekundi; međutim, većina eksplozivnih pokreta značajno smanjuje vreme. Iz tog razloga optimalna upotreba i transformacija dobijene maksimalne snage mišića u "eksplozivnost" glavnih mišićnih grupa donjih ekstremiteta, koji učestvuju u skoku, zahtevaju posebnu obuku i energiju. Ova vrsta treninga trebalo bi, prema Verchoshanski (1995), iti jasno usmerena na aktivaciju adaptivnog mehanizma organizma sportiste koji odgovara potrebama konkretne sportske aktivnosti. Odgovarajući izbor metoda obuke, vežbi i individualnog intenziteta i obima treninga spada među ključne aspekte u pripremi snage igrača i programa za razvijanje snage. Pliometrijska metoda je rangirana među najčešće korišćenim metodama za kondicione vežbe u odbojci. Ona dovodi do razvijanja eksplozivne snage i reaktivne brzine mišićnog sistema zasnovanih na poboljšanju reakcije CNS-a i snage koja je potrebna za apsorbovanje stresa prilikom doskoka. Metoda se zasniva na kontrakciji muskulature, koja daje odgovor na brzi rast, izazvan uglavnom kinetičkom energijom tokom faze kretanja usporenja. Pored kontraktilnog i elastičnog atributa mišića, može se uočiti poboljšanje mišićne propriocepcije i tolerancije za istezanje. Prednost ovakvog vida treninga je u tome što povećava funkcionalnu snagu i omogućava mišićima da postignu veći nivo snage. Pliometrijska metoda takođe smanjuje inhibiciju refleksa mišića, povećava osetljivost goldžijevih tetivnih organa, poboljšava osetljivost mišićnih vretena, povećava napetost mišića i istovremeno može smanjiti rizik od povreda (Bompa, & Carrera, 2005; Boyle, 2004; Chu, 1998; Gambetta, 1999; Potač, & Chu, 2000; Zatsiorski, & Kraemer, 2006). Cilj ovog istraživanja bio je da

Chu, 2000; Zatsiorski, & Kraemer, 2006). This study aimed to investigate the effects of the plyometric training on motor skills of top volleyball players.

### **METHOD**

The study was of a longitudinal type, involving two measurements, an initial measurement for all subjects to determine the initial level of all the analyzed characteristics and abilities, and a final measurement where the effects of the experimental program were investigated after a programmed experimental process to develop certain capabilities of the analyzed sample of the subjects. The entire survey was conducted on a sample of 72 senior subjects divided into two sub-samples, one sub-sample experimental group consisted of volleyball players of VC "Radnik" Bijeljina, VC "Majeвица" Lopare, VC "Jedinstvo" Brčko, 36 of them, while second sub-sample composed of volleyball players of VC "Jahorina" Pale, VC "Tempo" Ražljevo, VC "Drina" Zvornik, these respondents were representatives of the control group and there were also 36 respondents.

A specific battery of volleyball motor tests was used to assess motor skills.

#### **I For the evaluation of the explosive strength of the lower limbs:**

- 1) Reachable height with one arm (cm)
- 2) Block reach (cm)

#### **II For the flexibility assessment:**

- 1) Back saver (cm)

#### **III To evaluate the speed of alternative arm movements:**

- 1) Plate tapping test (frequency)

#### **IV To evaluate agility:**

- 1) Japan test (s)

#### **V To assess the velocity of the arm and torso muscles:**

- 1) Throwing medicine ball from lying position with arms outstretched (2kg) (cm)

#### **VI To evaluate the repetitive strength of abdominal muscles and hip joint flexors:**

- 1) Sit – ups 30s (frequency)

#### **VII To evaluate repetitive strength of back muscles:**

- 1) Back 30s (frequency)

se ispituju efekti pliometrijskog treninga na motoričke sposobnosti vrhunskih odbojkaša.

### **METOD**

Istraživanje je bilo longitudinalnog karaktera, gde su se podrazumevala dva merenja, inicijalno merenje da se utvrdi početni nivo svih analiziranih karakteristika i sposobnosti, i finalno merenje gde su se ispitivali efekti uticaja eksperimentalnog programa nakon programiranog eksperimentalnog procesa za razvijanje određenih sposobnosti analiziranog uzorka ispitanika. Celokupno istraživanje je sprovedeno na uzorku od 72 ispitanika seniorskog uzrasta, koji su podeljeni na dva subuzorka. Jedan subuzorak- eksperimentalnu grupu činili su odbojkaši OK „Radnik“ Bijeljina, OK „Majeвица“ Lopare, OK „Jedinstvo“ Brčko i to njih 36, dok je drugi subuzorak sastavljen od odbojkaša OK „Jahorina“ Pale, OK „Tempo“ Ražljevo, OK „Drina“ Zvornik i ovi ispitanici bili su predstavnici kontrolne grupe kojih je takođe bilo 36.

Za procenu motoričkih sposobnosti primenjena je specifična baterija motoričkih testova za odbojkaše.

#### **I Za procenu eksplozivne snage donjih ekstremiteta:**

- 1) Dohvatna visina sa jednom rukom (cm),
- 2) Dohvat za blok (cm),

#### **II Za procenu fleksibilnosti:**

- 1) Pretklon na klupici (cm),

#### **III Za procenu brzine alternativnih pokreta ruku:**

- 1) Taping rukom (frekv),

#### **IV Za procenu agilnosti:**

- 1) Japan test (s.),

#### **V Za procenu brzinske snage mišića opružaća ruku i trupa:**

- 1) Bacanje medicine iz ležećeg položaja ispruženih ruku (2kg) (cm),

#### **VI Za procenu repetitivne snage mišića ruku i ramenog pojasa:**

- 1) Sklek 30 sekundi (frekv),

#### **VII Za procenu repetitivne snage trbušnih mišića i pregibača zgloba kuka:**

- 1) Ležanje - sed 30 sekundi (frekv),

The experimental program that was implemented based on plyometric exercises in the experimental group was represented for twelve weeks, twice a week in the period from December 2017 to February 2018.

The players were presented, verbally and visually, with the exercises and how they are performed to provide feedback on kinesiological treatment.

Statistical data processing included the calculation of basic descriptive indicators (arithmetic mean, standard deviation, minimum measured values, maximum measured values, skewness, kurtosis), Kolmogorov distribution normality test by Smirnov test, and calculation of multivariate and univariate (MANOVA and ANOVA) analysis of variance of it „t“ test for dependent samples.

## RESULTS

**Table 1.** Basic descriptive indicators of motor variables of experimental groups (E) at initial measurement.

Varijable / Variables	MIN	MAX	AS	S	Sk	Kurt
Dohvatna visina sa jednom rukom / Reachable height with one arm	20,0	59,0	39,28	11,99	0,088	-0,856
Dohvat za blok / Block reach	2,0	39,0	18,92	10,22	-0,008	-0,206
Pretklon na klupici / Back saver	7,0	50,0	25,27	14,97	0,320	-1,960
Taping rukom / Plate tapping test	46	74	64,86	7,26	-0,998	2,404
Japan test / Japan test	12,84	14,92	13,20	0,697	0,275	-1,067
Bacanje medicinke iz ležećeg pol. / Medicine ball throwing from lying position	6,2	13,0	9,79	1,96	0,089	-0,532
Sklek 30s / Push – ups 30s	12	40	27,00	8,91	-0,213	-0,880
Ležanje-sed 30s / Sit – ups 30s	21	34	27,57	4,43	-0,347	-1,057
Leda 30s / Back 30s	29	50	39,14	5,94	0,006	-0,621

**Legend:** MIN – minimum recorded measurement result; MAX – the maximum recorded measurement result; AM – arithmetic mean; S – standard deviation; Sk – skewness (the inclination of the distribution of results); Kurt – kurtosis (the elongation of the distribution of results)

Table 1 gives an overview of the basic descriptive statistics of the motor variables of the experimental group at the initial measurement. By examining the values in the table, one can conclude that there is good discriminability of measurements in all variables for motor estimation except for two variables, the variable for assessing the explosive strength of the lower extremities Block reach and the variable for assessing the flexibility of the biceps femoris Back saver, as can be seen from the relation between standard deviation and arithmetic mean, where it is not possible to classify three standard deviations in one arithmetic mean. The minimum and maximum measurement values have a normal range in almost all measured variables, except for two variables

Eksperimentalni program koji je realizovan na bazi pliometrijskih vežbi u eksperimentalnoj grupi bio je zastupljen dvanaest nedelja po dva puta sedmično u periodu od decembra 2017. do februara 2018. godine.

Igračima je usmeno i vizuelno prikazano koje vežbe i na koji način se realizuju, kako bi bila obezbeđena povratna informacija kineziološkog tretmana.

Statistička obrada podataka podrazumevala je izračunavanje osnovnih deskriptivnih pokazatelja, testiranje normalnosti distribucije, te izračunavanje multivarijantne i univarijantne (MANOVA i ANOVA) analize varijanse i „t“ testa za zavisne uzorke.

## REZULTATI

**Tabela 1.** Osnovni deskriptivni pokazatelji motoričkih varijabli eksperimentalne grupe (E) na inicijalnom merenju

Varijable / Variables	MIN	MAX	AS	S	Sk	Kurt
Dohvatna visina sa jednom rukom / Reachable height with one arm	20,0	59,0	39,28	11,99	0,088	-0,856
Dohvat za blok / Block reach	2,0	39,0	18,92	10,22	-0,008	-0,206
Pretklon na klupici / Back saver	7,0	50,0	25,27	14,97	0,320	-1,960
Taping rukom / Plate tapping test	46	74	64,86	7,26	-0,998	2,404
Japan test / Japan test	12,84	14,92	13,20	0,697	0,275	-1,067
Bacanje medicinke iz ležećeg pol. / Medicine ball throwing from lying position	6,2	13,0	9,79	1,96	0,089	-0,532
Sklek 30s / Push – ups 30s	12	40	27,00	8,91	-0,213	-0,880
Ležanje-sed 30s / Sit – ups 30s	21	34	27,57	4,43	-0,347	-1,057
Leda 30s / Back 30s	29	50	39,14	5,94	0,006	-0,621

**Legenda:** MIN – minimalni zabeleženi rezultat merenja; MAX – maksimalni zabeleženi rezultat merenja; AS – aritmetička sredina; S – standardna devijacija; Sk – skjunis (nagnutost distribucije rezultata); Kurt – kurtosis (izduženost distribucije rezultata)

U tabeli 1. dat je prikaz osnovnih deskriptivnih statistika motoričkih varijabli eksperimentalne grupe na inicijalnom merenju. Pregledom vrednosti u tabeli može se zaključiti postojanje dobre diskriminativnosti merenja u svim varijablama za procenu motorike sem u dve varijable i to u varijabli za procenu eksplozivne snage donjih ekstremiteta Dohvat za blok i varijabli za procenu fleksibilnosti lumbalnih ekstenzora i zadnje lože buta Pretklon na klupici, što se vidi iz odnosa standardne devijacije i aritmetičke sredine gde se uočava da nije moguće svrstati tri standardne devijacije u jednu aritmetičku sredinu. Minimalne i maksimalne vrednosti merenja imaju normalan raspon u skoro svim izmerenim varijablama, sem u dve varijable gde se uočavaju povećane vrednosti ras-

that show increased values of the range of results, the variables for evaluating the explosive power of the lower extremities *Block reach* and the variable for assessing the flexibility of the biceps femoris *Back saver*. Acceptable negative asymmetry of the distribution in the variable for estimating the speed of alternative movements by *Plate tapping test* is observed based on the skewness values, in all other variables, the skewness coefficients are within the good values of the results. The analysis of kurtosis coefficients shows the increased values of the four variables: *Back saver*, *Hand tapping*, *Japan test*, *Sit-ups 30s*. The *Hand tapping* variable has increased positive kurtosis coefficients indicating greater clustering of results around the arithmetic mean resulting in an elongated leptokurtic distribution. The remaining three variables *Back saver*, *Japan test*, *Sit-ups 30s* have acceptably increased values of the kurtosis coefficients with a negative sign characterizing the platykurtic distribution of the result having a flattened peak of the distribution curve. This distribution indicates increased dispersion of results in the three analyzed variables.

**Table 2.** The normality of distribution tested by Kolmogorov - Smirnov test of motor variables for the experimental group at the initial measurement.

Variable / Variables	MEA	K-S	p
Dohvatna visina sa jednom rukom / Reachable height with one arm	0,112	0,421	0,994
Dohvat za blok / Block reach	0,116	0,434	0,992
Pretklon na klupici / Back saver	0,247	0,923	0,362
Taping rukom / Plate tapping test	0,134	0,501	0,963
Japan test / Japan test	0,124	0,464	0,983
Bacanje medicinke iz ležećeg pol. / Medicine ball throwing from lying position	0,139	0,520	0,949
Sklek 30s / Push-ups 30s	0,141	0,528	0,943
Ležanje-sed 30s / Sit-ups 30s	0,163	0,610	0,851
Leđa 30s / Back 30s	0,150	0,562	0,911

**Legend:** *K-S* – Kolmogorov – Smirnov *Z* coefficient; *p* – the level of statistical significance of Kolmogorov - Smirnov *Z* coefficient; *MEA* – the maximum extreme difference between the obtained and the expected distribution.

By presenting the tabulated values in the table 2, where the results of the distribution normality testing are presented using the Kolmogorov Smirnov test for motor variables at the initial measurement with the examinees in the experimental group, it is concluded that there is no statistically significant deviation of the tested distribution from the normal one. No maximum extreme deviation value exceeds the K-S test value. Based on the *p* coefficient, it is noticed that there is no statistical significance of the

pona rezultata i to u varijablama za procenu eksplozivne snage donjih ekstremiteta *Dohvat za blok* i varijabli za procenu fleksibilnosti lumbalnih ekstenzora i zadnje lože buta *Pretklon na klupici*. Na osnovu sk juničnih vrednosti uočava se prihvatljiva negativna asimetričnost distribucije u varijabli za procenu brzine alternativnih pokreta rukom *Taping rukom*, dok su u svim ostalim varijablama sk junični koeficijenti u okviru dobrih vrednosti rezultata. Analizom kurtičnih koeficijenata primećuje se povećane vrednosti u četiri varijable, i to: *Pretklon na klupici*, *Taping rukom*, *Japan test*, *Ležanje-sed 30s*. Varijabla *Taping rukom* ima povećane pozitivne kurtične koeficijente koji ukazuju na veće grupisanje rezultata oko aritmetičke sredine što za posledicu ima izduženu leptokurtičnu distribuciju. Preostale tri varijable *Pretklon na klupici*, *Japan test*, *Ležanje-sed 30s* imaju prihvatljivo povećane vrednosti kurtičnih koeficijenata sa negativnim predznakom koji karakteriše platikurtičnu distribuciju rezultata koja ima spljošten vrh krive distribucije. Ovakva distribucija ukazuje na povećanu disperziju rezultata u ove tri analizirane varijable.

**Tabela 2.** Normalnost distribucije testirana Kolmogorov – Smirnov testom motoričkih varijabli za eksperimentalnu grupu na inicijalnom merenju

**Legenda:** *K-S* – Kolmogorov – Smirnov *Z* koeficijent; *p* – nivo statističke značajnosti Kolmogorov – Smirnov *Z* koeficijenta; *MEA* – maksimalna ekstremna razlika između dobijene i očekivane distribucije.

Prikazom tabelarnih vrednosti u tabeli 2, gde su predstavljeni rezultati testiranja normalnosti distribucije primenom Kolmogorov Smirnov testa za motoričke varijable na inicijalnom merenju kod ispitanika eksperimentalne grupe, zaključuje se da ne postoji statistički značajno odstupanje testirane distribucije od normalne. Nijedna vrednost maksimalnog ekstremnog odstupanja ne prelazi vrednosti K-S testa. Na osnovu *p* koeficijenta uočava se da ne postoji statistička značajnost K-S testa ni



K-S test in any of the analyzed variables, which enables the further application of the parametric statistical methods of data processing in the continuation of the research.

**Table 3.** Basic descriptive indicators of the control group (C) motor variables at the initial measurement.

Varijable / Variables	MIN	MAX	AS	S	Sk	Kurt
Dohvatna visina sa jednom rukom / Reachable height with one arm	21,0	58,0	38,24	11,73	0,06	-1,05
Dohvat za blok / Block reach	3,0	37,0	17,54	9,18	0,11	-0,66
Pretklon na klupici / Back saver	9	49	26,61	13,99	-0,01	-1,75
Taping rukom / Plate tapping test	44	72	62,56	6,30	-0,989	2,07
Japan test / Japan test	12,21	14,22	13,66	0,60	0,19	-1,11
Bacanje medicine iz ležećeg pol. / Medicine ball throwing from lying position	7,1	13,2	9,20	1,75	0,55	-0,80
Sklek 30s. / Push-ups 30s	14	38	25,39	7,2	0,04	-0,65
Ležanje-sed 30s. / Sit-ups 30s	23	36	26,53	2,77	0,37	0,05
Leda 30s. / Back 30s	31	46	35,17	3,53	0,58	0,95

**Legend:** MIN - minimum recorded measurement result; MAX - maximum recorded measurement result; AM - arithmetic mean; S - standard deviation; Sk - skewness (the inclination of the distribution of results); Kurt - kurtosis (the elongation of the distribution of results)

Table 3 shows the basic descriptive statistical motor variables of the control group at the initial measurement. Based on the results presented in the table, it can be concluded that there is a good measuring discriminability in most of the measured values except in the variables for the estimation of lower extremities explosive power *Block reach* and in the variable for the estimation of the posterior line of the thigh flexibility *Back saver*. Considering the relationship between the arithmetic mean and standard deviation with these variables, it is not possible to place the three standard deviations in one arithmetic mean, which indicates the poorer discriminability of the measurements in these variables. By comparing the measured minimum and maximum values in the table, the increased values of the results in the span of two variables are noticed, and those are: in the variable for the estimation of lower extremities explosive power *Block reach* and in the variable for the estimation of the posterior line of the thigh flexibility *Back saver*. The measure of the shape of the distribution, the skewness which denotes the slope of the distribution, has good values in all variables except in the variable for the velocity of the alternative hand movement *Plate tapping test* where the negative asymmetry of distribution is expressed. The kurtosis values in the table have good and acceptable values in most analyzed variables except in the variable for the estimation of lower extremities explosive power *Reachable height with one arm*, the variable for the

u jednoj analiziranoj varijabli što omogućava dalju primenu parametrijskih statističkih metoda obrade podataka u nastavku istraživanja.

**Tabela 3.** Osnovni deskriptivni pokazatelji motoričkih varijabli kontrolne grupe (K) na inicijalnom merenju

**Legenda:** MIN – minimalni zabeleženi rezultat merenja; MAX – maksimalni zabeleženi rezultat merenja; AS – aritmetička sredina; S – standardna devijacija; Sk – skjunis (nagnutost distribucije rezultata); Kurt – kurtosis (izduženost distribucije rezultata)

U tabeli 3, prikazani su osnovni deskriptivni statistički motoričkih varijabli kontrolne grupe na inicijalnom merenju. Na osnovu prikazanih rezultata u tabeli, može se konstatovati dobra diskriminativnost merenja većine izmerenih vrednosti sem u varijablama za procenu eksplozivne snage donjih ekstremiteta *Dohvat za blok* i u varijabli za procenu fleksibilnosti lumbalnih ekstenzora i zadnje lože buta *Pretklon na klupici*. Kod ovih varijabli posmatrajući odnos aritmetičke sredine i standardne devijacije nije moguće svrstati tri standardne devijacije u jednu aritmetičku sredinu što ukazuje na lošiju diskriminativnost merenja u ovim varijablama. Komparacijom izmerenih minimalnih i maksimalnih vrednosti u tabeli uočavaju se povećane vrednosti rezultata raspona u dve varijable, i to: u varijabli za procenu eksplozivne snage donjih ekstremiteta *Dohvat za blok* i u varijabli za procenu fleksibilnosti lumbalnih ekstenzora i zadnje lože buta *Pretklon na klupici*. Mera oblika distribucije, skjunis koji označava nagnutost distribucije ima dobre vrednosti u svim varijablama sem u varijabli za procenu brzine alternativnih pokreta ruku *Taping rukom* gde je izražena negativna asimetrija distribucije. Kurtične vrednosti iz tabele imaju dobre i prihvatljive vrednosti u većini analiziranih varijabli sem u varijablama za procenu eksplozivne snage donjih ekstremiteta *Dohvatna visina sa jednom rukom*, varijabli za procenu fleksibilnosti lumbalnih ekstenzora i zadnje

estimation of the posterior line of the thigh flexibility *Back saver*, the variables for the velocity of the alternative hand movement *Plate tapping test*, and the variables for agility estimation *Japan test*. In the variable for the velocity of the alternative hand movement *Plate tapping test*, the kurtosis coefficient has a positive value which is characterized by the tip of the curve. The leptokurtic form of distribution shows the increased homogeneity of the result distribution. The other three variables have a negative sign that is characterized by a flattened peak of the distribution curve. The platykurtic shape of distribution depicts an increased dispersion of the results or a decreased homogeneity of results in these measured variables.

