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Sadržaj / Contents

Dragi čitaoci,

poznata latinska izreka ''Deforme est de se ipso praedicare'' (Neukusno je govoriti o samome sebi) neka bude naša prva misao u ovom predgovoru, jer želimo da vi više pričate o nama, nego mi sami o sebi.

U novi broj časopisa ''Sportske nauke i zdravlje'' uvršteni su radovi autora iz Poljske, Crne Gore, Slovačke, Indije, Srbije i Bosne i Hercegovine. Tematika radova se odnosi na značaj fizičke aktivnosti u zdravlju žena, preventivno djelovanje na loše držanje tijela kod djece školskog uzrasta, analizu mišićne sile kod djece narušenog posturalnog statusa, percepciju studenata o korištenju nedozvoljenih supstanci, kondicioni trening, stoni tenis, prognostičke vrijednosti Eurofit baterije testova i značaj fizičke aktivnosti u menadžmentu konflikata i pružanju usluga u zdravstvu. Uvjereni smo da će raznolikost tema i multidisciplinarnost samih radova biti zanimljivi široj čitalačkoj javnosti.

U želji da vaši radovi budu još vidljiviji i dostupniji široj naučnoj i stručnoj javnosti, od ovog broja časopis je uvršten i u međunarodnu citatnu bazu Cite factor.

Izrekom ''To što znamo je kapljica, a to što ne znamo je more'' (Isaac Newton) želimo da ohrabrimo i podstaknemo sve autore da i dalje istražuju, pišu i objavljuju svoje radove.

Uredništvo

Dear Readers,

the well-known Latin proverb ''Deforme est de se ipso praedicare'' (Bad taste is to talkabout himself) let it beourfirst thoughtinthepreface,because we wantyoutalkingmoreabout usthan we doabout ourselves.

In thenew issue of''SportsScienceand Health'' are included the worksof authors fromPoland, Montenegro, Slovakia,India,Serbiaand Bosniaand Herzegovina. Subjects of the papers are relating to the importance of physical activity in women's health, preventive action on bad body posture in children of school age, the analysis of muscle force in children with impaired postural status, perceptions of students about the use of illegal drugs, physical training, table tennis, prognostic value Eurofit battery of tests and the importance of physical activity in the management of conflicts and the provision of health services. We are convinced thatthe diversityof themes andthe multidisciplinary natureof the works themselvesare interestingto the generalpublic.

In orderthat yourworkbemore visibleandmore accessible tothe widerscientific and professional public, sincethisissue wasincludedin theinternationalcitationdatabaseCitefactor.

With '' Whatwe knowis a drop, and what we do not knowmore'' (Isaac Newton) we want to encourageandstimulate allauthors tocontinue toresearch,write and publishtheir works.

Editorial

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Original Scientific Paper

Držanje tijela kod djevojčica uzrasta od 7-15 godina u odnosu na njihov indeks tjelesne mase

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Sažetak: Uprkos značajnim teorijskim izvorima koji se odnose na loše držanje kod djece i adolescenata, a koje je izazvala promjena načina života, saznanja o problemu abnormalne kičmene krivine treba da budu dopunjena. Može se uvidjeti sve veći broj gojazne djece i ovaj problem težine može dovesti do veće učestalosti lošeg držanja tijela. Ovaj rad ima za cilj da utvrdi učestalost dobrog i lošeg držanja tijela kod djevojčica u odnosu na njihove tjelesne težine, kao i da otkrije da li prekomjerna težina (gojaznost) daju predispoziciju za loše držanje. Istraživanje je obuhvatilo 500 djevojčica uzrasta 7-15 godina, koje žive u Szczecinu u Poljskoj. U procjeni držanja tjela, korišćena je sferosomatometrijska metoda Ivanovskog. Djevojčice sa normalnom tjelesnom težinom su predstavljale 77,7% ispitanika. U 6,7% slučajeva, identifikovana je nedovoljna tjelesna težina. 11,3% su imale višak kilograma , dok je 4,3% djevojčica bilo gojazno - što iznosi 15,6 % ispitanica. Nepravilno držanje tijela je identifikovano u 32,4% ispitanica. Najveći broj djevojčica sa lošim držanjem tijela pronađeno je među 9-godišnjakinjama (38,6%), 13-godišnjakinjama (35.2 %) i 15-godišnjakinjama (35,1%). Prekomjerna težina i gojaznost je bila predispozicija kod ispitanica za pojavu nepravilnog držanja kičme: abnormalna kičmena krivina je pronađena u 30,8% gojaznih djevojčica i djevojčica sa prekomjernom težinom.
Ključne riječi: BMI, zdravlje, fiziološka krivina kičme, držanje, djevojčice.