**Table 4.** The normality of distribution tested by Kolmogorov - Smirnov test of motor variables for the control group at the initial measurement.

Varijable / Variables	MEA	K-S	p
Dohvatna visina sa jednom rukom / Reachable height with one arm	0,142	0,855	0,458
Dohvat za blok / Block reach	0,154	0,925	0,359
Pretklon na klupici / Back saver	0,185	1,113	0,168
Taping rukom / Plate tapping test	0,120	0,718	0,681
Japan test / Japan test	0,136	0,813	0,523
Bacanje medicine iz ležećeg pol. / Medicine ball throwing from lying position	0,149	0,892	0,403
Sklek 30s. / Push-ups 30s	0,160	0,957	0,319
Ležanje-sed 30s. / Sit-ups 30s	0,103	0,617	0,840
Leda 30s. / Back 30s	0,120	0,723	0,673

**Legend:** *K-S* – Kolmogorov – Smirnov *Z* coefficient; *p* – the level of statistical significance of Kolmogorov - Smirnov *Z* coefficient; *MEA* – the maximum extreme difference between the obtained and the expected distribution.

By comparing the results in table 4, where the normality of distribution tested by Kolmogorov - Smirnov test of the motor variables for the control group (C) at the initial measurement is shown, it can be seen that there is no statistically significant deviation of the tested distribution from the normal one. All the analyzed results of the maximum extreme deviation are such that they are within the *K-S* test value. There is no statistical significance of the *p* coefficient in the observed variables, which led to the further application of parametric statistical methods of data processing in the continuation of this research.

lože buta *Pretklon na klupici*, varijabli za procenu brzine alternativnih pokreta ruku *Taping rukom*, i varijabli za procenu agilnosti *Japan test*. U varijabli za procenu brzine alternativnih pokreta ruku *Taping rukom* kurtični koeficijent ima pozitivnu vrednost koja se karakteriše izraženim vrhom krive. Leptokurtičan oblik distribucije ukazuje na povećanu homogenost distribucije rezultata. Preostale tri varijable imaju negativan predznak koji se karakteriše spljoštenim vrhom krive distribucije. Plati-kurtičan oblik distribucije ukazuje na povećanu disperziju rezultata odnosno smanjenu homogenost rezultata u ovim izmerenim varijablama.

**Tabela 4.** Normalnost distribucije testirana Kolmogorov – Smirnov testom motoričkih varijabli za kontrolnu grupu (K) na inicijalnom merenju

**Legenda:** *K-S* – Kolmogorov – Smirnov *Z* koeficijent; *p* – nivo statističke značajnosti Kolmogorov – Smirnov *Z* koeficijenta; *MEA* – maksimalna ekstremna razlika između dobijene i očekivane distribucije.

Komparacijom rezultata u tabeli 4, gde je prikazana normalnost distribucije testirana Kolmogorov – Smirnov testom motoričkih varijabli za kontrolnu grupu (K) na inicijalnom merenju, uočava se da ne postoji statistički značajno odstupanje testirane distribucije od normalne. Svi analizirani rezultati maksimalnog ekstremnog odstupanja su takvi da se nalaze u okviru vrednosti *K-S* testa. Ne postoji statistička značajnost *p* koeficijenta u posmatranim varijablama, što je dovelo do toga da se pristupi daljoj primeni parametrijskih statističkih metoda obrade podataka u nastavku ovog istraživanja.

**Table 5:** Differences between groups in motor ability at the initial measurement.

Varijable / Variables	Grupa / Group	AS	S	f	p	$\eta^2$																																																																												
Dohvatna visina sa jednom rukom / Reachable height with one arm	E	39,28	11,99	0,496	0,484	0,017																																																																												
	K	38,24	11,73				Dohvat za blok / Block reach	E	18,92	10,22	1,793	0,185	0,025	K	17,54	9,18	Pretklon na klupici / Back saver	E	25,27	14,97	1,101	0,980	0,012	K	26,61	13,99	Taping rukom / Plate tapping test	E	64,86	7,26	2,059	0,156	0,029	K	62,56	6,30	Japan test / Japan test	E	13,20	0,697	3,917	0,012	0,111	K	13,66	0,60	Bacanje medicine iz ležećeg pol. / Medicine ball throwing out of lying position	E	9,79	1,96	1,009	0,925	0,012	K	9,20	1,75	Sklek 30s / Push-ups 30s	E	27,00	8,91	1,088	0,767	0,011	K	25,39	7,2	Ležanje-sed 30s / Sit-ups 30s	E	27,57	4,43	1,110	0,741	0,032	K	26,53	2,77	Leđa 30s / Back 30s	E	39,14	5,94	8,816	0,004
Dohvat za blok / Block reach	E	18,92	10,22	1,793	0,185	0,025																																																																												
	K	17,54	9,18				Pretklon na klupici / Back saver	E	25,27	14,97	1,101	0,980	0,012	K	26,61	13,99	Taping rukom / Plate tapping test	E	64,86	7,26	2,059	0,156	0,029	K	62,56	6,30	Japan test / Japan test	E	13,20	0,697	3,917	0,012	0,111	K	13,66	0,60	Bacanje medicine iz ležećeg pol. / Medicine ball throwing out of lying position	E	9,79	1,96	1,009	0,925	0,012	K	9,20	1,75	Sklek 30s / Push-ups 30s	E	27,00	8,91	1,088	0,767	0,011	K	25,39	7,2	Ležanje-sed 30s / Sit-ups 30s	E	27,57	4,43	1,110	0,741	0,032	K	26,53	2,77	Leđa 30s / Back 30s	E	39,14	5,94	8,816	0,004	0,122	K	35,17	3,53						
Pretklon na klupici / Back saver	E	25,27	14,97	1,101	0,980	0,012																																																																												
	K	26,61	13,99				Taping rukom / Plate tapping test	E	64,86	7,26	2,059	0,156	0,029	K	62,56	6,30	Japan test / Japan test	E	13,20	0,697	3,917	0,012	0,111	K	13,66	0,60	Bacanje medicine iz ležećeg pol. / Medicine ball throwing out of lying position	E	9,79	1,96	1,009	0,925	0,012	K	9,20	1,75	Sklek 30s / Push-ups 30s	E	27,00	8,91	1,088	0,767	0,011	K	25,39	7,2	Ležanje-sed 30s / Sit-ups 30s	E	27,57	4,43	1,110	0,741	0,032	K	26,53	2,77	Leđa 30s / Back 30s	E	39,14	5,94	8,816	0,004	0,122	K	35,17	3,53																
Taping rukom / Plate tapping test	E	64,86	7,26	2,059	0,156	0,029																																																																												
	K	62,56	6,30				Japan test / Japan test	E	13,20	0,697	3,917	0,012	0,111	K	13,66	0,60	Bacanje medicine iz ležećeg pol. / Medicine ball throwing out of lying position	E	9,79	1,96	1,009	0,925	0,012	K	9,20	1,75	Sklek 30s / Push-ups 30s	E	27,00	8,91	1,088	0,767	0,011	K	25,39	7,2	Ležanje-sed 30s / Sit-ups 30s	E	27,57	4,43	1,110	0,741	0,032	K	26,53	2,77	Leđa 30s / Back 30s	E	39,14	5,94	8,816	0,004	0,122	K	35,17	3,53																										
Japan test / Japan test	E	13,20	0,697	3,917	0,012	0,111																																																																												
	K	13,66	0,60				Bacanje medicine iz ležećeg pol. / Medicine ball throwing out of lying position	E	9,79	1,96	1,009	0,925	0,012	K	9,20	1,75	Sklek 30s / Push-ups 30s	E	27,00	8,91	1,088	0,767	0,011	K	25,39	7,2	Ležanje-sed 30s / Sit-ups 30s	E	27,57	4,43	1,110	0,741	0,032	K	26,53	2,77	Leđa 30s / Back 30s	E	39,14	5,94	8,816	0,004	0,122	K	35,17	3,53																																				
Bacanje medicine iz ležećeg pol. / Medicine ball throwing out of lying position	E	9,79	1,96	1,009	0,925	0,012																																																																												
	K	9,20	1,75				Sklek 30s / Push-ups 30s	E	27,00	8,91	1,088	0,767	0,011	K	25,39	7,2	Ležanje-sed 30s / Sit-ups 30s	E	27,57	4,43	1,110	0,741	0,032	K	26,53	2,77	Leđa 30s / Back 30s	E	39,14	5,94	8,816	0,004	0,122	K	35,17	3,53																																														
Sklek 30s / Push-ups 30s	E	27,00	8,91	1,088	0,767	0,011																																																																												
	K	25,39	7,2				Ležanje-sed 30s / Sit-ups 30s	E	27,57	4,43	1,110	0,741	0,032	K	26,53	2,77	Leđa 30s / Back 30s	E	39,14	5,94	8,816	0,004	0,122	K	35,17	3,53																																																								
Ležanje-sed 30s / Sit-ups 30s	E	27,57	4,43	1,110	0,741	0,032																																																																												
	K	26,53	2,77				Leđa 30s / Back 30s	E	39,14	5,94	8,816	0,004	0,122	K	35,17	3,53																																																																		
Leđa 30s / Back 30s	E	39,14	5,94	8,816	0,004	0,122																																																																												
	K	35,17	3,53																																																																															

**Legend:** Group: E-experimental, C-control; AM- arithmetic mean; S - standard deviation; f-value of univariate f-test; p - the level of statistical significance of univariate f-test;  $\eta^2$  - partial eta square (effect size)

With the projection of the obtained results in table 5, where the differences between groups in motor abilities at the initial measurement were analyzed, it can be stated that statistically significant differences were noticed between the analyzed groups of subjects at the initial measurement ( $F = 2,14$ ;  $P = 0,004$ ;  $\eta^2 = 0,112$ ) with a satisfactory effect of influence  $\eta^2 = 0,112$ . By analyzing each variable individually, we notice that the statistical significance is present in two variables, and those variables are the variables for assessing the agility *Japan test* in favor of the experimental group and the variables for assessing the repetitive strength of the back muscles *Back 30s*.

**Table 6.** Basic descriptive indicators of motor variables of the experimental group (E) at the final measurement.

Varijable / Variable	MIN	MAX	AS	S	Sk	Kurt
Dohvatna visina sa jednom rukom / Reachable height with one arm	20,0	59,0	41,80	10,26	-0,00	-0,46
Dohvat za blok / Block reach	8,0	39,0	23,44	7,01	0,196	0,971
Pretklon na klupici / Back saver	10	50	28,78	13,32	0,140	-1,54
Taping rukom / Plate tapping test	50	74	65,47	5,67	-0,78	0,56
Japan test / Japan test	12,0	14,22	13,07	0,59	0,289	-0,75
Bacanje medicine iz ležećeg pol. / Medicine ball throwing out of lying position	7,9	13,0	10,09	1,52	0,632	-0,57

**Tabela 5.** Razlike između grupa u motoričkim sposobnostima na inicijalnom merenju

**Legenda:** Grupa: E-eksperimentalna, K-kontrolna; AS- aritmetička sredina; S - standardna devijacija; f-vrednost univarijatnog f-testa;  $\eta^2$  - parcijalni eta kvadrat (veličina efekta)

Projekcijom dobijenih rezultata u tabeli 5, gde su analizirane razlike između grupa u motoričkim sposobnostima na inicijalnom merenju, može se konstatovati da su uočene statistički značajne razlike između analiziranih grupa ispitanika na inicijalnom merenju ( $F=2,14$ ;  $P=0,004$ ;  $\eta^2=0,112$ ) uz zadovoljavajući efekat uticaja  $\eta^2=0,112$ . Analizirajući svaku varijablu pojedinačno uočava se da je statistička značajnost prisutna u dve varijable, i to varijabli za procenu agilnosti *Japan test* u korist eksperimentalne grupe i varijabli za procenu repetitivne snage leđnih mišića *Leđa 30s*.

**Tabela 6.** Osnovni deskriptivni pokazatelji motoričkih varijabli eksperimentalne grupe (E) na finalnom merenju

Sklek 30s / Push-ups 30s	16	41	28,03	6,99	0,293	-0,98
Ležanje-sed 30s / Sit-ups 30s	20	34	28,17	3,40	-0,31	-0,17
Leđa 30s / Back 30s	29	50	39,69	4,92	0,164	-0,38

**Legend:** MIN - minimum recorded measurement result; MAX - maximum recorded measurement result; AM - arithmetic mean; S - standard deviation; Sk - skewness (the inclination of the distribution of results); Kurt - kurtosis (the elongation of the distribution of results).

By analyzing table 6, where the basic descriptive indicators of the motor variables of the experimental group (E) are shown at the final measurement, a good discriminability of the measurements is found in all variables, except the variable for the estimation of the posterior line of the thigh flexibility *Back saver*. The minimum and maximum measured values in all variables are within the range of normal range results, and there aren't any increased range results as a measure of variability in the analyzed variables for motor skills assessment. Skewness coefficients are all within good and acceptable values and there is no significant asymmetry of the distribution. By examining the kurtosis, one can see that in the variable for the estimation of the posterior line of the thigh flexibility *Back saver* there is a dispersion of the measurement results, that is, a reduced homogeneity of the distribution, which is characterized by the flattened tip of the distribution curve, which is in a platykurtic shape.

**Table 7.** The normality of distribution tested by Kolmogorov - Smirnov test of motor variables for the experimental group (E) at the final measurement.

Varijable / Variables	MEA	K-S	p
Dohvatna visina sa jednom rukom / Reachable height with one arm	0,108	0,645	0,799
Dohvat za blok / Block reach	0,175	1,048	0,222
Pretklon na klupici / Back saver	0,200	1,200	0,112
Taping rukom / Plate tapping test	0,148	0,891	0,406
Japan test / Japan test	0,136	0,814	0,522
Bacanje medicinke iz ležećeg pol. / Medicine ball throwing out of lying position	0,159	0,952	0,325
Sklek 30s / Push-ups 30s	0,142	0,851	0,464
Ležanje-sed 30s / Sit-ups 30s	0,134	0,805	0,536
Leđa 30s / Back 30s	0,139	0,837	0,486

**Legend:** K-S – Kolmogorov – Smirnov Z coefficient; p – the level of statistical significance of Kolmogorov - Smirnov Z coefficient; MEA – the maximum extreme difference between the obtained and the expected distribution.

By comparing the results in table 7, where the normality of distribution was tested by the Kolmogorov - Smirnov test of the motor variables for the experimental

**Legenda:** MIN – minimalni zabeleženi rezultat merenja; MAX – maksimalni zabeleženi rezultat merenja; AS – aritmetička sredina; S – standardna devijacija; Sk – skjunis (nagnutost distribucije rezultata); Kurt – kurtosis (izduženost distribucije rezultata).

Analizirajući tabelu 6, gde su prikazani osnovni deskriptivni pokazatelji motoričkih varijabli eksperimentalne grupe (E) na finalnom merenju, konstatuje se dobra diskriminativnost merenja u svim varijablama sem u varijabli za procenu fleksibilnosti lumbalnih ekstenzora i zadnje lože buta *Pretklon na klupici*. Minimalne i maksimalne izmerene vrednosti u svim varijablama su u zoni normalnih rezultata raspona, te ni u jednoj analiziranoj varijabli za procenu motoričkih sposobnosti nema povećanih rezultata raspona kao mere varijabilnosti. Skjunični koeficijenti su svi u okviru dobrih i prihvatljivih vrednosti, te nema značajnije asimetrije distribucije. Pregledom kurtičnih vrednosti, uočava se da u varijabli za procenu fleksibilnosti lumbalnih ekstenzora i zadnje lože buta *Pretklon na klupici* postoji disperzija rezultata merenja, odnosno smanjena homogenost distribucije, što se karakteriše spljoštenim vrhom krive distribucije, koji je platikurtičnog oblika.

**Tabela 7.** Normalnost distribucije testirana Kolmogorov – Smirnov testom motoričkih varijabli za eksperimentalnu grupu (E) na finalnom merenju

**Legenda:** K-S – Kolmogorov – Smirnov Z koeficijent; p – nivo statističke značajnosti Kolmogorov – Smirnov Z koeficijenta; MEA – maksimalna ekstremna razlika između dobijene i očekivane distribucije.

Komparacijom rezultata u tabeli 7, gde se testirala normalnost distribucije Kolmogorov – Smirnov testom motoričkih varijabli za eksperimentalnu grupu (E) na fi-

group (E) at the final measurement, it can be seen that there is no significant deviation of the tested distribution from the normal one. All coefficients of maximum extreme deviation (MEA) are less than the values of the K-S test, and the statistical significance of the K-S test was not detected in any of the motor variables analyzed.

**Table 8.** Basic descriptive indicators of the control group (C) motor variables at the final measurement.

Varijable / Variable	MIN	MAX	AS	S	Sk	Kurt
Dohvatna visina sa jednom rukom / Reachable height with one arm	21,0	58,0	38,50	11,40	0,117	-1,04
Dohvat za blok / Block reach	4,0	37,0	17,79	8,86	0,189	-,588
Pretklon na klupici / Back saver	9	49	26,89	14,02	-0,03	-1,79
Taping rukom / Plate tapping test	44	72	62,81	6,18	-1,01	2,655
Japan test / Japan test	12,0	14,19	13,23	0,55	-0,07	-0,92
Bacanje medicinke iz ležećeg pol. / Medicine ball throwing out of lying position	7,1	13,2	9,87	1,65	0,597	-0,70
Sklek 30s. / Push-ups 30s	16	38	26,22	5,80	0,374	-0,52
Ležanje-sed 30s. / Sit-ups 30s	22	34	26,97	2,42	0,457	1,021
Leđa 30s. / Back 30s	32	46	36,03	2,75	0,276	2,59

**Legend:** MIN - minimum recorded measurement result; MAX - maximum recorded measurement result; AM - arithmetic mean; S - standard deviation; Sk - skewness (the inclination of the distribution of results); Kurt - kurtosis (the elongation of the distribution of results).

Table 8 presents the results of the basic descriptive indicators of the control group (C) motor variables at the final measurement. By comparing their arithmetic means and standard deviations, a good discriminability in most variables is noted, except for two variables, the variable for the estimation of lower extremities explosive power *Block reach* and the variable for the estimation of the posterior line of the thigh flexibility *Back saver*. By analyzing the range of the results in all the variables it is seen that there are no major deviations and that all values of the range are in the area of normal and acceptable results. By examining the skewness values, the asymmetry of the distribution in the variable for the velocity of the alternative hand movement *Plate tapping test* is stated, in all other analyzed variables the obtained results were in the zone of good and acceptable values. The kurtosis values show an increased grouping of results around the arithmetic mean into two variables, namely the variable for the velocity of the alternative hand movement *Plate tapping test* and the variables for the estimation of the repetitive strength of the abdominal muscles *Sit-ups 30sec*. This type of distribution is characterized by an elongated tip of the curve that has a leptokurtic shape. The increased dispersion of the results which is noted based on the negative sign of the kurto-

nalnom merenju, uočljivo je da nema značajnog odstupanja testirane distribucije od normalne. Svi koeficijenti maksimalnog ekstremnog odstupanja (MEA) su manje od vrednosti K-S testa, a statistička značajnost K-S testa nije detektovana ni u jednoj analiziranoj motoričkoj varijabli.

**Tabela 8.** Osnovni deskriptivni pokazatelji motoričkih varijabli kontrolne grupe (K) na finalnom merenju

**Legenda:** MIN – minimalni zabeleženi rezultat merenja; MAX – maksimalni zabeleženi rezultat merenja; AS – aritmetička sredina; S – standardna devijacija; Sk – skjunis (nagnutost distribucije rezultata); Kurt – kurtosis (izduženost distribucije rezultata).

U tabeli 8, prezentovani su rezultati osnovnih deskriptivnih pokazatelja motoričkih varijabli kontrolne grupe (K) na finalnom merenju. Komparacijom njihovih aritmetičkih sredina i standardnih devijacija primećuje se dobra diskriminantivnost u većini varijabli, sem u varijablama za procenu eksplozivne snage donjih ekstremiteta *Dohvat za blok* i varijabli za procenu fleksibilnosti lumbalnih ekstenzora i zadnje lože buta *Pretklon na klupici*. Analizom raspona rezultata u svim varijablama konstatuje se da nema većih odstupanja i da su sve vrednosti raspona u zoni normalnih i prihvatljivih rezultata. Pregledom skjuničnih vrednosti konstatuje se asimetrija distribucije u varijabli za procenu brzine alternativnih pokreta ruku *Taping rukom*, a u svim drugim analiziranim varijablama su dobijeni rezultati u zoni dobrih i prihvatljivih vrednosti. Vrednosti kurtozisa pokazuju povećano grupisanje rezultata oko aritmetičke sredine u dve varijable i to varijabli za procenu brzine alternativnih pokreta ruku *Taping rukom* i varijabli za procenu repetitivne snage abdominalnih mišića *Ležanje-sed 30s*. Ovakav oblik distribucije karakteriše se izduženim vrhom krive koji ima leptokurtičan oblik. Povećana disperzija rezultata koja se uočava na osnovu negativnog predznaka kurtičnog koeficijenta zabeležena je u dve

sis coefficient was recorded in two variables: the variable for the estimation of lower extremities explosive power *Reachable height with one arm* and the variable for the estimation of the posterior line of the thigh flexibility *Back saver*. This negative distribution is characterized by the flattened tip of the curve, which has a platykurtic shape.

**Table 9.** The normality of distribution tested by Kolmogorov - Smirnov test of motor variables for the control group (C) at the final measurement.

Varijable / Variables	MEA	K-S	p
Dohvatna visina sa jednom rukom / <i>Reachable height with one arm</i>	0,156	0,933	0,349
Dohvat za blok / <i>Block reach</i>	0,148	0,887	0,411
Pretklon na klupici / <i>Back saver</i>	0,194	1,164	0,133
Taping rukom / <i>Plate tapping test</i>	0,158	0,949	0,329
Japan test / <i>Japan test</i>	0,180	1,079	0,195
Bacanje medicinke iz ležećeg pol. / <i>Medicine ball throwing from lying position</i>	0,186	1,117	0,165
Sklek 30s. / <i>Push-ups 30s</i>	0,126	0,758	0,613
Ležanje-sed 30s. / <i>Sit-ups 30s</i>	0,128	0,770	0,594
Leđa 30s. / <i>Back 30s</i>	0,171	1,024	0,245

**Legend:** K-S – Kolmogorov – Smirnov Z coefficient; p – the level of statistical significance of Kolmogorov - Smirnov Z coefficient; MEA – the maximum extreme difference between the obtained and the expected distribution.

By displaying the results in table 9, where the normality of distribution was tested by Kolmogorov - Smirnov test of motor variables for the control group (C) at the final measurement, it is concluded that there is no significant deviation of the tested distribution from the normal (theoretical). No value of the maximum extreme deviation (MEA) exceeds the values of the K-S test and is not statistically significant. This justifies the use of parametric statistical methods of data processing in the continuation of the research.

**Table 10.** Quantitative differences between the initial and the final measurements of the experimental group in motor variables at the final measurement.

Varijable/Grupe / Variables/Groups	AS <sub>1</sub> -AS <sub>2</sub>	p
Dohvatna visina sa jednom rukom / <i>Reachable height with one arm</i>	-1,63	0,005
Dohvat za blok / <i>Block reach</i>	-2,98	0,000
Pretklon na klupici / <i>Back saver</i>	-2,25	0,003
Taping rukom / <i>Plate tapping test</i>	-0,75	0,112
Japan test / <i>Japan test</i>	0,42	0,006
Bacanje medicinke iz ležećeg pol. / <i>Medicine ball throwing from lying position</i>	-0,34	0,101
Sklek 30s / <i>Push-ups 30s</i>	-2,08	0,000
Ležanje-sed 30s / <i>Sit-ups 30s</i>	-1,33	0,072
Leđa 30s / <i>Back 30s</i>	-1,19	0,060

**Legend:** AS<sub>1</sub>-AS<sub>2</sub>-the first and the second measurement; p – the level of statistical significance of the t-test.

varijable, i to: varijabli za procenu eksplozivne snage donjih ekstremiteta *Dohvatna visina sa jednom rukom* i varijabli za procenu fleksibilnosti lumbalnih ekstenzora i zadnje lože buta *Pretklon na klupici*. Ovakva negativna distribucija se karakteriše spljoštenim vrhom krive koja ima platikurtičan oblik.

**Tabela 9.** Normalnost distribucije testirana Kolmogorov – Smirnov testom motoričkih varijabli za kontrolnu grupu (K) na finalnom merenju

**Legenda:** K-S – Kolmogorov – Smirnov Z koeficijent; p – nivo statističke značajnosti Kolmogorov – Smirnov Z koeficijenta; MEA – maksimalna ekstremna razlika između dobijene i očekivane distribucije.

Prikazom rezultata u tabeli 9, gde je testirana normalnost distribucije testirana Kolmogorov – Smirnov testom motoričkih varijabli za kontrolnu grupu (K) na finalnom merenju, konstatuje se da nema značajnog odstupanja testirane distribucije od normalne (teorijske). Nijedna vrednost maksimalnog ekstremnog odstupanja (MEA) ne prelazi vrednosti K-S testa i nije statistički značajna. To opravdava primenu parametrijskih statističkih metoda obrade podataka u nastavku istraživanja.

**Tabela 10.** Kvantitativne razlike između inicijalnog i finalnog merenja eksperimentalne grupe u motoričkim varijablama na finalnom merenju

**Legenda:** AS<sub>1</sub>-AS<sub>2</sub>-prvo i drugo merenje; p-nivo statističke značajnosti t-testa.

Table 10 shows the quantitative differences between the initial and the final measurements of the experimental group in motor variables at the final measurement at a level of statistical inference of  $p < 0.001$ . Statistically significant differences between the initial and the final measurements in motor ability in the experimental group were observed in five variables: the variable for the estimation of lower extremities explosive power *Reachable height with one arm* and *Block reach* and that was the goal of the programmed transformation process which was applied to top athletes, in the variable for the estimation of the posterior line of the thigh flexibility *Back saver*, the variables for agility estimation *Japan test*, and the variables for the estimation of the repetitive strength of the abdominal muscles *Sit-ups 30s*. By looking at the negative sign of the mentioned variables, we see that four statistically significant variables achieved better results on the final measurement, while in the variables for agility estimation *Japan test* sign is positive but since it is an inverse metric and a time unit where the worse result is actually better, we see that in this variable, the results were statistically significantly better at the final measurement. Based on everything stated in table number 10, it is concluded that the differences were the result of the applied experimental treatment.

**Table 11.** Quantitative differences between the initial and the final measurements of the control group in motor variables at the final measurement.

Varijable/Grupe / Variables/Groups	Kontrolna / Control	
	AS <sub>1</sub> -AS <sub>2</sub>	p
Dohvatna visina sa jednom rukom / <i>Reachable height with one arm</i>	-0,25	0,202
Dohvat za blok / <i>Block reach</i>	-0,25	0,119
Pretklon na klupici / <i>Back saver</i>	-0,27	0,031
Taping rukom / <i>Plate tapping test</i>	-0,25	0,037
Japan test / <i>Japan test</i>	-0,03	0,818
Bacanje medicinke iz ležećeg pol. / <i>Medicine ball throwing from lying position</i>	-0,17	0,115
Sklek 30s. / <i>Push-ups 30sec</i>	-0,83	0,033
Ležanje-sed 30s. / <i>Sit-ups 30sec</i>	-0,44	0,016
Leđa 30s. / <i>Back 30sec</i>	-0,86	0,001

**Legend:** AS<sub>1</sub>-AS<sub>2</sub>-the first and the second measurement; p - the level of statistical significance of the t-test.

Quantitative differences between the initial and the final measurements of the control group in motor variables at the final measurement are presented in table 11 at the statistical inference level  $p < 0.001$ . By reviewing the results obtained in the table above, it is concluded that there are statistically significant differences in the two variables

U tabeli 10, prikazane se kvantitativne razlike između inicijalnog i finalnog merenja eksperimentalne grupe u motoričkim varijablama na finalnom merenju pri nivou statističkog zaključivanja od  $p < 0,001$ . Statistički značajne razlike između inicijalnog i finalnog merenja u motoričkim sposobnostima kod eksperimentalne grupe uočene su u pet varijabli, i to: varijablama za procenu eksplozivne snage donjih ekstremiteta *Dohvatna visina sa jednom rukom* i *Dohvat za blok* a što je bio i cilj samog programiranog transformacionog procesa koji je primenjen na vrhunskim sportistima, u varijabli za procenu fleksibilnosti lumbalnih ekstenzora i zadnje lože buta *Pretklon na klupici*, varijabli za procenu agilnosti *Japan test*, i varijabli za procenu snage mišića ruku i ramenog pojasa *Sklek 30s*. Posmatrajući negativan predznak navedenih varijabli vidi se da su u četiri varijable dobijene statistički značajne razlike i ostvareni bolji rezultati na finalnom merenju, dok je u varijabli za procenu agilnosti *Japan test* predznak pozitivan, ali pošto se radi o inverznoj metrici i vremenskoj jedinici gde je lošiji rezultat ustvari bolji, vidi se da su u ovoj varijabli rezultati statistički značajno bili bolji na finalnom merenju. Na osnovu svega iznetog u tabeli 10. konstatuje se da su nastale razlike plod primenjenog eksperimentalnog tretmana.

**Tabela 11.** Kvantitativne razlike između inicijalnog i finalnog merenja kontrolne grupe u motoričkim varijablama na finalnom merenju

**Legenda:** AS<sub>1</sub>-AS<sub>2</sub>-prvo i drugo merenje; p-nivo statističke značajnosti t-testa.

Kvantitativne razlike između inicijalnog i finalnog merenja kontrolne grupe u motoričkim varijablama na finalnom merenju predstavljene su u tabeli 11, na nivou statističkog zaključivanja  $p < 0,001$ . Pregledom dobijenih rezultata u navedenoj tabeli konstatuje se da postoje statistički značajne razlike u dve varijable na finalnom me-

at the final measurement: the variables for the estimation of the repetitive strength of the abdominal muscles *Sit-ups 30s* and the variables for assessing the repetitive strength of the back muscles *Back 30s*. Based on the sign, we can see that the statistical significance of the mentioned variables was achieved on the final measurement in both variables, which can be the result of accomplished training tasks in the control group of athletes.

## DISCUSSION

Plyometric training involves performance involving eccentric contraction of great intensity immediately after the fast and powerful concentric contraction (Malisoux, Francaux, Nielens, Theisen, 2006). The effects of plyometric training on vertical jump performance were studied heavily. Numerous studies on plyometrics showed improvements in jump height (Wilson, Murphy, Giorgi, 1996; Wilson, Newton, Murphy, 1993; Adams, O'Shea, O'Shea, 1992; Marković, Jukić, Milanović, 2007; Malisoux, Francaux, Nielens, 2006; Kotzamanidis, 2006; Dvir, 1985; Blattner, Noble, 1979; Mataulj Kukulj, Ugarkovic 2001; Brown, Mayhew, Boleach, 1986; Fatouros, Jamurtas, Leontsini, 2000; Gehri, Ricard, Kleiner, 1998; Spurrs, Murphy, Watsford, 2003; Diallo, Dore, Duche, 2001; Chimera, Swanik, Swanik, 2004; Tricoli, Lamas, Carnevale, 2005; Holcomb, Lander, Rutland, 1996; Lehance, Cruising, Bury, 2005). These results are certainly consistent with the results obtained in this study on the positive impact of plyometric training on changes in explosive strength in elite athletes.

The tested quantitative differences between the initial and final measurements of the experimental group in the motor variables final measurements have shown positive effects in five analyzed variables, as follows: the variables for the evaluation of the explosive strength of the lower extremities Reachable height with one arm and Block reach which was the initial objective of the programmed transformation process that is applied to top athletes, the variables for assessing the flexibility of hamstring Back saver, variables for assessing agility Japan test, and variables for assessing muscle strength of arms and shoulders Push - up 30sec. Looking at the negative sign of the mentioned variables, we see that four statistically significant variables achieved better results on the final measurement, while in the agility assessment variable *Japan test*, the sign is positive but since it is an inverse metric and a time unit where the worse result is better, we see that in this variable, the results were statistically significantly better on the final measurement.

renju i to: u varijabli za procenu repetitivne snage trbušnih mišića i pregibača zgloba kuka *Ležanje-sed 30s*. i u varijabli za procenu repetitivne snage leđnih mišića *Leđa 30s*. Na osnovu predznaka vidi se da je statistička značajnost navedenih varijabli ostvarena na finalnom merenju u obe varijable, što može biti plod ostvarenih trenažnih zadataka u kontrolnoj grupi sportista.

## DISKUSIJA

Pliometrijski trening podrazumeva performanse koje uključuju ekscentričnu kontrakciju velikog intenziteta odmah nakon brze i snažne koncentrične kontrakcije (Malisoux, Francaux, Nielens, Theisen, 2006). Efekti pliometrijskog treninga na performanse vertikalnog skoka su proučavani u velikoj meri. Brojne studije o pliometriji pokazale su poboljšanja u visini skokova (Wilson, Murphy, Giorgi, 1996; Wilson, Newton, Murphy, 1993; Adams, O'Shea, O'Shea, 1992; Markovic, Jukic, Milanovic, 2007; Malisoux, Francaux, Nielens, 2006; Kotzamanidis, 2006; Dvir, 1985; Blattner, Noble, 1979; Mataulj, Kukulj, Ugarkovic, 2001; Brown, Mayhew, Boleach, 1986; Fatouros, Jamurtas, Leontsini, 2000; Gehri, Ricard, Kleiner, 1998; Spurrs, Murphy, Watsford, 2003; Diallo, Dore, Duche, 2001; Chimera, Swanik, Swanik, 2004; Tricoli, Lamas, Carnevale, 2005; Holcomb, Lander, Rutland, 1996; Lehance, Croisier, Bury, 2005). Ovi rezultati su svakako u skladu sa dobijenim rezultatima u ovom istraživanju o pozitivnom uticaju pliometrijskog treninga na promene u eksplozivnoj snazi kod vrhunskih sportista.

Testirane kvantitativne razlike između inicijalnog i finalnog merenja eksperimentalne grupe u motoričkim varijablama na finalnom merenju pokazale su pozitivne efekte u pet analiziranih varijabli, i to: varijablama za procenu eksplozivne snage donjih ekstremiteta *Dohvatna visina sa jednom rukom i Dohvat za blok*, a što je bio i cilj samog programiranog transformacionog procesa koji je primenjen na vrhunskim sportistima, u varijabli za procenu fleksibilnosti lumbalnih ekstenzore i zadnje lože buta *Pretklon na klupici*, varijabli za procenu agilnosti *Japan test*, i varijabli za procenu repetitivne snage mišića ruku i ramenog pojasa *Sklek 30s*. Posmatrajući negativan predznak navedenih varijabli vidi se da su u četiri varijable ostvareni bolji rezultati na finalnom merenju, dok je u varijabli za procenu agilnosti *Japan test* predznak pozitivan, ali pošto se radi o inverznoj metrici i vremenskoj jedinici gde je lošiji rezultat ustvari bolji, vidi se da su i u ovoj varijabli rezultati statistički značajno bili bolji na finalnom merenju.



## CONCLUSION

The primary objective of this longitudinal study was to determine the effects of special treatment of kinesiologic activities based on plyometric exercises on the motor abilities of experimental volleyball subjects. The study was conducted on a sample of 72 volleyball subjects divided into two groups (experimental and control group). The experimental group consisted of 36 volleyball subjects with whom a special treatment of kinesiological activities was implemented, structured in content from plyometric exercises. The control group also consisted of 36 volleyball subjects not covered by kinesiological treatment. The survey applied 9 variables to assess motor skills. Measurements of motor variables were performed at the beginning and end of treatment in both groups of subjects. Differences between initial and final measurements were found in both groups of subjects. The obtained results indicate that there were statistically significant changes in the experimental group compared to the control group. The resulting changes are evident in the five applied motor variables (single arm reach height, block reach, bench lean, 30 s push, and Japan test). Of course, the most important changes are those related to the improvement of the specific motor skills of volleyball players (one-handed reach, reach for the block), which can be attributed to the effects of applied plyometric training. Thus, the treatment applied in the experimental group participants contributed to the improvement of the explosive power of the lower extremities (vertical jump), which is one of the very important abilities for the success of the game of volleyball.

The results of the research can be useful for volleyball coaches in the quality creation and programming of training work with volleyball players, but also as an incentive for other researchers to design and implement new work programs and to monitor their effects.

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## ZAKLJUČAK

Primarni cilj ovog longitudinalnog istraživanja bio je usmeren na utvrđivanje efekata posebnog tretmana kinezioloških aktivnosti zasnovanih na pliometrijskim vežbama na motoričke sposobnosti ispitanika-odbojkaša eksperimentalne. Istraživanje je provedeno na uzorku od 72 ispitanika-odbojkaša podeljenih u dve grupe (eksperimentalnu i kontrolnu grupu). Eksperimentalnu grupu činilo je 36 ispitanika odbojkaša sa kojom je realizovan posebni tretman kinezioloških aktivnosti sadržajno strukturiran od pliometrijskih vežbi. Kontrolnu grupu činilo je takođe 36 ispitanika-odbojkaša koji nisu obuhvaćeni kineziološkim tretmanom. U istraživanju je primenjeno 9 varijabli za procenu motoričkih sposobnosti. Izvršena merenja motoričkih varijabli provedena su na početku i na kraju tretmana kod obe grupe ispitanika. Razlike između inicijalnog i finalnog merenja utvrđivane su kod obe grupe ispitanika. Dobijeni rezultati ukazuju da je kod ispitanika eksperimentalne grupe došlo do statistički značajnijih promena u odnosu na ispitanike kontrolne grupe. Nastale promene su vidljive kod pet primenjenih motoričkih varijabli (dohvatna visina sa jednom rukom, dohvat za blok, pretklon na klupici, sklek 30 s i japan test). Svakako, da su najvažnije promene one koje se odnose na poboljšanje specifičnih motoričkih sposobnosti odbojkaša (dohvatna visina sa jednom rukom, dohvat za blok), što se može pripisati efektima primenjenog pliometrijskog treninga. Dakle, primenjeni tretman kod ispitanika eksperimentalne grupe je doprineo poboljšanju eksplozivne snage donjih ekstremiteta (vertikalne skočnosti), što predstavlja jednu od vrlo važnih sposobnosti za uspešnost igre u odbojci.

Rezultati istraživanja mogu biti od koristi odbojkaškim trenerima u kvalitetnijem kreiranju i programiranju trenažnog rada sa odbojkašima, ali isto tako i kao poticaj drugim istraživačima za izradu i primenu novih programa rada kao i praćenje njihovih efekata.

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## REPEATED SPRINT ABILITY IN FOOTBALL PLAYERS AT DIFFERENT LEVELS OF COMPETITION

ŽELJKO SEKULIĆ<sup>1</sup>, NIKOLA ILIĆ<sup>2</sup>, DRAŽEN DRAGOSAVLJEVIĆ<sup>3</sup>  
<sup>1</sup> University of Banja Luka, Faculty of Physical Education and Sport,  
<sup>2</sup> Pan-European University "Apeiron", Faculty of Sport Science,  
<sup>3</sup> JU CSŠ „Petar Kočić“ Srbac

### Correspondence:

Nikola Ilić

Pan-European University Apeiron, Faculty of Sports Science  
 nikolabl84@gmail.com

**Abstract:** This research was conducted to identify differences in repeated sprint ability between football players at different levels of competition and to confirm the role of this ability as a predictor of elite performance in modern football. The study involved 30 football players from two ranks of competition (15 football players from the first rank of the competition and 15 football players from the third rank of the competition). The RSA test consisted of 6 sprints at a distance of 30 meters with an active rest between two sprints of 20 seconds. Total sprint time and average sprint time were calculated for all subjects in both groups. In addition to the total and average sprint time, a percentage decline in sprint performance was calculated. The results of the study showed a significant decline in the performance of sprint repetition in both groups of subjects. The sprint speed of all six reps was significantly higher for Division 1 football players, as shown by the times gained at a distance of 30 meters. In addition, Division 1 football players had a statistically better total and average sprint time compared to Division 3 players ( $p < 0.01$ ). The only performance parameter in which the players of different competition rank did not differ was the percentage decline in performance ( $p > 0.05$ ). The conclusion is that professional football players have a better developed ability to repeat sprints than amateurs, which confirms the previously proven role of this ability in modern football.