Uvod

Pitanje epidemiologije lošeg držanja tijela kod djece i adolescenata izaziva veoma različite stavove. Istraživanje o držanju tijela sprovedeno u različitim regionima Poljske je ukazalo da je značajan dio (32,5% do 93,2%) djece i adolescenata sa značajnim poremećajima u po-

Body Posture of Girls Aged 7-15 in Relation to Their Body Mass Index

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Abstract: Despite significant theoretical resources related to bad posture in children and adolescents, the problem of abnormal spinal curvature needs to be supplemented, which is caused by a changing lifestyle. One can observe an increasing number of overweight/obese children and this weight problem may result in a greater incidence of bad posture. This paper aims to determine the incidence of good and bad posture in girls in relation to their body weight, as well as to reveal whether excess weight/obesity predispose them to bad posture. The research involved 500 girls aged 7-15, living in Szczecin, Poland. In the assessment of body posture, Iwanowski's spherosomatometric method was employed. Girls with correct body weight constituted 77.7% of the subjects. In 6.7% cases, an insufficient body weight was identified. 11.3% suffered from excess weight while 4.3% of girls were obese – which totals 15.6% of the subjects. Incorrect body posture was identified in 32.4% of the subjects. The highest proportion of girls with bad posture was found among 9-year-olds (38.6%), 13-year-olds (35.2%), and 15-year-olds (35.1%). Overweight and obesity did predispose the subjects to bad posture: abnormal spine curvature was found in 30.8% of overweight/obese girls.
Key words: BMI, health, physiological spine curvature, posture, girls.

Introduction

The issue of epidemiology of bad posture in children and adolescents provokes very diverse attitudes. Research on body posture conducted in various regions of Poland pointed to a significant proportion (32.5 to 93.2%) of children and adolescents with considerable abnormali-

gledu lokomotornog aparata i statike tijela. Mnoga istraživanja govore o učestalosti lošeg držanja u populaciji: 32,5% (Łubkowska, 2003), 33,6% (Suder i sar., 2002), 40,0% (Kasperczyk, 1988), 51,1% (Żukowska, 2012), 52,5-59,7% (Stoliński i Kotwicki, 2011), 60% (Barczyk i sar., 1997; Starosta, 1993; Żukowska i sar., 2014), 71,4% (Maciałczyk-Paprocka i sar., 2012), 81,9% (Maciałczyk-Paprocka i sar., 2011), 83-93,2% zavisno od regiona (Mrozkowiak, 2007), 93,2% (Janiszewska et al., 2009). Novakovski (2011) smatra da se procenat svih anomalija držanja tijela tokom perioda rasta kreće oko 90% (kičme i grudi 40-50%, donji ekstremiteti 50%).

Kontroverzni epidemiološki podaci se takođe mogu naći u odnosu na učestalost lateralnog krivljenja kičme, odnosno skolioze (1,4 % do 69%). Postoje više istraživanja koja govore o učestalosti skolioze: 1,4-9,9% (Stoliński & Kotwicki, 2011), 4,1-28,3% (Mrozkowiak, 2007), 9,8% (Janiszewska i sar., 2009), 18% (Śliwa i sar., 1995), 38% (Prętkiewicz-Abacjew i sar., 1992), 48% (Standera, 1999), 50% (Łabaziewicz, 1993), 65,3% (Kania-Gudzio & Wiernicka, 2002), 65,6% (Żukowska i sar., 2014), 69% (Wilczyński, 2005). Kao rezultat toga, mora se voditi diskusija da bi se odgovorilo na pitanje, koji procenat populacije pati od lošeg držanja tijela?

Razlike su rezultat, između ostalog, korištenja različitih metoda istraživanja i nedosljednih kvalifikacionih kriterijuma za procjenu držanja i njegovih komponenti. Mrozkowiak i sar. (2014) su razvili opis preko 100 metoda procjene položaja tijela. Istraživači su odlučili da iznesu svoje klasifikacije metoda koje se koriste za dijagnozu položaja tijela, dijeleći ih na: metode inspekcije, siluet inspekcije, manuelne i operativne dijagnostike, metode point-based, aktivnosti pokreta, metode koje koriste složene mehaničke mjerne instrumente, metode koje koriste jednostavne mjerne instrumente i tehnološki napredne metode procjene držanja tijela, uključujući i tehnološke uređaje površinskog renderinga. Uprkos nedosljednim podacima koji se odnose na učestalost nepravilnog držanja tijela, problem je dovoljno značajan da postane i značajan socijalni problem, pošto ispravno držanje tijela ne služi samo estetskoj funkciji, vec, prije svega, takođe utiče na zdravlje i kvalitet života (Łubkowska i Troszczinski, 2011; Pupišova 2013, 2014). Pregledi držanja tijela pomažu u ranom otkrivanju anomalija lokomotornog aparata, a u budućnosti oni mogu da doprinesu smanjenju bolesti vezanih za bolesti lokomotornog aparata, nervnog sistema, kao i kardiovaskularnog i respiratornog sistema. Novakovski (2011) navodi da su bolesti kičme i stanja lokomotornog aparata rezultat netretiranih abnormalnosti držanja tijela. Bendikova & Kostencka (2013) , Pivovarniček i sar. (2013a,b) ,

ties in terms of motor organs and body statics. Below is a list of incidence of bad posture in the population: 32.5% (Łubkowska, 2003), 33.6% (Suder et al., 2002), 40.0% (Kasperczyk, 1988), 51.1% (Żukowska, 2012), 52.5-59.7% (Stoliński and Kotwicki, 2011), 60% (Barczyk et al., 1997; Starosta, 1993; Żukowska et al., 2014), 71.4% (Maciałczyk- Paprocka et al., 2012), 81.9% (Maciałczyk-Paprocka et al., 2011), 83-93.2% depending on the region (Mrozkowiak, 2007), 93.2% (Janiszewska et al., 2009). Nowakowski (2011) believes that the proportion of all posture abnormalities during the growth period revolves around 90% (spine and chest: 40-50%, lower limbs: 50%).

Controversial epidemiological data can also be found in relation to incidence of lateral curvature of the spine, i.e. scoliosis (1.4% to 69%). Below is a list of incidence of scoliosis: 1.4-9.9% (Stoliński & Kotwicki, 2011), 4.1-28.3% (Mrozkowiak, 2007), 9.8% (Janiszewska et al., 2009), 18% (Śliwa et al., 1995), 38% (Prętkiewicz-Abacjew et al., 1992), 48% (Standera, 1999), 50% (Łabaziewicz, 1993), 65.3% (Kania-Gudzio & Wiernicka, 2002), 65.6% (Żukowska et al., 2014), 69% (Wilczyński, 2005).

As a result, one needs to struggle to answer the question: *What proportion of population suffers from bad posture?* The discrepancies result from, inter alia, using different research methods and inconsistent qualifying criteria to assess posture and its components. Mrozkowiak et al. (2014) developed a description of over 100 methods of body posture assessment. The researchers decided to put forward their own classification of methods used to diagnose body posture, dividing them into: inspection methods, silhouette inspections, manual and operational diagnostics, point-based methods, motion activities, methods using complex mechanical measuring instruments, methods using simple measuring instruments, and technologically-advanced methods of body posture assessment, including surface-rendering technological devices.

Despite inconsistence data related to bad posture incidence, the problem is significant enough to become a considerable social issue, as correct body posture does not only serve an esthetic function, but – above all – it also impacts one's health and wellbeing (Łubkowska and Troszczyński, 2011 a; Pupišová 2013, 2014). Body posture examinations help detect abnormalities of the motor organ early on, and in the future they can contribute to reducing ailments related to diseases of the motor organ, nervous system, as well as circulatory and respiratory systems. Nowakowski (2011) states that spinal ailments and motor organ conditions result from untreated posture abnormalities.

Pupišova - Pupiš (2013), Šmida (2015) su došli do sličnih zaključaka. Oni su predstavili teorijske i praktične rezultate istraživanja dobijenih od strane istraživača koji se bave zdravstvenim problemima. Istraživanje je koncentrisano na funkcionalne i strukturne promjene na mišićno-koštanom sistemu. Autori su zaključili da nedovoljna primarna i sekundarna prevencija i dijagnostika, kao i funkcionalni nemar ili morfološke promjene u mišićno-koštanom sistemu često dovode do funkcionalnih i strukturnih poremećaja lokomotornog aparata kod odraslih.

Prema Janiszevska i sar. (2009), uzroci lošeg držanja tijela su raznovrsni. Mogu uključivati genetske predispozicije, statičke i dinamičke poremećaje ravnoteže, razne bolesti, kao i nepovoljne uslove života (navike u ishrani, zamor, nedostatak fizičke aktivnosti, dugo vrijeme provedeno u sjedećem položaju, itd).