**Keywords:** sprint repetition ability, football, performance decline.

### INTRODUCTION

Top-level football requires from players to constantly repeat activities of varying intensities and lengths throughout the game. Maximum or approximately maximum intensity activities are constantly alternated with periods of low or moderate intensity that allow partial

## SPOSOBNOST PONAVLJANJA SPINTA KOD FUDBALERA RAZLIČITOG NIVOA TAKMIČENJA

ŽELJKO SEKULIĆ<sup>1</sup>, NIKOLA ILIĆ<sup>2</sup>, DRAŽEN DRAGOSAVLJEVIĆ<sup>3</sup>  
<sup>1</sup> Univerzitet u Banjoj Luci, Fakultet fizičkog vaspitanja i sporta  
<sup>2</sup> Panevropski Univerzitet Apeiron, Fakultet sportskih nauka  
<sup>3</sup> JU CSŠ „Petar Kočić“ Srbac

### Korespondencija:

Nikola Ilić

Panevropski univerzitet Apeiron, Fakultet sportskih nauka  
 nikolabl84@gmail.com

**Apstrakt:** Ovo istraživanje je provedeno sa ciljem da se utvrde razlike u izvedbi ponavljanja sprinta između fudbalera različitog nivoa takmičenja i da se potvrdi uloga ove sposobnosti kao prediktora vrhunske izvedbe u savremenom fudbalu. U istraživanju je učestvovalo 30 fudbalera iz dva ranga takmičenja (15 fudbalera iz prvog ranga takmičenja i 15 fudbalera iz trećeg ranga takmičenja). Test ponavljanja sprinta se sastojao od uzastopnog izvođenja 6 sprinteva na distanci od 30 metara sa aktivnim odmorom između dva sprinta od 20 sekundi. Ukupno vrijeme sprinta i prosječno vrijeme sprinta su izračunati za sve ispitanike u obe grupe. Pored ukupnog i prosječnog vremena sprinta izračunat je i procentualni pad izvedbe sprinta. Rezultati istraživanja su pokazali značajan pad izvedbe ponavljanja sprinta kod obe grupe ispitanika. Brzina sprinta svih šest ponavljanja je bila statistički značajno viša kod fudbalera 1. lige, što pokazuju ostvarena vremena na distanci od 30 metara. Pored toga, fudbaleri 1. lige su imali i statistički značajno bolje ukupno i prosječno vrijeme sprinta u odnosu na fudbalere 3. lige ( $p < 0.01$ ). Jedini parametar izvedbe u kome se fudbaleri različitog ranga takmičenja nisu razlikovali je bio procentualni pad izvedbe ( $p > 0.05$ ). Zaključak je da profesionalni fudbaleri imaju bolje razvijenu sposobnost ponavljanja sprinta u odnosu na amatere, što potvrđuje ranije dokazanu ulogu ove sposobnosti u savremenom fudbalu.

**Gljučne reči:** sposobnost ponavljanja sprinta, fudbal, pad izvedbe.

### Uvod

Vrhunski fudbal od igrača zahtijeva da tokom igre stalno ponavljaju aktivnosti različitih intenziteta i dužine trajanja. Aktivnosti maksimalnog ili približno maksimalnog intenziteta se stalno smijenjuju sa periodima niskog ili umjerenog intenziteta koji omogućuju djelimični ili potpuni oporavak organizma (Bradley i sar., 2009). Sposobnost igrača da se u kratkom periodu vremena brzo opo-

or complete recovery (Bradley et al., 2009). The ability of players to recover quickly from a previous sprint in a short period of time and perform each subsequent sprint without significantly reducing the running speed is an important predictor of quality performance in the game. This component is defined as repeated sprint ability and refers to sprints of short duration (less than 10 seconds) with recovery periods of less than 60 seconds (Gleister et al., 2005; Spencer et al., 2005). Research have shown that sprint accounts for 1-10% of the total distance covered during game, and it covers 1-3% of effective play time (Stolen et al., 2005; Buchheit et al., 2010). The ability to quickly recover during the performance of a sprint series has, in addition to the player's technical and tactical skills, been designated as an important component of quality player performance (Buchheit et al., 2010). A significant correlation was found between RSA and distance covered by high intensity running and sprint during professional football game (Rampinini et al., 2006). Also, RSA tests have been found to significantly discriminate professional and amateur players (Aziz et al., 2008; Impellizzeri et al., 2008; Rampinini et al., 2009). The fatigue that occurs during play is closely related to the ability to perform sprints (Krustrup et al., 2010). In addition, a significant decline in sprint running in the later stages of the game was found in top football players (Mohr et al., 2003). The same conclusions were drawn in a study conducted on a sample of professional football players (Krustrup et al., 2005). The aim of this research was to determine whether there is a difference in the performance of RSA between football players at different levels of competition and thus to confirm the role and importance of this ability as a predictor of top performance in modern football.

## METHODS

### *Participants*

Thirty male football players (15 amateurs and 15 professionals) participated in this research. Amateur football players were selected from a team that competed in the 3rd League of Bosnia and Herzegovina ( $M = 23.3 \pm 3.2$  years), while professional football players were selected from a team that competed in the 1st (Premier) League of Bosnia and Herzegovina ( $M = 22.4 \pm 3.4$  years). Participants were fully informed of the possible risk and discomfort associated with testing prior to giving written consent to participate in the study. Division 1 players had six training sessions per week and an official game, while Division 1 players had three training ses-

sions per week and an official game. The aim of this research was to determine whether there is a difference in the performance of RSA between football players at different levels of competition and thus to confirm the role and importance of this ability as a predictor of top performance in modern football.

rave od prethodnog sprints i da izvedu svaki sledeći sprint bez značajnog smanjenja brzine trčanja je važan prediktor kvalitetne izvedbe u igri. Ova komponenta je definisana kao sposobnost ponavljanja sprints (eng. repeated sprint ability) i odnosi se na sprinteve kratkog trajanja (manje od 10 sekundi) sa periodima oporavka kraćim od 60 sekundi (Gleister i sar., 2005; Spencer i sar., 2005). Analize su pokazale da sprint sačinjava 1-10% ukupne distance pokrivene tokom igre, odnosno da obuhvata 1-3% efektivnog vremena igre (Stolen i sar., 2005; Buchheit i sar., 2010).

Sposobnost brzog oporavka tokom izvođenja serije sprinteva je, pored tehničkih i taktičkih vještina igrača, označena kao važna komponenta kvalitetne izvedbe igrača (Buchheit i sar., 2010). Značajna povezanost je pronađena između sposobnosti ponavljanja sprints i distance pokriveno trčanjem visokim intenzitetom i sprintom tokom igre u profesionalnom fudbalu (Rampinini i sar., 2006). Takođe, utvrđeno je da testovi ponavljanja sprints značajno diskriminišu profesionalne i amaterske igrače (Aziz i sar., 2008; Impellizzeri i sar., 2008; Rampinini i sar., 2009). Zamor koji nastaje u toku igre usko je povezan sa sposobnošću izvođenja sprinteva (Krustrup i sar., 2010). Pored toga, utvrđeno je i značajno smanjenje trčanja u sprintu u kasnijim fazama utakmice kod vrhunskih fudbalera (Mohr i sar., 2003). Isti zaključci su izvedeni i u istraživanju koje je provedeno na uzorku profesionalnih fudbalerki (Krustrup i sar., 2005). Cilj ovog istraživanja je bio da se utvrdi da li postoji razlika u izvedbi ponavljanja sprints između fudbalera različitog ranga takmičenja i na taj način da se potvrdi uloga i važnost ove sposobnosti kao prediktora vrhunске izvedbe u savremenom fudbalu.

## METODE

### *Ispitanici*

Trideset fudbalera muškog pola (15 amatera i 15 profesionalaca) je učestvovalo u ovom istraživanju. Fudbaleri amateri su izabrani iz ekipe koja se takmičila u 3. ligi Bosne i Hercegovine (prosječna starost ispitanika je bila  $23.3 \pm 3.2$  godine), dok su fudbaleri profesionalci izabrani iz ekipe koja se takmičila u 1. (Premijer) ligi Bosne i Hercegovine (prosječna starost ispitanika je bila  $22.4 \pm 3.4$  godine). Ispitanici su bili potpuno informisani o eventualnim rizicima i nelagodnostima povezanim sa testiranjem prije davanja pismene saglasnosti za učešće u istraživanju. Igrači iz 1. lige su imali treninge šest puta sedmično i zvaničnu utakmicu, dok su igrači 3. lige trenirali tri puta sedmično i učestvovali u zvaničnoj utakmici. Ispitanici su informisani da dan prije testiranje izbjegavaju intenzivnu fizičku aktivnost i da ne uzimaju napitke koji sadrže kofein.

sions per week and an official game. Participants were instructed that avoid intense physical activity and not take caffeine-containing beverages a day prior to testing.

### **Measurement procedures**

#### **Repeated sprint ability performance testing**

Prior to the repeated sprint ability testing, all subjects performed a 10-15 minutes low-intensity warm-up consisting of functional mobility exercises (8-10 exercises, 10-12 repetitions of each exercise). Before warm up, the subjects were familiar with the RSA test protocol and the importance of performing each sprint at maximum intensity. The RSA test consisted of successive performance of 6 sprints at a distance of 30 meters with an active rest between two sprints of 20 seconds. Sprint time was measured using a photocell system (Globus Ergotester, Italy). Testing was carried out indoors in the morning on an artificial floor. The subjects started the test in a high stance behind the start line of 30 meters distance and after the sound signal they started in the maximum sprint. Players were required to maintain maximum running speed for the entire length of the course and to slow down only after passing through photocells at 30 meters. After that, the players jogged 20 seconds to the start line and prepare for the next sprint.

Total sprint time and average sprint time were calculated for all subjects in both groups. The total sprint time was calculated as a sum of all six sprints, while the average sprint time was obtained by dividing the total sprint time by the total number of sprints.

**total sprint time = sprint 1 + sprint 2 + sprint 3 + sprint 4 + sprint 5 + sprint 6**

**average sprint time = (total sprint time) / number of sprints**

In addition to the total and average sprint time, the percentage decline in sprint performance was calculated according to the following formula (Girard et al., 2011):

**performance decline (%) = [((sprint 1 + sprint 2 + sprint 3 + sprint 4 + sprint 5 + sprint 6) / fastest sprint x number of sprints) - 1] x 100**

#### **Statistical analyzes**

Statistical data processing was performed using the SPSS 20 for the Windows operating system. The first step in data analysis was to determine the normality of the distribution. Using the Wilks-Shapiro test, it was determined whether the test results deviated significantly from the normal distribution. The normality of the distribution was tested at a significance level of 0.05. Measures of central tendency and dispersion are represented by arithmetic means

### **Procedure mjerenja**

#### **Mjerenje izvedbe ponavljanja sprinta**

Prije izvođenja testa ponavljanja sprinta svi ispitanici su proveli zagrijavanje niskog intenziteta trajanja 10-15 minuta koje je bilo sastavljeno od vježbi funkcionalne pokretljivosti u kretanju (8-10 vježbi, 10-12 ponavljanja svake vježbe). Prije zagrijavanja ispitanici su upoznati sa načinom izvođenja protokola testiranja ponavljanja sprinta i važnosti izvođenja svakog sprinta maksimalnim intenzitetom. Test ponavljanja sprinta se sastojao od uzastopnog izvođenja 6 sprinteva na distanci od 30 metara sa aktivnim odmorom između dva sprinta od 20 sekundi. Mjerenje vremena sprinta je izvršeno korištenjem sistema fotočelija (Globus Ergotester, Italija). Testiranje je provedeno u prijedpodnevnim satima u zatvorenom prostoru (sala) na vještačkoj podlozi (tartan). Ispitanici su početak testa čekali u visokom stavu iza linije starta distance od 30 metara i nakon zvučnog signala su startali u maksimalni sprint. Od ispitanika je zahtijevano da održe maksimalnu brzinu trčanja čitavom dužinom staze i da usporavaju tek nakon prolaska kroz fotočelije na 30 metara. Poslije toga, ispitanici su imali 20 sekundi da se u laganom trčanju vrate na start i da se pripreme za sledeći zvučni signal i sledeći sprint. Registrovano je vrijeme svih šest sprinteva i upisivano u unaprijed pripremljen obrazac radi kasnijeg izračunavanja parametara izvedbe sprinta.

Ukupno vrijeme sprinta i prosječno vrijeme sprinta su izračunati za sve ispitanike u obe grupe. Ukupno vrijeme sprinta je dobijeno sabiranjem ostvarenih vremena na svih šest sprinteva, dok je prosječno vrijeme sprinta dobijeno dijeljenjem ukupnog vremena sprinta sa ukupnim brojem sprinteva.

**ukupno vrijeme sprinta = sprint1 + sprint2 + sprint 3 + sprint 4 + sprint 5 + sprint 6**

**prosječno vrijeme sprinta = (ukupno vrijeme sprinta) / broj sprinteva**

Pored ukupnog i prosječnog vremena sprinta izračunat je i procentualni pad izvedbe sprinta prema sledećoj formuli (Girard i sar., 2011):

**pad izvedbe (%) = [((sprint1+sprint2+sprint3+sprint4+sprint5+sprint6)/najbrži sprint x broj spinteva)-1] x 100**

#### **Statističke analize**

Statistička obrada podataka izvršena je primjenom kompjuterskog programa SPSS 20 za operativni sistem Windows. Prvi korak u analizi podataka je bilo utvrđivanje normalnosti distribucije rezultata. Primjenom Vilks-Šapiro testa (Wilks-Shapiro test) je utvrđeno da li rezultati testiranja značajno odstupaju od normalne distribucije. Normalnost distribucije rezultata je testirana na nivou značajnosti od 0.05. Mjere centralne tendencije i disperzije rezultata su

and standard deviations. A ANOVA with repeated measurements with Bonferoni correction and post hoc comparison was used to test the statistical significance of the time differences of six sprints separately for the amateur soccer group and the professional soccer group. A t-test for independent samples was used to determine the significance of the arithmetic mean differences of each individual sprint and the arithmetic mean differences of the sprint performance between two groups of football players. The magnitude (power) of the difference determined by the t-test for independent samples is represented by Cohen's d (Cohen effect size). The criterion proposed by Hopkins (2004) was used to interpret the magnitude (power) of the differences. Based on the proposed criterion, the differences were interpreted as follows: <0.2 - trivial difference; 0.2-0.6 - small difference; 0.6-1.2 - moderate difference; 1.2-2.0 - large difference; > 2.0 - very large difference.

## RESULTS

Both groups of players performed a RSA test that consisted of 6 repeated sprints over a distance of 30 meters, with an active rest between sprints (20 seconds). A decline in running speed with the each subsequent sprint was evident in both groups of players (Figure 1). A statistically significant decline in sprint time was found between the first and second sprint in both groups of players ( $p < 0.01$ ). The third sprint running speed was statistically significantly lower than the second sprint running speed ( $p < 0.01$ ). Running speed continued to decline in both groups of players during the fourth sprint compared to the third sprint ( $p < 0.01$ ). The difference between the time of the fourth and fifth sprints was not statistically significant ( $p > 0.05$ ), while the decline in running speed was the smallest between the fifth and sixth sprint ( $p > 0.05$ ).

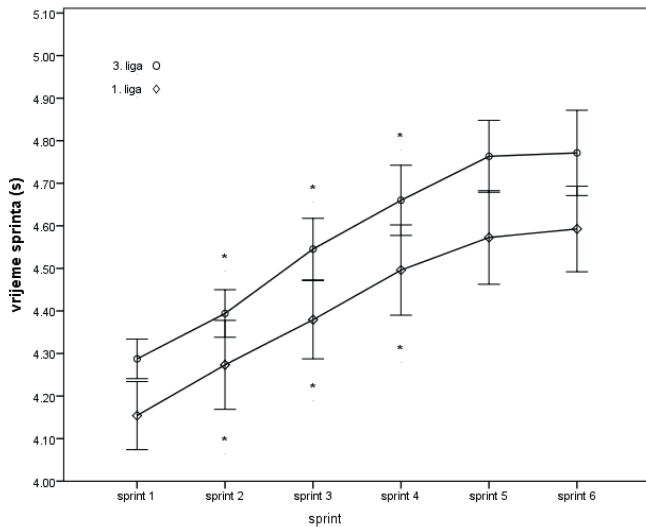
Differences of each individual sprint between amateur and professional football players were analyzed, as well as differences in total and average sprint time as indicators of performance quality. In addition, the differences in the percentage decline in sprint performance and the magnitude of fatigue during the RSA test were analyzed (Tables 1 and 2). Professional football players had significantly better performance on all six sprints compare to amateur football players (Figure 2). The difference was particularly pronounced for the first, third and fifth sprints ( $p < 0.01$ ), while for the second, fourth and sixth sprints the difference was slightly smaller ( $p < 0.05$ ). The difference between the two groups of football players was also statistically significant considering the fastest and slowest sprint times ( $p < 0.01$ ).

predstavljene aritmetičkim sredinama i standardnim devijacijama. Analiza varijanse ponovljenih mjerenja sa Bonferoni korekcijom i post hoc poređenjem je korištena za testiranje statističke značajnosti razlika vremena šest sprinteva odvojeno za grupu fudbalera amatera i za grupu fudbalera profesionalaca. Za utvrđivanje značajnosti razlika aritmetičkih sredina vremena svakog pojedinačnog sprinta i parametara izvedbe sprinta između dvije grupe fudbalera korišten je t-test za nezavisne uzorke. Veličina (snaga) razlike utvrđene t-testom za nezavisne uzorke je predstavljena Koenvim d (Cohen effect size). Za interpretaciju veličine (snage) razlika korišten je kriterijum predložen od strane Hopkinsa (2004). Na osnovu predloženog kriterijuma razlike su interpretirane na sledeći način: <0.2 – trivijalna razlika; 0.2-0.6 – mala razlika; 0.6-1.2 – umjerena razlika; 1.2-2.0 – velika razlika; >2.0 – veoma velika razlika.

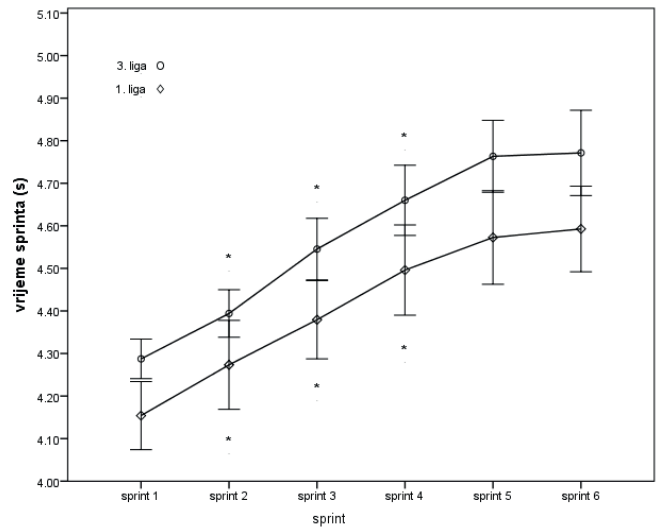
## REZULTATI

Obe grupe ispitanika, fudbaleri 1. lige i fudbaleri 3. lige, su izveli test koji se sastojao od ponavljanja 6 sprinteva na distanci od 30 metara, sa aktivnim odmorom između sprinteva (lagano trčanje od 20 sekundi). Pad brzine trčanja je evidentan kod obe grupe ispitanika, sa ponavljanjem svakog narednog sprinta (Slika 1). Statistički značajno duže vrijeme sprinta je utvrđeno između prvog i drugog sprinta kod obe grupe fudbalera ( $p < 0.01$ ). Brzina trčanja tokom izvođenja trećeg sprinta je bila statistički značajno manja nego kod izvedbe drugog sprinta ( $p < 0.01$ ). Brzina trčanja se i dalje smanjivala, pa su obe grupe fudbalera postigle statistički značajno lošije vrijeme tokom izvedbe četvrtog sprinta, u odnosu na treći sprint ( $p < 0.01$ ). Razlika između vremena četvrtog i petog sprinta nije bila statistički značajna ( $p > 0.05$ ) kod obe grupe ispitanika, dok je pad brzine trčanja bio najmanji između petog i šestog sprinta ( $p > 0.05$ ).

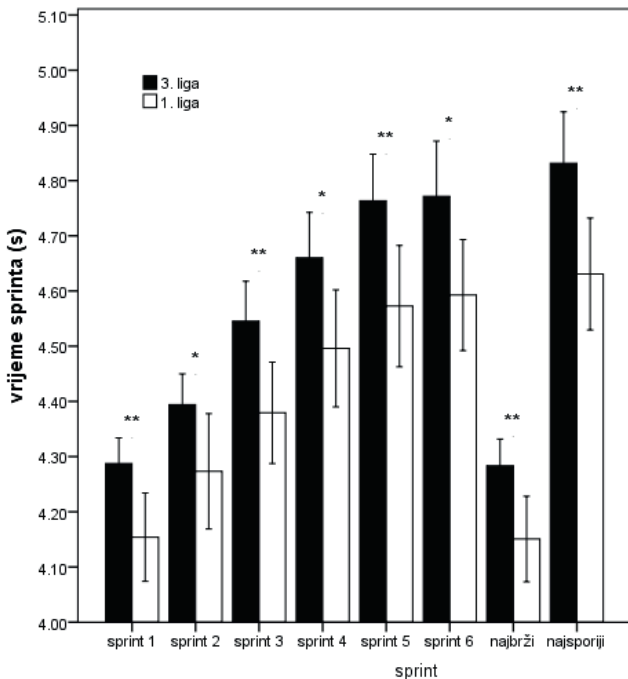
Poslije analize izvedbe ponavljanja sprinta posebno za svaku grupu ispitanika, trebalo je dati odgovor na pitanje da li se fudbaleri različitog nivoa kvaliteta razlikuju u sposobnosti ponavljanja sprinta. Analizirane su razlike svakog pojedinačnog sprinta između amatera i profesionalaca, kao i razlike u ukupnom i prosječnom vremenu sprinta kao pokazateljima kvaliteta izvedbe. Pored toga, analizirane su i razlike u procentualnom padu izvedbe ponavljanja sprinta, odnosno stepenu pojave zamora tokom izvođenja serije sprinteva (Tabele 1 i 2). Fudbaleri profesionalci su imali značajno bolja vremena svih šest sprinteva u odnosu na fudbalere amatere (Slika 2). Razlika je bila naročito izražena kod prvog, trećeg i petog sprinta ( $p < 0.01$ ), dok je kod drugog, četvrtog i šestog sprinta razlika bila nešto manja ( $p < 0.05$ ). Razlika između dvije grupe fudbalera je bila i statistički značajna kad su u obzir uzeta vremena najbržeg i najsporijeg sprinta ( $p < 0.01$ ).