Ključni metod borbe protiv lošeg držanja tijela je fizikalna terapija, odnosno tretmani na bazi kretanja (kineziterapija). Fizičke vježbe su izgleda glavni faktor za izliječenje (Kotwicki, 2011). Takođe se smatra da je to jedna od ključnih preventivnih mjera (Łubkowska & Troszczinski, 2011b). Nedostatak fizičke aktivnosti dovodi do prekomjerne težine i gojaznosti (Maciałczik-Paprocka, 2012), koje sa svoje strane dovode do degenerativnih promjena kičme zbog preopterećenja. Ove promjene nisu više tipične samo za starije ili srednje dobi pacijenata-one takođe utiču na djecu i adolescente (Kim i sar., 2010; Martinez-Lage i sar., 2003). Istraživanje sprovedeno od strane Levandovski (2011), koje je obuhvatilo 5.321 učenika uzrasta od 14-19 godina, je pokazalo da 63 % ispitanika pati od hroničnog bola kičme. Bol je možda izazvana nedovoljnom fizičkom aktivnošću učenika, koja je možda dovela do povećanja učestalosti lošeg držanja tijela. Istraživanje koje je sprovela Zukowska i sar. (2014) ukazuje da postoje statistički značajne korelacije između lošeg držanja tela u sagitalnom podrucju i fizičke spretnosti-funkcionalnosti među učenicima prvog razreda u ruralnim područjima.

Razmatrana pitanja opravdavaju dalja istraživanja, pa je cilj ovog rada da se utvrdi učestalost lošeg i dobrog držanja tijela kod devojčica uzrasta od 7-15 godina, uzimajuci u obzir njihovu tjelesnu masu kako bi se odgovorilo na sljedeće pitanje: Da li su prekomjerna težina i gojaznost predispozicija za loše držanje tijela?

Metod

Istraživanje je obuhvatilo 500 djevojčica uzrasta od 7-15 godina koje su pohađale škole u različitim dijelovima Szczecina- velikog lučkog grada u Poljskoj. Izbor škola i ispitanica je nasumično izabrano, samo na osnovu starosne kategorije (Tabela 1). Da bi se utvrdila starost

Bendíková & Kostencka (2013), Pivovarniček et al. (2013a,b), Pupišová – Pupiš (2013), Šmída (2015) arrived at similar conclusions: they presented theoretical and practical research results obtained by researchers who focus on health issues. The research concentrated on functional and structural malfunctions of the musculoskeletal system. The authors concluded that insufficient primary and secondary prevention and diagnostics, as well as functional negligence or morphological changes in the musculoskeletal system often lead to functional and structural disorders of the motor organ in adults.

According to Janiszewska et al. (2009), origins of bad posture are diverse: they may include genetic predispositions, static and dynamic balance disorders, various diseases, as well as unfavorable living conditions (dietary habits, fatigue, lack of physical exercise, long stretches of time spent in sedentary position, etc.).

Key method of fighting bad posture is physical therapy, i.e. treatments based on movement (kinesiotherapy). Providing physical exercise seems to be the main healing factor (Kotwicki, 2011); it is also considered to be one of the key preventive measures (Łubkowska & Troszczyński, 2011b). Lack of exercise leads to overweight and obesity (Maciałczyk-Paprocka et al., 2012), which in turn results in degenerative overload changes of the spine. These changes are no longer typical only of the elderly or middle-aged patients – they also affect children and adolescents (Kim et al., 2010; Martínez-Lage et al., 2003). Research made by Lewandowski (2011), which included 5,321 pupils aged 14-19, indicated that 63% of subjects suffered from chronic spinal pain. The pain might have been caused by insufficient physical activity of the pupils, which may have led to an increased incidence of bad posture. Research conducted by Żukowska et al. (2014) indicated that there are statistically significant correlations between bad posture in sagittal plane and physical dexterity/functionality amongst 1st grade pupils in rural areas.

The discussed issues justify further research, therefore the aim of this paper is to determine the incidence of bad and good posture in girls aged 7-15 with consideration given to their body mass in order to answer the following question: *Does overweight and obesity predispose them to bad posture?*

Methodology

The research encompassed 500 girls aged 7-15 who attended schools in various parts of Szczecin – a large, port city in Poland. The choice of schools was merithorically-based, and the subject group was selected at random, based only on age categories (Table 1). To

subjekata korišćene su kalendarske godine; da se utvrde segmenti starosti, ± ½ sredina godine je tretirana kao segment polovine.

determine subjects' age, calendar years were used; to determine age segments, ± ½ middle of the year was treated as the segment half.

Tabela 1. *Kvantitativne karakteristike subjekata (n = 500)*

Table 1. *Quantitative characteristics of the subjects (n = 500)*

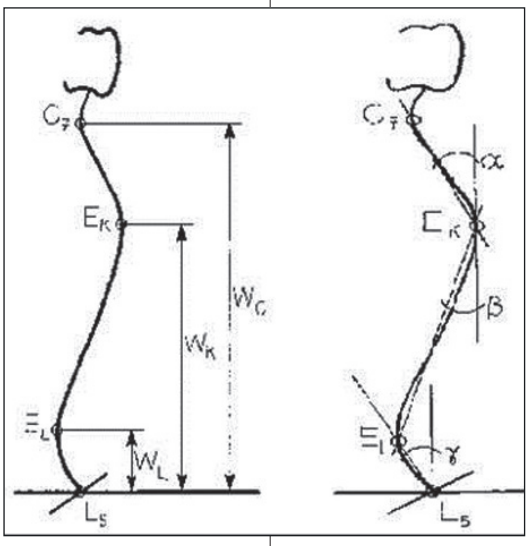
Starost (godine) / *Age (years)*	7	8	9	10	11	12	13	14	15
Djevojcice (n = 500) / *Girls (n = 500)*	51	52	57	54	57	57	54	61	57

Za procjenu položaja tijela Ivanovski (1982) je koristio sferosomatometrijsku metodu, koja određuje oblik prednje i zadnje fiziološke krivine kičme u sagitalnoj ravni. U ovom postupku, grafički prikaz prostorne krivine se dobija u razmjeri 1:1. To je skup tačaka koje predstavljaju vrhove spinosus procesa. Mjerenje je uključilo raspon od C7 - L5. Analiza grafikona je utvrdila uglove - a, b, g –koji ilustruju obim grudnog koša kifoze i lumbalne lordoze. Oni određuju krivinu gornjeg dijela grudnog koša -kifoze (ugao a), donji dio grudne kifoze (ugao b) i lumbalne lordoze (ugao γ) (Slika. 1).

Detaljna analiza uglova kičmene krivine koristi normativne obime fizioloških kičmenih krivina koju je definisala Łubkowska (2012) za djecu i omladinu u Szczecinu. Tako je uspostavljena klasifikacija pravilnih i nepravilnih oblika kičmenog stuba ispitanica.

To assess body posture, Iwanowski's (1982) spherosomatometric method was used, which determines the shape of front and back physiological curvatures of the spine in sagittal plane. In this method, a graphic representation of the spacial curvature is obtained in 1:1 scale; it is a collection of points representing the tips of spinous processes. The measurement included a range of C7 – L5. The analysis of the graphs determined angles - a, b, g - which illustrate the scope of thoracic kyphosis and lumbar lordosis; they determine the curvature of the upper section of the thoracic kyphosis (alpha angle - a), lower section of the thoracic kyphosis (beta angle - b), and lumbar lordosis (gamma angle - γ) (Fig. 1).

The detailed analysis of spine curvature angles used normative ranges of physiological spinal curvatures, prepared by Łubkowska (2012) for children and adolescents in Szczecin. Thus, a classification of correct and incorrect spine shapes of the subjects was established.



Slika 1. *Fiziološke krivine kičme i način utvrđivanja uglova i visina spinalnih dijelova*

Figure 1. *Physiological spine curvature and method of determining angles and heights of spine sections*

Legenda: *C7 - tačka koja odgovara visini sedmog vratnog pršljena; L5/S - tačka koja odgovara visini petog lumbalnog pršljena, tretirana ovde kao vrh interglutealnog zazora; Ek - najisturenija tačka grudne krivine (ekstremne kifoze); El - najisturenija tačka lumbalne lordoze (ekstremna lordoza); Vc – visina kicme od L5/S do C7; VK - visina kičme od L5/S do Ekstremne kifoze ,Ek; VL - visina kičme od L5/S do ekstremne lordoze El; Alfa ugao - α – nagibni ugao gornjeg grudnog dijela; Beta ugao - ß - nagibni ugao donjeg grudnog dela (torako lumbalni dio) ; Gama ugao - γ - nagibni ugao lumbalnog dijela (Lumbo – sakralni dio).*

Legend: *C7 – a point corresponding to the height of the seventh cervical vertebrae; L5/S – a point corresponding to the height of the fifth lumbar vertebrae, treated here as a tip of intergluteal cleft; Ek – the most protruding point of thoracic curvature (extremum of kyphosis); El – the most protruding point of lumbar lordosis (extremum of lordosis); Wc – Spine height from L5/S to C7; Wk – spine height from L5/S to extremum of kyphosis Ek; Wl – spine height from L5/S to extremum of lordosis El; Alpha angle - α – inclination angle of the upper thoracic section; Beta angle - ß – inclination angle of the lower thoracic section (thoraco-lumbar section); Gamma angle - γ – inclination angle of the lumbar section (lumbo-sacral section).*

Mjerenje visine i tjelesne težine je izvedeno korišćenjem direktne metode, prema principima antropometrije: stepen gojaznosti (pothranjenost je određena BMI indeksom (indeks tjelesne mase), izračunat pomoću sljedeće formule: BMI = tjelesna masa (u kg) / visina² (m), prema Woinarowska (2013). Statistička analiza je koristila mjere centralne tendencije i mjere disperzije: aritmetičku sredinu i standardnu devijaciju.