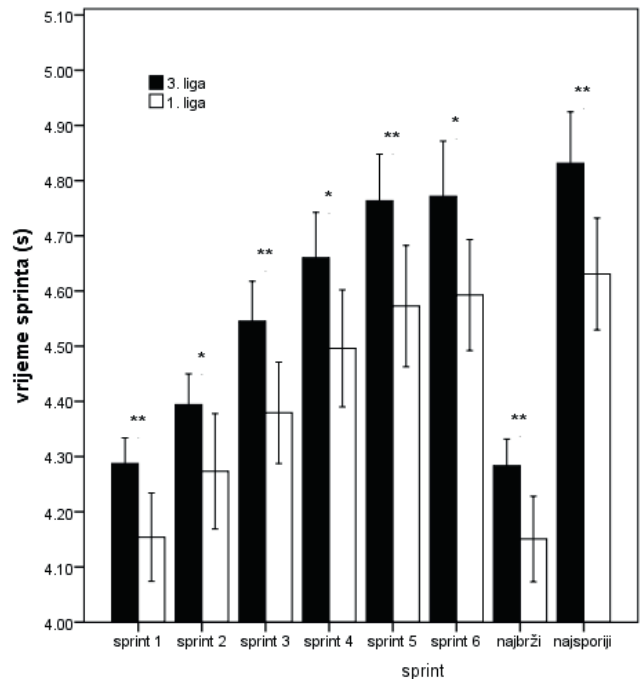
**Figure 1.** Speed decline in 6x30m RSA test, separately for a sub-sample of Division 3 and Division 1 players. The circles represent the group of Division 3 players, and the squares represent the group of Division 1 players. The results are presented as arithmetic means and standard deviations ( $M \pm SD$ ). (\*) represents a statistically significant difference between two sprints at a significance level of 0.01 within the same group of players



**Slika 1.** Pad brzine trčanje kod izvedbe sprinta 6x30 m, odvojeno za subuzorak fudbalera 3. lige i fudbalera 1. lige. Krugovi (○) prikazuju grupu fudbalera 3. lige, a rombovi (◇) grupu fudbalera 1. lige. Rezultati su prikazani kao aritmetičke sredine i standardne devijacije ( $M \pm SD$ ). (\*) predstavlja statistički značajnu razliku između dva sprinta na nivou značajnosti od 0.01 unutar iste grupe ispitanika



**Figure 2.** Differences between groups of Division 3 players and Division 1 players in RSA test (6x30m). The closed columns represent the results of Division 3 football players, the open columns represent the results of Division 1 football players. All results are presented as arithmetic means and standard deviations ( $M \pm SD$ ). (\*) shows statistically significant difference at significance level of 0.05, (\*\*) shows statistically significant difference at significance level of 0.01.



**Slika 2.** Razlike između grupa fudbalera 3. lige i fudbalera 1. lige u izvedbi ponavljanja sprinta (6x30m). Zatvoreni stupci prikazuju rezultate fudbalera 3. lige, otvoreni stupci prikazuju rezultate fudbalera 1. lige. Svi rezultati su prikazani kao aritmetičke sredine i standardne devijacije ( $M \pm SD$ ). (\*) prikazuje statistički značajnu razliku na nivou značajnosti od 0.05, (\*\*) prikazuje statistički značajnu razliku na nivou značajnosti od 0.01.

**Table 1.** Arithmetic mean differences of six individual sprints of 30 m (6x30m) between Division 3 players (amateurs) and Division 1 players (professionals), with t-test results for independent samples and effect size estimation

	III liga / Division 3		I liga / Division 1		Cohen-ovo d / Cohen's d	95% CI	veličina razlike / magnitude of difference	p vrijednost / p value
	M <sub>1</sub>	SD <sub>1</sub>	M <sub>2</sub>	SD <sub>2</sub>				
sprint 1 / sprint 1	4.29	0.08	4.15	0.14	1.13	(0.36, 1.90)	umjerena / moderate	0.005**
sprint 2 / sprint 2	4.39	0.1	4.27	0.19	0.8	(0.05, 1.54)	umjerena / moderate	0.04*
sprint 3 / sprint 3	4.54	0.13	4.38	0.16	1.11	(0.34, 1.88)	umjerena / moderate	0.005**
sprint 4 / sprint 4	4.66	0.15	4.5	0.19	0.96	(0.20, 1.71)	umjerena / moderate	0.014*
sprint 5 / sprint 5	4.76	0.15	4.57	0.2	1.07	(0.31, 1.84)	umjerena / moderate	0.006**
sprint 6 / sprint 6	4.77	0.18	4.59	0.18	0.98	(0.23, 1.74)	umjerena / moderate	0.012*
najbrži sprint / fastest sprint	4.28	0.09	4.15	0.14	1.14	(0.36, 1.90)	umjerena / moderate	0.005**
najsporiji sprint / slowest sprint	4.83	0.17	4.63	0.18	1.14	0.37, 1.91)	umjerena / moderate	0.004**

**Tabela 1.** Razlike aritmetičkih sredina vremena šest pojedinačnih sprinteva dužine 30 m (6x30m) između igrača 3. lige (amateri) i igrača 1.lige (profesionalci), sa rezultatima t-testa za nezavisne uzorke i procjenom veličine razlike (effect size)

**Table 2.** Differences in arithmetic means of sprint performance parameters between Division 3 players (amateurs) and Division 1 players (professionals), with results - test for independent samples and effect size estimation

	III liga / Division 3		I liga / Division 1		Cohen-ovo d / Cohen's d	95% CI	veličina razlike / magnitude of difference	p vrijednost / p value
	M <sub>1</sub>	SD <sub>1</sub>	M <sub>2</sub>	SD <sub>2</sub>				
prosječno vrijeme / average time	4.5702	0.11036	4.4113	0.16804	1.12	(0.35, 1.88)	umjerena / moderate	0.005**
ukupno vrijeme / total time	27.4213	0.66216	26.468	1.00823	1.12	(0.35, 1.89)	umjerena / moderate	0.005**
pad izvedbe (%) / performance decline (%)	6.7047	1.86	6.2709	1.22432	0.28	(-0.44, 0.99)	mala / small	0.457

**Tabela 2.** Razlike aritmetičkih sredina parametara izvedbe sprinta između igrača 3. lige (amateri) i igrača 1. lige (profesionalci), sa rezultatima t-testa za nezavisne uzorke i procjenom veličine razlike (effect size)

**Legend:** M<sub>1</sub> ± SD<sub>1</sub> - arithmetic means and standard deviations of sprint performance parameters (amateurs), M<sub>2</sub> ± SD<sub>2</sub> - arithmetic means and standard deviations of sprint performance parameters (professionals), Cohen's d - difference size parameter (<0.2 - trivial; 0.2 - 0.6 small; 0.6 - 1.2 moderate; 1.2 - 2.0 large; 2.0 - 4.0 very large; > 4.0 - extremely large; according to Hopkins, 2004), p - significance level, \*\* - statistically significant at the 0.01 level; \* - statistically significant at the 0.05 level

The results showed that Division 1 football players had significantly better results in all six sprints compared to League 3 players. The magnitude of the difference is expressed by the Cohen's d (effect size) parameter with recommendations for interpreting this parameter proposed by Hopkins (2004). The difference between the two groups of players was most pronounced in the first, third, and fifth sprint. In addition, the significance level of t statistics was less than 0.01. The arithmetic mean of the first sprint time for professional soccer players was lower than for amateur players (4.15 ± 0.14 vs 4.29 ± 0.08). The magnitude of the difference was indicated as moderate (d = 1.13), while the obtained t statistic was significant at the level of 0.01 (p =

**Legenda:** M<sub>1</sub>±SD<sub>1</sub> - aritmetičke sredine i standardne devijacije parametara izvedbe sprinta (amateri), M<sub>2</sub>±SD<sub>2</sub> - aritmetičke sredine i standardne devijacije parametara izvedbe sprinta (profesionalci), Cohen-ovo d - parametar veličine razlike (<0.2 - razlika trivijalna; 0.2 - 0.6 razlika mala; 0.6 - 1.2 razlika umjerena; 1.2 - 2.0 razlika velika; 2.0 - 4.0 razlika vrlo velika; >4.0 - razlika ekstremno velika; prema Hopkinsu, 2004), p - nivo značajnosti t statistika, \*\* - statistički značajno na nivou 0.01; \* - statistički značajno na nivou 0.05

Rezultati su pokazali da su fudbaleri 1. lige imali statistički značajno bolja vremena na svih šest sprinteva u odnosu na fudbalere 3. lige. Veličina razlike je izražena parametrom Cohen d (effect size) sa preporukama za tumačenje ovog parametra koje je predložio Hopkins (2004). Razlika između dvije grupe ispitanika je bila najizraženija kod izvedbe prvog, trećeg i petog sprinta, jer su vrijednosti Koenovog d bile najveće. Pored toga, ostvareni nivo značajnosti testiranja statističke značajnosti t statistika je bio manji od 0.01. Aritmetička sredina vremena prvog sprinta kod fudbalera profesionalaca je bila manja nego kod amatera (4.15±0.14 vs 4.29±0.08). Veličina razlike je označena kao umjerena (d=1.13), dok je dobijeni t statistik bio značajan na



0.005). The magnitude of the difference in the arithmetic means of the second sprint time was also classified as moderate ( $d = 0.8$ ) and the difference in the arithmetic means was slightly smaller compare to first sprint ( $4.27 \pm 0.19$  vs  $4.39 \pm 0.1$ ). The t-statistic was also statistically significant, but at the 0.05 level ( $p = 0.04$ ). In the third sprint, the Division 1 players had again better sprint times than the Division 3 players ( $4.38 \pm 0.16$  vs  $4.54 \pm 0.13$ ). The magnitude of the difference was indicated as moderate ( $d = 1.11$ ), and the t-test showed that the difference of arithmetic means was statistically significant at the 0.01 level ( $p = 0.005$ ). The arithmetic mean of the fourth sprint time of professionals and amateurs differed significantly at the 0.05 level ( $p = 0.014$ ;  $4.5 \pm 0.19$  vs  $4.66 \pm 0.15$ ). The value of Cohen's d was 0.96, so the difference was again marked as moderate. The fifth sprint performance was better in the group of Division 1 players ( $4.57 \pm 0.2$  vs  $4.76 \pm 0.15$ ), the value of Cohen's d was 1.07 which classified the obtained difference as moderate. The difference in arithmetic mean was statistically significant, as the t-statistic was statistically significant at the 0.01 level ( $p = 0.006$ ). Cohen's d value at the sixth sprint was 0.98 (moderate difference), and the t-statistic was statistically significant at the 0.05 level ( $p = 0.012$ ). The arithmetic mean of the sixth sprint time of professional football players was lower compared to amateur football players ( $4.59 \pm 0.18$  vs  $4.77 \pm 0.18$ ). The repeated sprint ability is estimated based on the values of performance parameters, total sprint time, average sprint time, and percentage decline in sprint performance. Division 1 football players had a significantly better total and average sprint time compared to Division 3 football players. The magnitude of the difference in the arithmetic means of the total sprint time between the two groups of football players was moderate, the value of Cohen's d was 1.12. The difference of arithmetic means was statistically significant at the 0.01 level ( $p = 0.005$ ;  $4.41 \pm 0.17$  vs  $4.57 \pm 0.11$ ). As for the average sprint time, the same values of Cohen's d ( $d = 1.12$ ) were obtained and the difference was also indicated as moderate. The arithmetic mean of the average sprint time of Division 1 players ( $4.41 \pm 0.17$ ) was significantly smaller than the arithmetic mean of the average sprint time of Division 3 players ( $4.57 \pm 0.11$ ;  $p = 0.005$ ). The percentage decline in sprint performance did not differ significantly between the two groups of football players. The level of significance of the differences in the arithmetic means of the percentage decline in sprint performance was above the threshold value of 0.05 (t statistic not statistically significant). The arithmetic mean of the decline in sprint performance in professionals was slightly smaller than the arithmetic mean of the decline in sprint performance in amateurs ( $6.27 \pm 1.22$  vs  $6.70 \pm 1.80$ ). The dif-

nivou od 0.01 ( $p=0.005$ ). Veličina razlike aritmetičkih sredina vremena drugog sprinta je takođe klasifikovana kao umjerena ( $d=0.8$ ), s tim da je razlika aritmetičkih sredina u ovom slučaju bila nešto manja u odnosu na prvi sprint ( $4.27\pm 0.19$  vs  $4.39\pm 0.1$ ). T- statistik je takođe bio statistički značajan, ali na nivou 0.05 ( $p=0.04$ ). Kod izvedbe trećeg sprinta, fudbaleri 1. lige su ponovo postizali bolja vremena u odnosu na fudbalere 3. lige ( $4.38\pm 0.16$  vs  $4.54\pm 0.13$ ). Veličina razlike je označena kao umjerena ( $d=1.11$ ), a t-test je pokazao da je razlika aritmetičkih sredina statistički značajna na nivou 0.01 ( $p=0.005$ ). Aritmetičke sredine vremena četvrtog sprinta profesionalaca i amatera su se statistički značajno razlikovale na nivou 0.05 ( $p=0.014$ ;  $4.5\pm 0.19$  vs  $4.66\pm 0.15$ ). Vrijednost Koenovog d je iznosila 0.96, pa je razlika ponovo označena kao umjerena. Izvedba petog sprinta u seriji je bila bolja kod grupe fudbalera 1. lige ( $4.57\pm 0.2$  vs  $4.76\pm 0.15$ ), vrijednost Koenovog d je bila 1.07 što je dobijenu razliku klasifikovalo kao umjerenu. Razlika aritmetičkih sredina je bila statistički značajna, jer je t-statistik bio statistički značajan na nivou 0.01 ( $p= 0.006$ ). Vrijednost Koenovog d kod šestog sprinta je bila 0.98 (umjerena razlika), a t-statistik je bio statistički značajan na nivou 0.05 ( $p=0.012$ ). Aritmetička sredina vremena šestog sprinta fudbalera profesionalaca je bila manja nego kod fudbalera amatera ( $4.59\pm 0.18$  vs  $4.77\pm 0.18$ ). Nivo sposobnosti ponavljanja sprinta se procjenjuje na osnovu vrijednosti parametara izvebe, ukupnog vremena sprinta, prosječnog vremena sprinta i procentualnog pada izvebe. Fudbaleri 1. lige su imali statistički značajno bolje ukupno i prosječno vrijeme sprinta u odnosu na fudbalere 3. lige. Niže vrijednosti ovih parametara znače bolju izvedbu ponavljanja sprinta. Veličina razlike aritmetičkih sredina ukupnog vremena sprinta između dvije grupe fudbalera je bila umjerena, vrijednost Koenovog d je bila 1.12. Razlika aritmetičkih sredina je bila statistički značajna na nivou 0.01 ( $p=0.005$ ;  $4.41\pm 0.17$  vs  $4.57\pm 0.11$ ). Kad je u pitanju prosječno vrijeme sprinta dobijene su iste vrijednosti Koenovog d ( $d=1.12$ ) i razlika je takođe označena kao umjerena. Aritmetička sredina prosječnog vremena sprinta fudbalera 1. lige ( $4.41\pm 0.17$ ) je bila statistički značajno manja od aritmetičke sredine prosječnog vremena sprinta fudbalera 3. lige ( $4.57\pm 0.11$ ;  $p=0.005$ ). Procentualni pad izvedbe ponavljanja sprinta se nije značajno razlikovao između dvije grupe fudbalera. Ostvareni nivo značajnosti razlika aritmetičkih sredina procentualnog pada izvedbe je bio iznad granične vrijednosti od 0.05 i iznosio je 0.457 (t statistik nije statistički značajan). Aritmetička sredina pada izvedbe uzorka profesionalaca je bila neznatno manja od aritmetičke sredine pada izvedbe amatera ( $6.27\pm 1.22$  vs  $6.70\pm 1.80$ ). Veličina razlike je označena kao mala, jer je d parametar iznosio 0.28 (Cohen effect size).

ference size was labeled small because the *d* parameter was 0.28 (Cohen effect size).

## DISCUSSION

Muscle fatigue occurs when sprints are repeated, which causes a decline in sprint performance. In this study, the aim was to determine how muscle fatigue is associated with decline in sprint performance. In addition, the study compared the performance of sprint between players of different level of competition to determine whether higher-ranked football players have a better repeated sprint ability and whether muscle fatigue is lower in group of Division 1 football players. In addition, the aim was to confirm the association of RSA with match performance by comparing differences in sprint performance between players of different quality. The results of the study showed a significant decline in sprint performance in both groups of players. These results are consistent with those of other studies (Rampinini et al., 2009; Bishop & Edge, 2006; Bishop et al., 2003; Aziz et al., 2008). Repeating sprints at a distance of 30 meters, with an active pause of 20 seconds, led to muscle fatigue as the sprint speed decreased with each subsequent sprint. The difference in all six sprints were significant for both groups of players ( $p = 0.001$ ). After the fourth sprint, there was a stabilization of the running speed, so the decline in the sprint speed from the fourth to the sixth sprint was smaller than at the beginning of the test. Professional football players had significantly better sprint times compared to amateur football players ( $p < 0.01$ ;  $p < 0.05$ ). The sprint speed of all six reps was significantly higher for Division 1 players. In addition, Division 1 football players had a significantly better total and average sprint time compared to Division 3 players ( $p < 0.01$ ). The only performance parameter in which the players of different competition rank did not differ was the percentage decline in sprint performance ( $p > 0.05$ ). Certain authors find it more appropriate to use total sprint time as an indicator of the RSA performance than the percentage decline in performance (Gabbett, 2010; Fitzsimons et al., 1993; Gleister et al., 2007). It is very important that the fatigue indicator during the series of sprints (percentage decline in performance) is not taken as the only parameter of performance quality, since large / small fatigue does not in any case mean worse / better performance (Mohr et al. 2007; Racinais et al. 2010). The time of the first sprint can significantly affect the values of the fatigue index (percentage decline in performance) and can thus lead to an incorrect interpretation of the quality of the sprint performance. Research has shown that first sprint time can correlate significantly with performance decline during sprint repetition (Mendez-Villanueva et al., 2008; Bishop et al., 2003;

## DISKUSIJA

Tokom ponavljanja sprinta dolazi do pojave mišićnog zamora koji uzrokuje pad izvedbe sprinta, pa je i u ovom istraživanju cilj bio da se utvrdi u kojoj mjeri dolazi do razvoja mišićnog zamora i sa njim povezanog pada izvedbe. Dodatno, u istraživanju je poređena izvedba ponavljanja sprinta između fudbalera 1. i 3. lige kako bi se utvrdilo da li fudbaleri višeg ranga takmičenja imaju bolje razvijenu sposobnost ponavljanja sprinta, i da li je stepen mišićnog zamora manji kod kvalitetnijih fudbalera. Pored toga, cilj je bio da se poređenjem razlika izvedbe ponavljanja sprinta između fudbalera različitog kvaliteta potvrdi povezanost sposobnosti ponavljanja sprinta sa boljom izvedom u toku fudbalske igre. Rezultati istraživanja su pokazali značajan pad izvedbe ponavljanja sprinta kod obe grupe ispitanika. Ovi rezultati su u skladu sa rezultatima drugih studija (Rampinini i saradnici, 2009; Bishop & Edge, 2006; Bishop i saradnici, 2003; Aziz i saradnici, 2008). Ponavljanje sprinteva na distanci od 30 metara, sa aktivnom pauzom od 20 sekundi, dovelo je do pojave mišićnog zamora jer je brzina sprinta opadala svakim narednim sprintom. Vremena šest sprinteva su se statistički značajno razlikovala kod obe grupe fudbalera ( $p=0.001$ ), s tim da pad brzine trčanja poslije četvrtog sprinta više nije bio statistički značajan. Poslije četvrtog sprinta je došlo do stabilizacije brzine trčanja, tako da je pad brzine trčanja od četvrtog do šestog sprinta bio manji nego na početku testa. Fudbaleri profesionalci su imali statistički značajno bolja vremena sprinta u odnosu na fudbalere amatere ( $p < 0.01$ ;  $p < 0.05$ ). Brzina sprinta svih šest ponavljanja je bila statistički značajno viša kod fudbalera 1. lige, što pokazuju ostvarena vremena na distanci od 30 metara. Pored toga, fudbaleri 1. lige su imali i statistički značajno bolje ukupno i prosječno vrijeme sprinta u odnosu na fudbalere 3. lige ( $p < 0.01$ ). Jedini parametar izvedbe u kome se fudbaleri različitog ranga takmičenja nisu razlikovali je bio procentualni pad izvedbe ( $p > 0.05$ ). Određeni autori smatraju da je primjerenije koristiti ukupno vrijeme sprinta, kao pokazatelj kvaliteta izvedbe ponavljanja sprinta, nego procentualni pad izvedbe (Gabbett, 2010; Fitzsimons i saradnici, 1993; Gleister i saradnici, 2007). Veoma je važno da se pokazatelj zamora tokom ponavljanja sprinta (procentualni pad izvedbe) ne uzima kao jedini parametar kvaliteta izvedbe, jer veći/manji zamor ne znači u svakom slučaju lošiju/bolju izvedbu (Mohr i saradnici, 2007; Racinais i saradnici, 2010). Vrijeme prvog sprinta može značajno uticati na vrijednosti indeksa zamora (procentualni pad izvedbe) i tako može dovesti do netačne interpretacije kvaliteta ponavljanja sprinta. Istraživanja su pokazala da vrijeme prvog sprinta može značajno korelirati sa padom izvedbe tokom ponavljanja sprinta (Mendez-Villanueva i saradnici, 2008; Bishop i saradnici, 2003; Yanagiya i saradnici, 2003). Ovo je vjerovat-