Rezultati

Srednje vrijednosti, standardna devijacija i niz varijabli (minimum-maksimum) koji karakterišu fizički razvoj ispitanica, prikazane su u tabeli 2.

Tabela 2. *Visina, tjelesna masa i BMI djevojčica (n=500)*

Height and body weight measurements were made using a direct method, according to principles of anthropometry; the extent of overweight / underweight was determined by BMI (Body Mass Index), calculated with the following formula: BMI = body weight [in kg] / height² [in m] (Woynarowska, 2013). The statistical analysis employed central tendency and measures of dispersion: arithmetic mean and standard deviation.

Results

Mean values, standard deviation and the range of variables (minimum-maximum) which characterized the physical development of the subjects, is presented in Table 2.

Table 2. *Height, body weight and BMI of the subjects (n = 500)*

Uzrast (godine) *Age (yesrs)*	n = 500	Mean ± SD min- max	Djevojčice		
			Visina (cm) *Height (cm)*	Tjelesna masa (kg) *Body mass (kg)*	Body mass index BMI (kg/m²)
7	51	Mean±SD	121.5±5.1	23.3±3.8	15.9±2.3
		min-max	112-130.5	17-31.5	11.7-22.3
8	52	Mean±SD	125.7±5.2	25.1±3.9	15.8±1.8
		min-max	114.5-138.5	18.5-33.5	13.1-19.2
9	57	Mean±SD	131.4±5.8	29.4±6.6	17.0±3.2
		min-max	125-145	19.7-46.5	13.1-28.2
10	54	Mean±SD	137.1±6.1	33.2±5.2	17.1±2.1
		min-max	117.5-148	22.6-44.5	13.5-22.5
11	57	Mean±SD	144.1±7.9	37.8±8.0	18.1±3.1
		min-max	130-168.5	22.5-61.5	13.3-27.7
12	57	Mean±SD	149.4±8.1	41.9±9.4	18.7±3.2
		min-max	125-167	26.8-74	13.7-26.5
13	54	Mean±SD	154.9±7.2	46.9±10.9	19.4±3.7
		min-max	139-171	28.5-73	14.3-30
14	61	Mean±SD	161.1±5.2	52.4±7.8	20.1±2.4
		min-max	147.5-172	33.8-71.5	14.5-26
15	57	Mean±SD	163.5±6.0	54.9±9.2	20.6±3.2
		min-max	149.5-178	37.2-83.3	15.3-32.1

Tabela 3 prikazuje rezultate analize BMI djevojčica uzrasta 7-15 godina. Poređenje izračunatog BMI sa "normom" za određene starosne segmente dobi i pola (Voinarovska, 2013) nam je dozvolilo da podijelimo subjekte u: neuhranjene djevojčice, djevojčice sa pravilnom tjelesnom težinom i gojazne (prekomjerne težine) djevojčice. Djevojčice sa normalnom tjelesnom težinom predstavljaju 77,7% ispitanica. U 6,7% slučajeva je identifikovana nedovoljna tjelesna masa. Višak kilograma je pronađen u 11,3% ispitanica, dok je gojaznost u 4,3%. Ove dvije

Table 3 presents results of the BMI analysis of girls aged 7-15. Comparison of the calculated BMI with the 'norm' for particular age and sex segments (Woynarowska, 2013) permitted us to divide the subjects into: underweight girls, girls with correct body weight and overweight/obese girls. Girls with a correct body weight constituted 77.7% of subjects. In 6.7% cases, an insufficient body weight was identified. Overweight was found in 11.3% of subjects, while obesity – in 4.3%. These two phenomena (over-

pojave (prekomjerna masa i gojaznost) čine do 15,6% od svih ispitanica (Tabela 3).

Tabela 3. *Učestalost neuhranjenosti, normalne tjelesne mase, prekomjerna mase i gojaznosti, zasnovan na BMI djevojčica uzrasta 7.-15. godina (n = 500)*

Uzrast [godine] / *Age (year)*	Djevojčice / *Girls* (n =500)										
	Pothranjenost / *Underweight*		Normalna tjelesna masa / *Correct body weight*		Prekomjernost / *Overweight*		Gojaznost / *Obesity*		Prekomjernost + gojaznost / *Overweight + Obesity*		Suma / *The sum*
	n	%	n	%	n	%	n	%	n	%	n
7	6	11.8	38	74.5	6	11.8	1	1.9	7	13.7	51
8	3	5.8	48	92.3	1	1.9	0	0	1	1.9	52
9	6	10.5	39	68.4	8	14.1	4	7.0	12	21.1	57
10	4	7.4	45	83.3	5	9.3	0	0	5	9.3	54
11	4	7.1	41	71.9	10	17.5	2	3.5	12	21.0	57
12	2	3.5	43	75.5	10	17.5	2	3.5	12	21.0	57
13	4	7.4	40	74.1	4	7.4	6	11.1	10	18.5	54
14	2	3.3	50	81.9	7	11.5	2	3.3	9	14.8	61
15	2	3.5	44	77.2	6	10.5	5	8.8	11	19.3	57
	33	6.70	388	77.7	57	11.3	22	4.3	79	15.6	500

Tabela 4 predstavlja pojavu nepravilnog držanja tijela u pojedinim starosnim grupama. Nepravilna spinalna krivina je identifikovana u 162 učenice, što čini 32,4 % ispitanika. Najveći broj djevojčica sa nepravilnim držanjem (abnormalno spinalna krivina) pronađeno je među 9-godišnjakinjama (38,6%), 13-godišnjakinjama (35,2 %) , i 15 -godišnjakinjama (35,1%). Učestalost lošeg držanja tijela je bila najmanja u sljedećim starosnim grupama: 12-godišnjakinjama (24,6%), 7-godišnjakinjama (29,4%) i 11-godišnjakinjama (29,8 %).

Tabela 4. *Učestalost lošeg držanja u ispitivanoj populaciji*

Fiziološka zakrivljenost kičme / Physiological spine curvature				
Uzrast (godine) / *Age (years*	pravilno / *normal*		nepravilno / *incorrect*	
	N	%	n	%
7	36	70.6	15	29.4
8	34	65.4	18	34.6
9	35	61.4	22	38.6
10	36	66.7	18	33.3
11	40	70.2	17	29.8
12	43	75.4	14	24.6
13	35	64.8	19	35.2
14	42	68.9	19	31.1
15	37	64.9	20	35.1
	338	67.6	162	32.4

weight and obesity) added up to 15.6% of all subjects (Table 3).

Table 3. *Incidence of underweight, correct body weight, overweight and obesity, based on the BMI of girls aged 7-15 (n = 500)*

Table 4 presents incidence of incorrect posture in particular age groups. Abnormal spinal curvature was identified in 162 pupils, which constitutes 32.4% of subjects. The highest proportion of girls with bad posture (abnormal spinal curvature) was found among 9-year-olds (38.6%), 13-year-olds (35.2%), and 15-year-olds (35.1%). The incidence of bad posture was the lowest in the following age groups: 12-year olds (24.6%), 7-year-olds (29.4%) and 11-year-olds (29.8%).

Table 4. *Incidence of bad posture in the researched population*

Tabela 5 prikazuje pojavu nepravilnog držanja tijela kod djevojčica u odnosu na njihove tjelesne težine. Nepravilno držanje tijela je identifikovano u 24,9% pretežkih i 5,9% gojaznih djevojčica, što pokazuje da je 30,8% prekomjerno uhranjenih (gojaznih devojaka). Učestalost lošeg držanja tijela je veća u 11 i 12- godišnjakinja koje pate od prekomjerne težine (gojaznosti).

Tabela 5. *Učestalost lošeg držanja u ispitivanoj populaciji djevojčica uzrasta 7-15 godina u odnosu na njihove tjelesne težine*

Table 5 presents incidence of bad posture in girls in relation to their body weight. Incorrect body posture was identified in 24.9% of overweight girls and 5.9% obese girls, which adds up to 30.8% of overweight/obese girls. Bad posture incidence was higher in 11- and 12-year-old girls suffering from overweight/obesity.