Yanagiya et al., 2003). This is probably related to the fact that athletes with better sprint performance in the series have greater changes in muscle metabolites, which is a consequence of a higher anaerobic energy provision for muscle work, which may ultimately be associated with a greater decline in performance (Gaitanos et al. 1993). Subjects with lower reserves of anaerobic power relied less on anaerobic metabolism, resulting in a smaller decline in performance during sprint repetition (nominally less fatigue). It is important to emphasize that the ability to repeat a sprint should not only be viewed through a relative decline in performance, a fall in speed relative to the fastest sprint. An important component of this ability is the fastest sprint, because as important as the sprint speed is to decrease as little as possible, it is also important that the fastest sprint benchmark be as good as possible. This underscores the importance of quality sprint performance, and the importance of developing quality of individual sprint. If we take the total sprint time as a valid indicator of the RSA, then higher level football players had better results. This data underscores the importance of sprinting ability in modern football, because excellent performance in sprint tests is significantly associated with certain parameters of the game, such as the distance covered by high-intensity running (Rampinini, 2007). In addition, it has been confirmed that football players from top-level clubs show better performance of high intensity intermittent activities (Bangsbo et al., 2008; Mohr et al., 2003) as well as repeated sprint performance (Impellizzeri et al., 2008). Studies of the validity of RSA tests have shown that this ability separates professional and amateur football players and this ability is valid predictor of good match performance in modern football (Aziz et al., 2008). The same conclusions can be drawn from our research, higher ranked football players had better individual sprint performance, so they had better times in all six sprints. Secondly, it has also been shown in this study that the percentage decline in performance (index of fatigue) cannot serve as a reliable parameter for evaluation of repeated sprint ability. Third, a difference was found in favor of the professionals, which confirms the previously proven role of this ability in modern football.

## CONCLUSION

Research has shown that players of different levels of competition differ significantly in the repeated sprint performance. Professional players had better total sprint time and average sprint time compared to amateur players. This confirms the importance of this ability in modern football, as it differentiates players of different levels of quality. The ability to repeat a sprint is an important predictor of quality

no povezano sa činjenicom da sportisti sa boljom izvedbom prvog sprinta u seriji imaju veće promjene mišićnih metabolita, što je posljedica većeg anaerobnog udjela u dobijanju energije za mišićni rad, što na kraju može biti povezano i sa većim padom izvedbe (Gaitanos i saradnici, 1993). Ispitanici sa manjim rezervama anaerobne snage se manje oslanjaju na anaerobni metabolizam, što rezultira manjim padom izvedbe tokom ponavljanja sprinta (nominalno manji zamor). Važno je naglasiti da sposobnost ponavljanja sprinta ne treba posmatrati samo preko relativnog pada izvedbe, pada brzine u odnosu na najbrži sprint. Važna komponenta ove sposobnosti je upravo parametar najbržeg sprinta, jer koliko je važno da brzina sprinta opada što manje, isto tako je važno i da referentna vrijednost najbržeg sprinta bude što bolja. To naglašava važnost kvalitetne izvedbe pojedinačnog sprinta, odnosno važnost razvijanja brzine pojedinačnog sprinta. Ako uzmemo pokazatelj ukupnog vremena sprinta, kao validan pokazatelj sposobnosti ponavljanja sprinta, onda su fudbaleri višeg nivoa takmičenja imali bolje rezultate. Ovaj podatak naglašava važnost sposobnosti ponavljanja sprinta u vrhunskom fudbalu, jer je upravo kvalitetan rezultat na testovima ponavljanja sprinta kod fudbalera visokog standarda značajno povezan sa određenim parametrima igre, kao što je distanca pokrivena trčanjem visokog intenziteta (Rampinini, 2007). Pored toga, potvrđeno je da fudbaleri višeg kvaliteta takmičenja pokazuju bolju izvedbu intermitentnih aktivnosti visokog intenziteta (Bangsbo i saradnici, 2008; Mohr i saradnici, 2003), kao i izvedbu ponavljanja sprinta (Impellizzeri i saradnici, 2008). Studije validnosti testova ponavljanja sprinta su pokazale da ova sposobnost razdvaja fudbalere višeg nivoa takmičenja i fudbalere nižeg nivoa takmičenja, što pokazuje koliko je sposobnost intermitentnog izvođenja sprinteva važna determinanta uspjeha u savremenom fudbalu (Aziz i saradnici, 2008). Isti zaključci se mogu izvesti i iz našeg istraživanja, fudbaleri višeg ranga takmičenja su imali kvalitetniju izvedbu pojedinačnog sprinta pa su na svih šest sprinteva imali bolja vremena. Drugo, i u ovom istraživanju se pokazalo da procentualni pad izvedbe (indeks) zamora ne može služiti kao pouzdani parametar za procjenu sposobnosti ponavljanja sprinta. Treće, utvrđena je razlika u korist profesionalca, što potvrđuje ranije dokazanu ulogu ove sposobnosti u savremenom fudbalu.

## ZAKLJUČAK

Provedeno istraživanje je pokazalo da se igrači različitog nivoa takmičenja značajno razlikuju u izvedbi ponavljanja sprinta. Igrači višeg ranga takmičenja su imali bolje ukupno vrijeme sprinta i prosječno vrijeme sprinta u poređenju sa igračima nižeg ranga takmičenja. To potvrđuje važnost ove sposobnosti u modernom fudbalu, jer razlikuje igrače

performance in football. Soccer training must include exercises to improve this ability. In addition, research has shown that the percentage decline in sprint performance cannot be taken as a reliable parameter for evaluating RSA because it is related to the performance of the first sprint in the series.

različitog nivoa kvaliteta. Sposobnost ponavljanja sprinta je važan prediktor kvalitetne izvedbe u fudbalu. Trening fudbalera mora uključivati vježbe za poboljšanje ove sposobnosti. Pored toga, istraživanje je pokazalo da se procentualni pad izvedbe ne može uzeti kao pouzdan parametar za procjenu sposobnosti ponavljanja sprinta jer je povezan sa izvedbom prvog sprinta u seriji.

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## MOTIVATIONAL ORIENTATION OF PRIMARY SCHOOL STUDENTS IN PHYSICAL EDUCATION CLASSES

NIKOLA LUKIĆ<sup>1</sup>, VELJKO VUKIĆEVIĆ<sup>1</sup>,  
SLOBODAN VIGNJEVIĆ<sup>2</sup>

<sup>1</sup> Faculty of Sport and Physical Education, University of Novi Sad,  
Serbia

<sup>2</sup> Srednja stručna škola "4. juli", Vrbas, Srbija

### Correspondence:

Veljko Vukićević

Faculty of Sport and Physical Education, University of Novi Sad,  
Serbia

vukicevicveljko9@gmail.com

**Abstract:** Physical education is considered to be a favorable context for achieving significant educational outcomes and promotion of physical activity in children and young people. The real scope of physical education is largely dependent on student motivation. The theory of self-determination as a kind of motivation of the motivation, offers a grateful framework for understanding the motivation of students in the teaching of physical education. On a sample of 121 respondents, from fifth through seventh grade and the same students, after one year, a self-regulation questionnaire was applied in order to examine students' motivational orientations. The student survey was conducted at the time of physical education at the elementary school "Branko Radičević" in Odžaci. Based on the results of motivational orientations of students obtained with the t-test for dependent samples, we obtained that there are statistically significant differences in the identified regulation and intrinsic motivation, while for other types of motivation the differences are small but not statistically significant. With differences between boys and girls at initial and final measurement in motivational orientations in physical education, in amotation we received statistically significant differences only on the final measurement. There was no change in external regulation, while in the introjected regulation there was a change only in the final measurement. With the identified regulation and intrinsic motivation, the results showed that there are statistically significant differences both on the initial and the final measurement. When it comes to boys, statistically significant differences are obtained in the identified regulation and intrinsic motivation. Regarding only girls, statistically significant differences existed in the identified regulation and intrinsic motivation as well as in the introjected regulation and amotization, while the difference was not only present in the external regulation.

**Keywords:** motivational orientation, pupils, elementary school, physical education.

## MOTIVACIONE ORIJENTACIJE UČENIKA OSNOVNE ŠKOLE U NASTAVI FIZIČKOG VASPITANJA

NIKOLA LUKIĆ<sup>1</sup>, VELJKO VUKIĆEVIĆ<sup>1</sup>, GOJKO ŠKUNDRIĆ<sup>1</sup>,  
SLOBODAN VIGNJEVIĆ<sup>2</sup>

<sup>1</sup> Fakultet sporta i fizičkog vaspitanja, Univerzitet u Novom Sadu,  
Srbija

<sup>2</sup> Srednja stručna škola "4. juli", Vrbas, Srbija

### Korespondencija:

Veljko Vukićević

Fakultet sporta i fizičkog vaspitanja, Univerzitet u Novom Sadu,  
Srbija,

vukicevicveljko9@gmail.com

**Apstrakt:** Fizičko vaspitanje se smatra povoljnim kontekstom za ostvarivanje značajnih obrazovnih ishoda i promociju fizičke aktivnosti kod dece i mladih. Realni dometi nastave fizičkog vaspitanja umnogome zavise od motivacije učenika. Teorija samoodređenja kao svojevrsna makroteorija motivacije, nudi zahvalan okvir za razumevanje motivacije učenika u nastavi fizičkog vaspitanja. Na uzorku od 121-og učenika, od petog do sedmog razreda i istih učenika nakon godinu dana primenjen je upitnik samoregulacije u cilju ispitivanja motivacionih orijentacija učenika. Anketiranje učenika je realizovano na času fizičkog vaspitanja u OŠ "Branko Radičević" u Odžacima. Na osnovu rezultata motivacionih orijentacija učenika dobijenih t-testom za zavisne uzorke, utvrđeno je da postoje statistički značajne razlike u identifikovanoj regulaciji i intrinzičnoj motivaciji, dok su kod ostalih tipova motivacije razlike male, ali ne i statistički značajne. Posmatrajući razlike između dečaka i devojčica na inicijalnom i finalnom merenju u motivacionim orijentacijama u nastavi fizičkog vaspitanja, u nemotivisanosti su dobijene statistički značajne razlike samo na finalnom merenju. Kod eksterne regulacije nije bilo promena, dok je kod introjektovane regulacije došlo do promena samo na finalnom merenju. Kod identifikovane regulacije i intrinzične motivacije rezultati su pokazali da postoje statistički značajne razlike i na inicijalnom i na finalnom merenju. Kada su u pitanju samo dečaci, statistički značajne razlike su dobijene u identifikovanoj regulaciji i intrinzičnoj motivaciji. Kada je reč samo o devojčicama, statistički značajne razlike su i kod njih postojale u identifikovanoj regulaciji i intrinzičnoj motivaciji, ali i u introjektovanoj regulaciji i nemotivisanosti, dok razlika jedino nije postojala u eksternoj regulaciji.

**Ključne riječi:** motivacione orijentacije, učenici, osnovna škola, fizičko vaspitanje.

## INTRODUCTION

Physical education contributes to the learning, personal development and health of students in a unique way. In almost 90% of countries in the world, it is represented as a compulsory subject (Hardman, 2008). Physical education should be a kind of springboard for sport and physical activity throughout your life. However, the analysis of the current state of physical education in the European Union and in the world shows that physical education often does not provide learners with an experience that would have a personal meaning for them and would be socially relevant. The contents and activities offered in the teaching of physical education do not correspond with the values and interests of children and young people today, so that the expected transfer from the teaching of physical education to everyday life is missing. Most curricula of physical education are characterized by a relatively small number of activities and orientation to the sporting competition, and school physical education remains aside in relation to the current culture of young people and important social trends (Hardman, 2007; Ideally, physical education should enable students to acquire a significant portion of the recommended daily dose of physical activity (Scruggs et al., 2003). However, interest in and participation in physical education declines with age (Van Wersch et al., 1992). In adolescence, the percentage of students who actively participate in at least half the time of physical education drops from 55% to 24%, and the decline is more drastic in pupils than in students (National Center for Health Statistics, 2001). Some students participate very little during classes of physical education, while others completely avoid participation or attendance (Ntoumanis et al., 2004, Brooks & Magnusson, 2006). As many as 40% of students always, or sometimes do not, have a lesson in physical education (Jorgic & Veselinovic, 2008). It is unlikely that these pupils will have the expected benefits of teaching physical education, that is, they will be engaged in physical activity in their free time, without any external coercion (or incentive). Indeed, at a time when dealing with physical activity becomes a matter of free choice, and not any more something organized and carried out by adults, the percentage of young people engaged in physical activity is falling drastically (Brooks & Magnusson, 2006). The experience in teaching physical education has a great impact on the decisions regarding sports. Negative experiences adversely affect the current motivation of adolescents to deal with sports (Coakley & White, 1992). As negative experiences in the teaching of physical education there is a feeling of boredom, a feeling of incompetence and a negative evaluation of pupils by peers. Positive experiences relate to the possibility of choosing and dealing with non-traditional activities. Stu-

## Uvod

Fizičko vaspitanje na jedinstven način doprinosi učenju, ličnom razvoju i zdravlju učenika. U gotovo 90% zemalja u svetu, zastupljeno je kao obavezan nastavni predmet (Hardman, 2008). Fizičko vaspitanje bi trebalo da bude svojevrсна odskočna daska za bavljenje sportom i fizičkom aktivnošću tokom čitavog života. Međutim, analiza trenutnog stanja fizičkog vaspitanja u Evropskoj uniji i u svetu pokazuje da fizičko vaspitanje često ne pruža učenicima iskustva koja bi za njih imala lično značenje i bila socijalno relevantna. Sadržaji i aktivnosti koji se nude u nastavi fizičkog vaspitanja ne korespondiraju sa vrednostima i interesovanjima dece i mladih danas, tako da izostaje očekivani transfer iz nastave fizičkog vaspitanja u svakodnevni život. Većinu kurikuluma fizičkog vaspitanja karakteriše relativno mali broj aktivnosti i orijentacija na sportsko takmičenje, pa školsko fizičko vaspitanje ostaje po strani u odnosu na aktuelnu kulturu mladih i važne socijalne trendove (Hardman, 2007; 2008). U idealnom slučaju, fizičko vaspitanje bi trebalo da omogući učenicima da steknu značajan deo preporučene dnevne doze fizičke aktivnosti (Scruggs et al., 2003). Međutim, interesovanje i učestvovanje u fizičkom vaspitanju opadaju sa uzrastom (Van Wersch et al., 1992). U adolescenciji, procenat učenika koji aktivno učestvuju barem na polovini časova fizičkog vaspitanja opada sa 55% na 24%, a opadanje je drastičnije kod učenica nego kod učenika (National Center for Health Statistics, 2001). Neki učenici se veoma malo zalažu tokom časova fizičkog vaspitanja, dok drugi potpuno izbegavaju učešće, odnosno prisustvovanje nastavi (Ntoumanis et al., 2004; Brooks & Magnusson, 2006). Čak 40% učenika uvek, ili ponekad, izostaje sa časova fizičkog vaspitanja (Jorgić i Veselinović, 2008). Malo je verovatno da će ovi učenici imati očekivane koristi od nastave fizičkog vaspitanja, odnosno da će se u slobodno vreme, bez neke spoljašnje prinude (ili podsticaja), baviti fizičkom aktivnošću. Zaista, u vreme kada bavljenje fizičkom aktivnošću postaje stvar slobodnog izbora, a ne više nešto što organizuju i sprovode odrasli, procenat mladih koji se bave fizičkom aktivnošću drastično opada (Brooks & Magnusson, 2006). Iskustva u nastavi fizičkog vaspitanja veoma utiču na odluke u vezi sa bavljenjem sportom. Negativna iskustva nepovoljno utiču na aktuelnu motivaciju adolescencata za bavljenje sportom (Coakley & White, 1992). Kao negativna iskustva u nastavi fizičkog vaspitanja pojavljuju se osećanje dosade, osećanje nekompetencije i negativno vrednovanje učenika od strane vršnjaka. Pozitivna iskustva odnose se na mogućnost izbora i bavljenja ne-tradicionalnim aktivnostima. Učenici koji su zadovoljni

dents who are satisfied with physical education classes are much more active physically out of school (Vilhjansson & Thorlindsson, 1998). The strength and direction of motivation for physical education 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 do not attend school (Biddle, 2001). Motivation of students is undoubtedly one of the key determinants of the real range of teaching of physical education. Namely, motivation is important not only because it contributes to student achievement, but also because it represents itself a significant educational outcome (Ames, 1990). Understanding the motivation of students in physical education can help improve the quality of teaching, or create such a teaching environment that promotes the engaged and sustained participation of students, and allows the transfer of behavior between school and leisure time. The theory of self-determination (Ryan & Deci, 2000) is an incentive theoretical model for understanding motivation, because it brings a qualitatively different approach to the perception of this problem. The theory of self-determination is a macro theory of motivation, and its principles and processes explained in this theory have important implications for the understanding of not only motivation, but also personality as a whole, social development and overall psychological functioning and well-being of man (Weiss & Amorose, 2008). The beginnings of the theory of self-determination were identified in 1975 in the nowadays classical part, "Intrinsic Motivation" (Deci et al., 1975). The shaping and development of the theory of self-determination can be traced in the next decades through the work of Deci and Ryan (Deci & Ryan, 1985; Ryan & Deci, 2000), as well as other authors who further developed or examined certain aspects of the theory of self-determination in the domain sports, physical education and physical activity (Vallerand & Losier, 1999; Ntoumanis, 2001; Chatzisarantis & Hagger, 2009). For the optimal psychological development and functioning of personality, it is necessary that three basic psychological needs for competence, autonomy and connection with others be satisfied. The need for competence relates to the need for one's own behavior and interaction with the social environment to be seen as effective, that is, effective. "Competence is not acquired skill or ability, but rather a feeling of self-confidence and effectiveness in action" (Ryan & Deci, 2002). The need for autonomy is the need for self-behavior to be seen as self-determined, that is, as freely chosen. Apart from the need for competence and autonomy, people also need to be connected with others, to have a sense of belonging and acceptance by others (Ryan & Deci, 2002). A social context can stimulate or prevent satisfying basic psycho-

na časovima fizičkog vaspitanja, mnogo su aktivniji fizički van škole (Vilhjansson & Thorlindsson, 1998). Snaga i smer motivacije za fizičko vaspitanje 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 (Biddle, 2001). Motivacija učenika nesumnjivo predstavlja jednu od ključnih odrednica stvarnih dometa nastave fizičkog vaspitanja. Naime, motivacija je važna ne samo zato što doprinosi postignuću učenika, već i zato što sama po sebi predstavlja značajan obrazovni ishod (Ames, 1990). Razumevanje motivacije učenika u fizičkom vaspitanju može da pomogne unapređenju kvaliteta nastave, odnosno kreiranju takvog nastavnog ambijenta koji promovira angažovano i istrajno učešće učenika, te omogućava transfer ponašanja između škole i slobodnog vremena. Teorija samoodređenja (Ryan & Deci, 2000) predstavlja podsticajan teorijski model za razumevanje motivacije, jer donosi kvalitativno drugačiji pristup sagledavanju ovog problema. Teorija samoodređenja predstavlja makro teoriju motivacije, a njeni principi i procesi objašnjeni u ovoj teoriji imaju značajne implikacije na razumevanje ne samo motivacije, već i ličnosti u celini, socijalnog razvoja i ukupnog psihološkog funkcionisanja i blagostanja čoveka (Weiss & Amorose, 2008). Začeci teorije samoodređenja naznačeni su još 1975. godine u, danas već, klasičnom delu „Intrinzična motivacija“ (Deci et al., 1975). Uobličavanje i razvoj teorije samoodređenja mogu da se prate u narednim decenijama kroz saradnički rad Disaja i Rajana (Deci & Ryan, 1985; Ryan & Deci, 2000), kao i drugih autora koji su dalje razvijali, ili ispitivali, pojedine aspekte teorije samoodređenja u domenu sporta, fizičkog vaspitanja i fizičke aktivnosti (Vallerand & Losier, 1999; Ntoumanis, 2001; Chatzisarantis & Hagger, 2009). Za optimalan psihološki razvoj i funkcionisanje ličnosti, neophodno je da tri bazične psihološke potrebe za kompetencijom, autonomijom i povezanošću sa drugima, budu zadovoljene. Potreba za kompetencijom odnosi se na potrebu da se sopstveno ponašanje i interakcija sa socijalnim okruženjem opažaju kao efikasni, to jest delotvorni. Kompetencija predstavlja osećanje samopouzdanja i delotvornosti u akciji. Potreba za autonomijom jeste potreba da se sopstvena ponašanja opažaju kao samoodređena, to jest kao slobodno odabrana. Osim potrebe za kompetencijom i autonomijom, ljudi imaju i potrebu da budu povezani sa drugima, da imaju osećaj pripadanja i prihvaćenosti od strane drugih (Ryan & Deci, 2002). Socijalni kontekst može da podstiče ili sprečava zadovoljavanje bazičnih psiholoških potreba, što ima značajan uticaj na motivaciju, psihološki rast, integritet i

logical needs, which has a significant impact on the motivation, psychological growth, integrity and well-being of an individual. The mini-theories that make up the theory of self-determination explain the various aspects of the individual's dialectical relationship and the social context mediated by the satisfaction of basic psychological needs (Deci & Ryan, 1985; Ryan & Deci, 2000, 2002). An important premise of the theory of self-determination refers to a differentiated approach to motivation. Namely, individuals differ not only in the level of motivation (how much motivation), but also in the orientation and motivation (which type of motivation) (Ryan & Deci, 2000). The theory of self-determination distinguishes types of motivation according to the degree of autonomy, that is, self-determination, with the types of motivation with the highest degree of autonomy having the most positive consequences. The theory of self-determination has been widely used in diverse domains, from the education and upbringing of children, through sports and nursing, to political behavior. However, when it comes to physical education, two mini-theories are most empirically checked: the theory of cognitive evaluation and the theory of integration of the organism. Cognitive evaluation theory is intrinsic or internal motivation (Deci et al., 1975). When internally motivated, individuals engage in a particular activity exclusively to satisfy, challenge and enjoy the immanent activities themselves. Intrinsic motivation is a prototype of self-determined activity, since participation is voluntary, internally initiated and regulated, supported by a pleasant experience of entertainment and fun (Ryan & Deci, 2002). Some indicators of intrinsic motivation are great advocacy, a sense of competence and interest, a low level of tension and anxiety (Cury et al., 1996). The theory of the integration of the organism deals with extrinsic motivation, its differentiation, development and dynamics (Deci & Ryan, 1985). Externally motivated behaviors occur as a result of certain instrumental incentives that are separate from the activity itself. Such external reasons are indispensable for individuals to engage in behavior that they do not perceive as immanently interesting and entertaining. Facing external stimuli, regulation and related values, people try to internalize them and integrate them with their own sense of self, and these processes are at the heart of the theory of integration of the organism. External regulation corresponds to the traditional understanding of the extrinsic, that is to say, external motivation, according to which behavior is thought to take place in order to receive a reward or to avoid punishment. It is the kind of regulation that is least autonomous. In introductory regulation, behavior is derived from the obligation, in order to avoid feeling guilty, shy, or to strengthen the ego and the feeling of personal value. Al-

blagostanje pojedinca. Mini-teorije koje sačinjavaju teoriju samoodređenja, objašnjavaju različite aspekte dijalektičkog odnosa pojedinca i socijalnog konteksta, posredovanog zadovoljavanjem bazičnih psiholoških potreba (Deci & Ryan, 1985; Ryan & Deci, 2000, 2002). Važna premisa teorije samoodređenja odnosi se na diferencirani pristup motivaciji. Naime, pojedinci se razlikuju ne samo u nivou motivacije (koliko motivacije), već i u orijentaciji te motivacije (koji tip motivacije) (Ryan & Deci, 2000). Teorija samoodređenja razlikuje tipove motivacije prema stepenu autonomije, to jest samoodređenosti, pri čemu tipovi motivacije sa najvišim stepenom autonomije imaju najpozitivnije posledice. Teorija samoodređenja našla je široku primenu u raznovrsnim domenima, od obrazovanja i vaspitanja dece, preko sporta i zdravstvene nege, do političkog ponašanja. Međutim, kada je reč o fizičkom vaspitanju, najviše su empirijski proveravane dve mini-teorije: teorija kognitivne evaluacije i teorija integracije organizma. Teorije kognitivne evaluacije jeste intrinzična ili unutrašnja motivacija (Deci et al., 1975). Kada su unutrašnje motivisani, pojedinci se angažuju u određenoj aktivnosti isključivo radi zadovoljstva, izazova i uživanja imanentnih samoj aktivnosti. Intrinzična motivacija predstavlja prototip samoodređene aktivnosti, jer je učešće dobrovoljno, unutrašnje pokrenuto i regulisano, podržano prijatnim doživljajem zanimljivosti i zabave (Ryan & Deci, 2002). Neki pokazatelji intrinzične motivacije su veliko zalaganje, osećanje kompetencije i interesovanja, nizak nivo tenzije i anksioznosti (Cury et al., 1996). Teorija integracije organizma bavi se ekstrinzičnom motivacijom, njenom diferencijacijom, razvojem i dinamikom (Deci & Ryan, 1985). Ponašanja motivisana spolja dešavaju se kao posledica određenih instrumentalnih podsticaja, koji su odvojeni od same aktivnosti. Ovakvi spoljašnji razlozi neophodni su da bi se pojedinci angažovali u ponašanjima koja ne doživljavaju kao imanentno zanimljiva i zabavna. Suočavajući se sa spoljašnjim podsticajima, regulacijama i pripadajućim vrednostima, ljudi pokušavaju da ih internalizuju i integrišu sa vlastitim osećanjem selfa, i ovi procesi su u osnovi teorije integracije organizma. Eksterna regulacija odgovara tradicionalnom shvatanju ekstrinzične, to jest spoljašnje motivacije, prema kome se smatra da se ponašanje odvija da bi se dobila nagrada ili izbegla kazna. To je vid regulacije koji je najmanje autonoman. Kod introjektovane regulacije ponašanje se izvodi iz obaveze, da bi se izbeglo osećanje krivice, stida, ili da bi se ojačao ego i osećanje lične vrednosti. Iako ima viši stepen samoodređenosti u odnosu na eksternu regulaciju, introjektovana regulacija se takođe smatra kontrolišućim tipom motivacije.



though it has a higher degree of self-determination than external regulation, the introduced regulation is also considered a controlling type of motivation. Identified regulation refers to the behavior that an individual perceives as important to him personally, comes to a conscious identification with the activity or value expressed by this activity, with the individual having a sense of choice (Ryan & Deci, 2002; Vallerand & Ratelle, 2002). Integrated regulation provides the basis for the most autonomous type of externally motivated behavior (Ryan & Deci, 2002). Although identification implies choice, dealing with an activity does not necessarily have to be coherent with other self-structure. When such a coherence and integration of the self is achieved, it is an integrated regulation (Vallerand & Ratelle, 2002).

Existing research in the field of physical activity and physical education consistently point to the connection of self-determined types of motivation (intrinsic motivation, identified regulation) with positive consequences: greater activity in a structured and free (not supervised) part of physical education (Lonsdale et al., 2009), persuasion (Ntoumanis, 2001), positive emotions (Standage et al., 2005), interest (Goudas et al., 1994), persistence and concentration (Ntoumanis, 2005), self-esteem (Standage & Gillison, 2007) (Standage et al., 2005; Mouratidis et al., 2008), the quality of life associated with health (Standage & Gillison, 2007), the intention to be physically active in leisure time (Hagger et al., 2003; Standage et al., 2003). Intrinsic motivation in the teaching of physical education and the positive experiences of students are predicates for choosing the physical activity of students during his free time (Ntoumanis, 2005; Cox et al., 2008). On the other hand, controlling motivation (external and introductory regulation) and non-motivation are associated with negative consequences, such as boredom, dissatisfaction, lack of intention to be active in leisure time (Ntoumanis, 2001; Standage et al., 2005; Mouratidis et al., 2008). Research based on the settings of self-determination theory has shown that there are three different types of motivation when it comes to students in teaching physical education (Ntoumanis, 2002). The first type covers from 43% to 45% of students and is defined as "self-determined type of motivation". These students are characterized by intrinsic motivation, identifiable regulation, advocacy, enjoyment, moderate introductory regulation, and low scores on the scale for assessing non-motivation, external regulation and boredom. The second type, which is called "moderate motivation" (from 39% to 45% of students) is characterized by moderate scores on all measured variables. The smallest student belongs to the third type of motivation, the so-called "controlling motivation" (from 10% to 18% of students). Students belonging to this motivational profile

Identifikovana regulacija odnosi se na ponašanje koje pojedinac doživljava kao važno za njega lično, dolazi do svesne identifikacije sa aktivnošću ili vrednošću koju ta aktivnost izražava, pri čemu pojedinac ima osećanje izbora (Ryan & Deci, 2002; Vallerand & Ratelle, 2002). Integrisana regulacija daje osnovu za najautonomniji vid spoljašnje motivisanog ponašanja (Ryan & Deci, 2002). Iako identifikacija podrazumeva izbor, bavljenje nekom aktivnošću ne mora nužno biti koherentno sa drugim strukturama selfa. Kada se dostigne takva koherentnost i integracija selfa, govori se o integrisanoj regulaciji (Vallerand & Ratelle, 2002).

Postojeća istraživanja u domenu fizičke aktivnosti i fizičkog vaspitanja, dosledno ukazuju na povezanost samoodređenih tipova motivacije (intrinzična motivacija, identifikovana regulacija) sa pozitivnim konsekvencama: veća aktivnost u strukturiranom i slobodnom (ne nadziranom) delu časa fizičkog vaspitanja (Lonsdale et al., 2009), zalaganje (Ntoumanis, 2001), pozitivne emocije (Standage et al., 2005), interesovanje (Goudas et al., 1994), istrajnost i koncentracija (Ntoumanis, 2005), samopoštovanje (Standage & Gillison, 2007), preferencija izazovnih zadataka (Standage et al., 2005; Mouratidis et al., 2008), kvalitet života povezan sa zdravljem (Standage & Gillison, 2007), namera da se bude fizički aktivan u slobodno vreme (Hagger et al., 2003; Standage et al., 2003). Intrinzična motivacija u nastavi fizičkog vaspitanja i pozitivna iskustva učenika, predstavljaju prediktore za izbor fizičke aktivnosti učenika tokom njegovog slobodnog vremena (Ntoumanis, 2005; Cox et al., 2008). S druge strane, kontrolišuća motivacija (eksterna i introjektovana regulacija) i nemotivisanost povezane su sa negativnim posledicama, kao što su dosada, nezadovoljstvo, nedostatak namere da se bude aktivan u slobodno vreme (Ntoumanis, 2001; Standage et al., 2005; Mouratidis et al., 2008). Istraživanje zasnovano na postavkama teorije samoodređenja pokazalo je da postoje tri različita tipa motivacije kad je reč o učenicima u nastavi fizičkog vaspitanja (Ntoumanis, 2002). Prvi tip obuhvata od 43% do 45% učenika i definiše se kao „samoodređeni tip motivacije“. Ove učenike karakteriše izražena intrinzična motivacija, iden tifikovana regulacija, zalaganje, uživanje, umerena introjektovana regulacija, te niski skorovi na skali za procenu nemotivisanosti, eksterne regulacije i dosade. Drugi tip, koji se naziva „umereni motivacioni“ (od 39% do 45% učenika) karakterišu umereni skorovi na svim merenim varijablama. Najmanje učenika pripada trećem tipu motivacije, takozvana „kontrolišuća motivacija“ (od 10% do 18% učenika). Učenici koji pripadaju ovom motivacionom profile imaju relativno nisku intrin-

have relatively low intrinsic motivation and identified regulation, as well as high external regulation and lack of motivation. Unlike sports, from which insufficiently motivated individuals can give up if the motivation does not develop in time, in physical education, as a compulsory school subject for all students, cancellation is not allowed. Of course, absenteeism, lack of adequate equipment for time, inactivity on time, or paramedical relief (Brooks & Magnusson, 2006) may be a kind of exclusion from physical education. It is unavoidable that with increasing age students are less actively observing exercises in the time of physical education and show lack of interest, which results in reduced physical activity. Accordingly, the aim of this paper is to examine the motivational orientation of pupils from the fourth to the seventh grade of elementary school, in order to examine the students' interest in teaching physical education.

### METHOD

The sample of respondents is made up of pupils from the fifth through seventh grade in the school year 2014/2015 and the same pupils after one year of schooling, in the school year 2015/2016, that is, from students of sixth to eighth grade of primary school, who attend Elementary School "Branko Radičević" in Odžaci. The total sample included 121 respondents - 66 boys and 55 girls, of which 20 were fifth, 20 sixth and 26 seventh grade students, and 20 female students were fifth, 20 sixth grade and 15 seventh grade students.

In order to examine students' motivational orientations, a self-regulation questionnaire was applied (Goudas et al., 1994), which consists of five subscales: non-motivation, external regulation, introduced regulation, identified regulations, and intricate motivations. It is a five-step scale (I do not agree, I do not agree, I am undecided, I agree, I completely agree), which consists of a total of 18 items at which the respondents assessed to what extent they agree with the given statements.

The student survey was carried out at the time of physical education at the elementary school "Branko Radičević" in Odžaci in cooperation with the subject teacher, with the provided optimal conditions for completing the questionnaire. All respondents were explained how the questionnaire was completed and performed in a way that preserved their anonymity. On the initial measurement in May 2015, pupils filled out the polls for the first time, while the same students filled in the same survey in May 2016.

For each subcalculate the initial and final measurement, the calculated arithmetic mean is the standard deviation, and the collected data were processed using the parametric test method for the dependent samples.

zičnu motivaciju i identifikovanu regulaciju, kao i visoku eksternu regulaciju i nedostatak motivacije. Za razliku od sporta, od koga nedovoljno motivisani pojedinci mogu da odustanu ukoliko se motivacija vremenom ne razvije, u fizičkom vaspitanju, kao obaveznom školskom predmetu za sve učenike, odustajanje nije dozvoljeno. Naravno, izostajanje sa nastave, nedonošenje adekvatne opreme za čas, neaktivnost na času, ili oslobađanje od nastave iz paramedicinskih razloga (Brooks & Magnusson, 2006) može da predstavlja svojevrsno isključivanje iz fizičkog vaspitanja. Neminovno je da s većim uzrastom učenici sve manje aktivno opažaju vežbe na času fizičkog vaspitanja i pokazuju nezainteresovanost, što za posledicu ima smanjenu fizičku aktivnost. Shodno tome, cilj ovog rada je da ispita motivacione orijentacije učenika od petog do sedmog razreda osnovne škole, kako bi se sagledala i zainteresovanost učenika za nastavu fizičkog vaspitanja.

### METOD

Uzorak ispitanika je sačinjen od učenika i učenica od petog do sedmog razreda u školskoj godini 2014/2015 i istih učenika i učenica nakon godinu dana školovanja, u školskoj 2015/2016, koji pohađaju OŠ "Branko Radičević" u Odžacima. Ukupan uzorak čini 121 ispitanik 66 dečaka i 55 devojčica, od toga 20 učenika petog, 20 učenika šestog i 26 učenika sedmog razreda, a kod učenica 20 učenica petog, 20 učenica šestog razreda i 15 učenica sedmog razreda.

U cilju ispitivanja motivacionih orijentacija učenika primenjen je upitnik samoregulacije (Goudas et al., 1994), koji se sastoji od pet subskala: nemotivisanost, eksterne regulacije, introjektovane regulacije, identifikovane regulacije, i intrizične motivacije. Radi se o petostepenoj skali (uopšte se ne slažem, ne slažem se, neodlučan sam, slažem se, potpuno se slažem) koja se sastoji od od ukupno 18 ajtema na kojoj su ispitanici procenili u kojoj se meri slažu sa datim tvrdnjama.

Anketiranje učenika je realizovano na času fizičkog vaspitanja u OŠ "Branko Radičević" u Odžacima u saradnji sa predmetnim nastavnikom uz obezbeđene optimalne uslove za popunjavanje upitnika. Svim ispitanicima je bilo objašnjeno kako se upitnik popunjava i obavio se na način koji im je sačuvao anonimnost. Učenici su na inicijalnom merenju u maju mesecu 2015. godine prvi put popunili ankete, dok su isti učenici na finalnom merenju iste ankete popunili u maju mesecu 2016. godine.

Za svaku subskalu na inicijalnom i finalnom merenju je izračunata aritmetička sredina i standardna devijacija, a prikupljeni podaci su obrađeni pomoću parametrijske metode t testa za zavisne uzorke.

**RESULTS**

**Table 1.** Descriptive statistics of motivational orientation of elementary school students on initial and final measurement

Varijable / Variable	Testiranje / Testing	AS	SD	p
Nemotivisanost / Amotivation	Inicijalno / Initially	1.75	0.86	0.064
	Finalno / Final	1.98	1.11	
Eksterna regulacija / External control	Inicijalno / Initially	2.72	0.74	0.321
	Finalno / Final	2.83	0.93	
Introjektovana regulacija / Introjected regulation	Inicijalno / Initially	2.52	1.01	0.161
	Finalno / Final	2.35	0.96	
Identifikovana regulacija / Identified regulation	Inicijalno / Initially	4.17	0.81	0.000
	Finalno / Final	3.72	1.00	
Intrinzična motivacija / Intrinsic motivation	Inicijalno / Initially	4.03	1.01	0.000
	Finalno / Final	3.46	1.13	

**Legend:** AS - arithmetic mean,; SD - standard deviation; p - level of statistical significance

From the obtained results in Table 1. we see that there are statistically significant differences in the identified regulation and intrinsic motivation, while for other types of motivation differences are small but not statistically significant. The lack of visibility shows an increase in mean values, which is a sign that children with the age are increasingly non-motivated in the teaching of physical education, and we see that in the identified and intrinsic motivation the results decrease, and therefore the internal motivation in children with the age.

**Table 2.** Differences between boys and girls at initial and final measurement in motivational orientations

Varujable / Variable	Inicijalno merenje / Initial Measurement				Finalno merenje / Final Measurement			
	pol / Gender	AS	SD	p	pol / Gender	AS	SD	p
Nemotivisanost / Amotivation	Dečaci / Boys	1.67	0.78	0.261	Dečaci / Boys	1.67	0.83	0.001
	Devojčice / Girls	1.85	0.94		Devojčice / Girls	2.35	1.28	
Eksterna regulacija / External control	Dečaci / Boys	2.65	0.77	0.221	Dečaci / Boys	2.76	0.92	0.362
	Devojčice / Girls	2.81	0.71		Devojčice / Girls	2.91	0.94	
Introjektovana regulacija / Introjected regulation	Dečaci / Boys	2.54	1.01	0.842	Dečaci / Boys	2.56	1.03	0.008
	Devojčice / Girls	2.50	1.01		Devojčice / Girls	2.10	0.82	
Identifikovana regulacija / Identified regulation	Dečaci / Boys	4.31	0.72	0.040	Dečaci / Boys	3.94	0.89	0.009
	Devojčice / Girls	4.00	0.81		Devojčice / Girls	3.47	1.07	
Intrinzična motivacija / Intrinsic motivation	Dečaci / Boys	4.27	0.83	0.004	Dečaci / Boys	3.78	0.99	0.001
	Devojčice / Girls	3.75	1.14		Devojčice / Girls	3.08	1.19	

**Legend:** AS - arithmetic mean,; SD - standard deviation; p - level of statistical significance

Table 2 shows the results obtained between boys and girls at initial and final measurement. In non-motivation, we see that there was a statistically significant difference between boys and girls only in the final measurement.

**REZULTATI**

**Tabela 1.** Deskriptivni statistici motivacionih orijentacija učenika osnovne škole na inicijalnom i finalnom merenju

Varijable / Variable	Testiranje / Testing	AS	SD	p
Nemotivisanost / Amotivation	Inicijalno / Initially	1.75	0.86	0.064
	Finalno / Final	1.98	1.11	
Eksterna regulacija / External control	Inicijalno / Initially	2.72	0.74	0.321
	Finalno / Final	2.83	0.93	
Introjektovana regulacija / Introjected regulation	Inicijalno / Initially	2.52	1.01	0.161
	Finalno / Final	2.35	0.96	
Identifikovana regulacija / Identified regulation	Inicijalno / Initially	4.17	0.81	0.000
	Finalno / Final	3.72	1.00	
Intrinzična motivacija / Intrinsic motivation	Inicijalno / Initially	4.03	1.01	0.000
	Finalno / Final	3.46	1.13	

**Legenda:** AS - aritmetička sredina; SD - standardna devijacija; p - nivo statističke značajnosti

Iz dobijenih rezultata u tabeli 1. vidi se da postoje statistički značajne razlike u identifikovanoj regulaciji i intrinzičnoj motivaciji, dok su kod ostalih tipova motivacije razlike male, ali ne i statistički značajne. Kod nemotivisanosti se vidi porast u srednjim vrednostima što je znak da su deca sa uzrastom sve više nemotivisana u nastavi fizičkog vaspitanja, kao i da u identifikovanoj i intrinzičnoj motivaciji dolazi do opadanja rezultata pa samim tim i do pada unutrašnje motivacije kod dece sa uzrastom.

**Tabela 2.** Razlike između dečaka i devojčica na inicijalnom i finalnom merenju u motivacionim orijentacijama

Varujable / Variable	Inicijalno merenje / Initial Measurement				Finalno merenje / Final Measurement			
	pol / Gender	AS	SD	p	pol / Gender	AS	SD	p
Nemotivisanost / Amotivation	Dečaci / Boys	1.67	0.78	0.261	Dečaci / Boys	1.67	0.83	0.001
	Devojčice / Girls	1.85	0.94		Devojčice / Girls	2.35	1.28	
Eksterna regulacija / External control	Dečaci / Boys	2.65	0.77	0.221	Dečaci / Boys	2.76	0.92	0.362
	Devojčice / Girls	2.81	0.71		Devojčice / Girls	2.91	0.94	
Introjektovana regulacija / Introjected regulation	Dečaci / Boys	2.54	1.01	0.842	Dečaci / Boys	2.56	1.03	0.008
	Devojčice / Girls	2.50	1.01		Devojčice / Girls	2.10	0.82	
Identifikovana regulacija / Identified regulation	Dečaci / Boys	4.31	0.72	0.040	Dečaci / Boys	3.94	0.89	0.009
	Devojčice / Girls	4.00	0.81		Devojčice / Girls	3.47	1.07	
Intrinzična motivacija / Intrinsic motivation	Dečaci / Boys	4.27	0.83	0.004	Dečaci / Boys	3.78	0.99	0.001
	Devojčice / Girls	3.75	1.14		Devojčice / Girls	3.08	1.19	

**Legenda:** AS - aritmetička sredina; S - standardna devijacija; p - nivo statističke značajnosti.

U tabeli 2. prikazani su dobijeni rezultati između dečaka i devojčica na inicijalnom i finalnom merenju. U nemotivisanosti se vidi da je postojala statistički značajna razlika između dečaka i devojčica samo na finalnom mere-

So in a year, when moving to one class more, there was a fall in motivation and consequently there were more non-motivated girls in the teaching of physical education than boys. In the case of external regulation, there was no change either on initial or final measurement, but with the introduced regulation, there was a change only on the final measurement. In the identified regulation and intrinsic motivation there were statistically significant differences between boys and girls, both on initial and final measurement. It was also observed that there was a drop in mean values in both boys and girls in a year. What is noticed is less value in the identified regulation and intrinsic motivation in both boys and girls at the final measurement. So it is noticed that internal motivation is falling in both boys and girls.

**Table 3.** Descriptive statistics of motivational orientations in elementary school boys on initial and final measurement

Varijabla / Varijable	Testiranje / Testing	AS	SD	p
Nemotivisanost / Amotivation	Inicijalno / Initially	1.67	0.78	0.974
	Finalno / Final	1.67	0.84	
Eksterna regulacija / External control	Inicijalno / Initially	2.65	0.77	0.465
	Finalno / Final	2.76	0.92	
Introjektovana regulacija / Introjected regulation	Inicijalno / Initially	2.54	1.01	0.897
	Finalno / Final	2.56	1.03	
Identifikovana regulacija / Identified regulation	Inicijalno / Initially	4.31	0.72	0.018
	Finalno / Final	3.94	0.89	
Intrinzična motivacija / Intrinsic motivation	Inicijalno / Initially	4.27	0.83	0.002
	Finalno / Final	3.78	0.99	

**Legend:** AS - arithmetic mean,; SD - standard deviation; p - level of statistical significance

Table 3 shows the results obtained in boys at initial and final measurement and we see that there are no statistically significant changes in non-motivation, external and intra-ordinated regulation, while in the identified regulation and intrinsic motivation we can see that there are statistically significant differences which can be said to have occurred values of internally motivated students in physical education classes.

nju. Dakle za godinu dana, na prelasku u jedan razred više, došlo je do pada motivacije i samim tim dovelo da postoji više nemotivisanih devojčica u nastavi fizičkog vaspitanja od dečaka. Kod eksterne regulacije nije bilo promena ni na inicijalnom ni na finalnom merenju, ali kod introjektovane regulacije je došlo do promene samo na finalnom merenju. U identifikovanoj regulaciji i intrinzičnoj motivaciji su postojale statistički značajne razlike između dečaka i devojčica i na inicijalnom i na finalnom merenju. Takođe je primećeno da je došlo do pada srednjih vrednosti i kod dečaka i kod devojčica za godinu dana. Ono što se primećuje su manje vrednosti u identifikovanoj regulaciji i intrinzičnoj motivaciji i kod dečaka i kod devojčica na finalnom merenju. Dakle primeti se da je unutrašnja motivacija u padu i kod dečaka i kod devojčica.

**Tabela 3.** Deskriptivni statistici motivacionih orijentacija kod dečaka osnovne škole na inicijalnom i finalnom merenju

**Legenda:** AS - aritmetička sredina; SD - standardna devijacija; p - nivo statističke značajnosti

U tabeli 3. prikazani su dobijeni rezultati kod dečaka na inicijalnom i finalnom merenju i vidi se da nema statistički značajnih promena kod nemotivisanosti, eksterne i introjektovane regulacije dok kod identifikovane regulacije i intrinzične motivacije postoje statistički značajne razlike, pa se može konstatovati da je došlo do pada vrednosti unutrašnje motivisanih učenika u nastavi fizičkog vaspitanja.

**Table 4.** Descriptive statistics of motivational orientations in elementary school girls at initial and final measurement

**Tabela 4.** Deskriptivni statistici motivacionih orijentacija kod devojčica osnovne škole na inicijalnom i finalnom merenju

Varijabla / Varijable	Testiranje / Testing	AS	SD	p
Nemotivisanost / Amotivation	Inicijalno / Initially	1.85	0.94	0.009
	Finalno / Final	2.35	1.28	
Eksterna regulacija / External control	Inicijalno / Initially	2.81	0.71	0.507
	Finalno / Final	2.91	0.94	
Introjektovana regulacija / Introjected regulation	Inicijalno / Initially	2.50	1.01	0.013
	Finalno / Final	2.10	0.82	
Identifikovana regulacija / Identified regulation	Inicijalno / Initially	4.00	0.81	0.007
	Finalno / Final	3.47	1.07	
Intrinzična motivacija / Intrinsic motivation	Inicijalno / Initially	3.75	1.14	0.004
	Finalno / Final	3.08	1.19	

**Legend:** AS - arithmetic mean,; SD - standard deviation; p - level of statistical significance

**Legenda:** AS - aritmetička sredina; S - standardna devijacija; p - nivo statističke značajnosti

In Table 4, we presented the results of motivational orientations in girls at initial and final measurements and noted that there are statistically significant differences in non-motivation, injected and identified regulation and intrinsic motivation. Only in the case of external regulation there were no statistically significant changes. What is noticed is that boys compared with boys in girls are much more significant and statistically significant. Girls have a higher level of non-motivation, while in boys it is similar in spacing of one year, but with regard to internal motivation, it is in decline both in one and the other, with the fact that it is more pronounced in girls.

U tabeli 4. su prikazani rezultati motivacionih orijentacija kod devojčica na inicijalnom i finalnom merenju i primećeno je da postoje statistički značajne razlike u nemotivisanosti, introjektovanoj i identifikovanoj regulaciji i intrinzičnoj motivaciji. Samo kod eksterne regulacije nije bilo statistički značajnih promena. Ono što se primećuje je da su u odnosu na dečake kod devojčica promenjene vrednosti mnogo veće i statistički značajnije. Kod devojčica je prisutan veći nivo nemotivisanosti dok je kod dečaka sličan u razmaku od godinu dana, ali što se tiče unutrašnje motivacije ona je u padu i kod jednih i kod drugih s tim što je kod devojčica to izraženije.

## DISCUSSION

This study included primary school students, a middle school age of 11-15 years corresponding to early adolescence. The total sample of students consisted of 121 students (66 boys and 55 girls) of the primary school "Branko Radičević" in Odzaci. The research consisted of two measurements, where students completed the self-regulation questionnaire at the first measurement (Goudas et al., 1994) and the same questionnaire after a year. From the obtained results of the students we see that the non-motivation shows an increase in mean values, which is a sign that children with the age are increasingly non-motivated in the teaching of physical education, and that there is a decrease in internal motivation in children with age, which coincides with the research (Yli-Piipari et al., 2011; Đorđić & Tumin, 2008). In non-motivation, we see that there was a statistically significant difference between boys and girls only on the final measurement, so that we can conclude

## DISKUSIJA

U ovom istraživanju su obuhvaćeni učenici osnovne škole, od petog do sedmog razreda što odgovara periodu rane adolescencije. Ukupan uzorak učenika je činio 121 učenik (66 dečaka i 55 devojčica) OŠ „Branko Radičević“ u Odžacima. Istraživanje se sastojalo od dva merenja, gde su učenici na prvom merenju popunili upitnik samoregulacije (Goudas et al., 1994) i isti upitnik nakon godinu dana. Iz dobijenih rezultata učenika vidi se da je kod nemotivisanosti porast u srednjim vrednostima što je znak da su deca sa uzrastom sve više nemotivisana u nastavi fizičkog vaspitanja, kao i da dolazi do pada unutrašnje motivacije kod dece sa uzrastom, što se podudara sa istraživanjima (Yli-Piipari et al., 2011; Đorđić i Tumin, 2008). U nemotivisanosti je postojala statistički značajna razlika između dečaka i devojčica samo na finalnom merenju tako da se može konstatovati da su devojčice uzrok sve više nemotivisanih učenika na časovi-

that girls are the cause of more and more non-motivated students at physical education classes that is in line with irregularities (Xiang et al., 2003; Egli et al., 2011), with a higher percentage of students attending physical education, there is a steady decline in the percentage of active girls (Gorely et al., 2011; Ikeda et al., 2018), which this study has shown. When it comes to boys only, research has shown that non-motivation at the same level is in the range of one year, unlike the identified regulation and intrinsic motivation where statistically significant differences are seen in that period. It is therefore noticeable that boys with age are less internally motivated in the teaching of physical education, as has been shown in the research (Sevil et al., 2018). In the case of external regulation, there was no change either on initial or final measurement, but with the introduced regulation, there was a change only on the final measurement. In the identified regulation and intrinsic motivation there were statistically significant differences between boys and girls, both on initial and final measurement. It was also observed that there was a drop in mean values in both boys and girls in a year. What is noticed is less value in the identified regulation and intrinsic motivation in both boys and girls at the final measurement. So it is noticed that internal motivation is falling in both boys and girls. Compared to the research (Žunić, 2012; Buišić et al., 2016), we see on the sample of high school students that pupils of elementary school are more motivated. On average they achieved better results. But comparing the motivation that is present in the classroom, the same results were obtained. The identified regulation is most present, and the lack of motivation is at least in both cases. Also, differences between boys and girls in motivational orientations have shown that in intrinsic motivation, identified regulation and introduced regulation, boys are predominant, and in external regulation and non-motivation, the girls are predominant in both studies. It is very important for a teacher that the students are internally motivated because it will make it easier for them to organize and work with them. Because students who are internally motivated more enjoy the lessons of physical education and are physically more active (Yli-Piipari et al., 2009). We can say that students belong to self-defined types and that the highest scores are achieved in the identified regulation, so we can conclude that students of secondary school age practice most during the physical education, because it is good for their health, because they want to strengthen, gain fitness, regulate physical weight to progress in class. The benefits of school physical education and its biological and pedagogical impact, as well as the effectiveness of longer-lasting exercises can only be expected from students who

ma fizičkog vaspitanja što je u skladu sa istraživanjima (Xiang et al., 2003; Egli et al., 2011). Sa odlaskom u više razrede procenat učenika koji pohađaju fizičko vaspitanje postojano opada, a naročito procenat aktivnih devojčica (Gorely et al., 2011; Ikeda et al., 2018) što je i ovo istraživanje pokazalo. Kada su u pitanju samo dečaci istraživanje je pokazalo da je nemotivisanost na istom nivou u rasponu od godinu dana za razliku od identifikovane regulacije i intrinzične motivacije gde se vide statistički značajne razlike u tom periodu. Dakle primetno je da su dečaci sa uzrastom manje unutrašnje motivisani u nastavi fizičkog vaspitanja, što se pokazalo i u istraživanju (Sevil et al., 2018). Kod eksterne regulacije nije bilo promena ni na inicijalnom ni na finalnom merenju, ali kod introjektovane regulacije je došlo do promene samo na finalnom merenju. U identifikovanoj regulaciji i intrinzičnoj motivaciji su postojale statistički značajne razlike između dečaka i devojčica i na inicijalnom i na finalnom merenju. Takođe je primećeno da je došlo do pada srednjih vrednosti i kod dečaka i kod devojčica za godinu dana. Ono što se primećuje su manje vrednosti u identifikovanoj regulaciji i intrinzičnoj motivaciji i kod dečaka i kod devojčica na finalnom merenju. Dakle, primeti se da je unutrašnja motivacija u padu i kod dečaka i kod devojčica. U poređenju sa istraživanjima (Žunić, 2012; Buišić et al., 2016) na uzorku učenika srednje škole, vidi se da su učenici osnovne škole motivisaniji. U proseku su ostvarili bolje rezultate. Ali upoređujući koja je motivacija koliko prisutna u nastavi dobijeni su isti rezultati. Identifikovana regulacija je najviše prisutna, a nemotivisanost najmanje u oba slučaja. Takođe razlike između dečaka i devojčica u motivacionim orijentacijama su pokazali da u intrinzičnoj motivaciji, identifikovanoj regulaciji i introjektovanoj regulaciji prednjače dečaci, a u eksternoj regulaciji i nemotivisanosti prednjače devojčice u oba istraživanja. Za nastavnika je veoma bitno da učenici budu unutrašnje motivisani jer će im to olakšati organizaciju i rad sa njima. jer učenici koji su unutrašnje motivisani više uživaju na časovima fizičkog vaspitanja i fizički su aktivniji (Yli-Piipari et al., 2009). Može se reći da učenici pripadaju samoodređenim tipovima i da su najveći skorovi ostvareni u identifikovanoj regulaciji čime se može zaključiti da učenici srednjeg školskog uzrasta većinom vežbaju na času fizičkog vaspitanja zato što je to dobro za njihovo zdravlje, zato što žele da ojačaju, steknu kondiciju, regulišu telesnu težinu, da napreduju u nastavi. Koristi od školskog fizičkog vaspitanja i njegovog biološkog i pedagoškog uticaja, kao i delotvornost dugotrajnijeg vežbanja mogu se očekivati samo od učenika koji su unutrašnje motivisani. Ali ono

are internally motivated. But what we dealt with is that this level of self-determined types of motivation with age decreases. Previous research and everyday practice suggest that students' motivation in teaching physical education is a key problem and challenge for teachers of physical education. Positive outcomes of teaching physical education can only be expected if students actively, engagedly and persistently participate in classes, or if their behavior is largely self-determined. The teacher of physical education must be more fully aware of the nature of the motivation process in order to create an adequate motivational climate and teaching strategies that promote the active participation, satisfaction and sense of competence of each student individually. The theory of self-determination in this sense possesses a significant, but insufficiently exploited, applicative potential. The realized research can be seen as a kind of action research, and it represents a cross-section of the situation in the elementary school "Branko Radičević" in Odžaci, so it can help teachers of physical education in further planning of teaching. When they have a realistic picture of student motivation in physical education, teachers can influence that to change. This is due to the fact that they are those who can encourage students in active participation on time and provide them with quality teaching, joy, challenge and good entertainment. By educating teachers, it is possible to encourage external motivated students towards self-determined forms of motivation (identified behavioral regulation, intrinsic motivation). By choosing the relevant teaching strategies, through the mediator role of the basic psychic needs of students (for autonomy, competence, connectivity), the teacher contributes to the inner motivation of students to participate in the teaching of physical education.

## CONCLUSION

Based on the results of motivational orientations of elementary school students on initial and final measurement, we have statistically significant differences in the identified regulation and intrinsic motivation, while in other types of motivation the differences are small but not statistically significant. With differences between boys and girls at initial and final measurements in motivational orientations in physical education classes, in the non-motivation we obtained statistically significant differences only on the final measurement. There was no change in external regulation, while in the introjected regulation there was a change only in the final measurement. With the identified regulation and intrinsic motivation, the results showed that there are statistically significant differences both on the initial and the final measurement. When it comes to

što smo utvrdili jeste da taj nivo samoodređenih tipova motivacije sa uzrastom opada. Dosadašnja istraživanja i svakodnevna praksa sugeriraju da motivacija učenika u nastavi fizičkog vaspitanja predstavlja ključni problem i izazov za nastavnika fizičkog vaspitanja. Pozitivni ishodi nastave fizičkog vaspitanja mogu se očekivati samo ako učenici aktivno, angažovano i istrajno učestvuju u nastavi, odnosno ako je njihovo ponašanje u velikoj meri samoodređeno. Nastavnik fizičkog vaspitanja mora potpunije poznavati prirodu procesa motivacije u cilju kreiranja adekvatne motivacione klime i nastavnih strategija koje promovišu aktivno učestvovanje, zadovoljstvo i osećanje kompetentnosti svakog učenika ponaosob. Teorija samoodređenja u tom smislu poseduje značajan, a nedovoljno iskorišćen, aplikativni potencijal. Realizovano istraživanje može se posmatrati i kao svojevrsno akciono istraživanje, i predstavlja presek stanja u osnovnoj školi „Branko Radičević“ u Odžacima, tako da može pomoći nastavnicima fizičkog vaspitanja u daljem planiranju nastave. Kada imaju realnu sliku motivacije učenika u fizičkom vaspitanju, nastavnici mogu da utiču da to promene. Jer oni su ti koji mogu da podstaknu učenike u aktivnom učešću na času i obezbede im kvalitetnu nastavu, radost, izazov i dobru zabavu. Zalaganjem nastavnika, moguće je podstaći spoljašnje motivisane učenike ka samoodređenim vidovima motivacije (identifikovana regulacija ponašanja, intrinzična motivacija). Odabirom relevantnih nastavnih strategija, preko medijatorske uloge bazičnih psihičkih potreba učenika (za autonomijom, kompetencijom, povezanošću), nastavnik doprinosi unutrašnjoj motivaciji učenika za učestvovanje u nastavi fizičkog vaspitanja.

## ZAKLJUČAK

Na osnovu rezultata motivacionih orijentacija učenika osnovne škole na inicijalnom i finalnom merenju, dobijeno je da postoje statistički značajne razlike u identifikovanoj regulaciji i intrinzičnoj motivaciji, dok su kod ostalih tipova motivacije razlike male, ali ne i statistički značajne. Kod razlika između dečaka i devojčica na inicijalnom i finalnom merenju u motivacionim orijentacijama u nastavi fizičkog vaspitanja, u nemotivisanosti su dobijene statistički značajne razlike samo na finalnom merenju. Kod eksterne regulacije nije bilo promena, dok je kod introjektovane regulacije došlo do promena samo na finalnom merenju. Kod identifikovane regulacije i intrinzične motivacije rezultati su pokazali da postoje statistički značajne razlike i na inicijalnom i na finalnom merenju. Kada su u pitanju samo dečaci statistički značajne razlike su dobijene u identifikovanoj regulaciji

boys, statistically significant differences were obtained in the identified regulation and intrinsic motivation, while the other values did not have statistically significant changes. Regarding girls only, statistically significant differences existed in the identified regulation and intrinsic motivation as well as in the introjected regulation of non-motivation, while the difference did not exist in the external regulation. When we look at the picture as a whole, we see that there is a decline in motivation with age.

i intrinzičnoj motivaciji dok ostale vrednosti nisu imale statistički značajne promene. Kada je reč o samo devojčicama statistički značajne razlike su i kod njih postojale u identifikovanoj regulaciji i intrinzičnoj motivaciji, ali i u introjektovanoj regulaciji nemotivisanosti, dok razlika jedino nije postojala u eksternoj regulaciji. Kada se sagleda slika u celini vidi se da dolazi do pada motivacije sa uzrastom.

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