Table 5. *Incidence of bad posture in the researched population of girls aged 7-15 in relation to their body weight*

Uzrast (godine) / *Age (year)*	Nepravilno držanje tijela / *Incorrect body posture*									
	Pothranjenost / *underweight*		Normalna tjelesna masa / *Correct body weight*		Pretežak / *Overweight*		Gojazan / *Obesity*		Zajedno / *Together*	
	n	%	n	%	n	%	n	%	n	%
7	3	20.0	8	53.3	3	20.0	1	6.7	15	29.4
8	0	0	17	94.5	1	5.5	0	0	18	34.6
9	1	4.6	14	63.6	7	31.8	0	0	22	38.6
10	1	5.6	14	77.8	3	16.6	0	0	18	33.3
11	1	5.9	7	41.2	7	41.2	2	11.7	17	29.8
12	0	0	4	28.6	8	57.1	2	14.3	14	24.6
13	0	0	13	68.4	3	15.8	3	15.8	19	35.2
14	1	5.2	14	73.7	4	21.1	0	0	19	31.1
15	2	10.0	14	70.0	3	15.0	1	5.0	20	35.1
	9	5.7	105	63.5	39	24.9	9	5.9	162	32.4

Diskusija i zaključak

Učestalost prekomjerne tjelesne mase i gojaznosti kod djece i adolescenata se povećava sličnom brzinom kao i kod odraslih . Prema IOTF -a (Međunarodne operativna grupa za gojaznost) izvještaju, 155 miliona učenika u svijetu boluje od prekomjerne težine (gojaznosti). Među njima, 30-45 miliona su gojazna djeca uzrasta 6-17 godina i 22 miliona su gojazna djeca mlađa od 5 godina (Obuchowicz, 2005; IOTF, 2004). Američko istraživanje koje je uključivalo grupu od 8.000 djece i adolescenata, završeno u 2002. godini, je pokazalo da oko 30% ispitanika pati od prekomjerne težine (Hedli, et al., 2004). Podaci SZO pokazuju da u zemljama zapadne Evrope procenat gojazne djece se povećao sa 10% na početku 1980-ih do 20% u kasnim 1990-im . U Poljskoj, u 2005. godini bilo je 13% gojaznih adolescenata uzrasta od 13-15 godina pa je i opravdano očekivati dalji rast ovih procenata (Woinarowska, 2013) .

Istraživanja prezentovana u ovom radu otkrila su da je 15,6% gojaznih djevojaka, sa najvećom učestalosti problema sa težinom među 9, 11 i 12 – godišnjakinjama (oko 21 %). Istraživanje koje su sproveli Maciałczyk i Paprocka (2012), koje je obuhvatalo 581 devojčica uzrasta od 7-12 godina, stalno nastanjenih u Poznanju

Discussion and Conclusion

Incidence of overweight and obesity in children and adolescents is increasing at a similar rate as amongst adults. According to IOTF's (International Obesity Task Force) report, 155 million schoolchildren in the world suffer from overweight/obesity. Amongst them, 30-45 million are obese children aged 6-17 and 22 million are obese children under the age of 5 (Obuchowicz, 2005; IOTF, 2004). American research which involved a group of 8,000 children and adolescents, completed in 2002, indicated that approximately 30% of subjects suffered from overweight (Hedley et al., 2004).WHO data indicated that in the Western European countries the proportion of obese children increased from 10% at the beginning of 1980s to 20% in the late 1990s. In Poland, in 2005 there were 13% of overweight/obese adolescents aged 13-15 and it is justified to expect a further increase of this proportion (Woynarowska, 2013).

Research presented in this paper revealed 15.6% of overweight/obese girls, with the highest incidence of weight problem amongst 9-, 11- and 12-year-olds (approx 21%). Research carried out by Maciałczyk-Paprocka's (2012) team, which encompassed 581 girls aged 7-12, who lived permanently in Poznań, Poland, identified

(Poljska), identifikovalo je 6,7% gojaznih djevojčica . Mazur i sar. (2001) su dijagnostikovali gojaznost u 10% učenica, dok Smorczewska- Czuprinska i sar. (2000) su identifikovali gojaznost u 12,3% djevojčica uzrasta 14 godina, koje žive u Białystok (Poljska).

Gojaznost je jedan od glavnih faktora rizika za učestalost degenerativnih promjena preopterećenja osteoartikularnog sistema. Gojazni subjekti pate uglavnom od degenerativnih promjena preopterećenja zglobova koljena i kuka, kao i lumbalne kičme. One mogu dovesti do skeletnih deformiteta. Američke procjene pokazuju da 50% gojaznih pate od bolova u zglobovima, kao i da nedostatak fizičke aktivnosti dovodi do povećanja gojaznosti (Skovronska i Fichna, 2011) .

Malo je istraživanja posvećeno, detaljnoj analizi držanja tijela u odnosu na tjelesnu masu. Autori ovog rada su pokazali da u istraženoj populaciji djevojčica uzrasta od 7-15 godina, 32,4% ispitanica pati od lošeg držanja tijela, što je znatno niža vrijednost nego u istraživanju drugih autora koji su se bavili ovom tematikom. Nesumnjivo, nedosljedan rezultat proizilazi iz različitih metodologija procjene položaja tijela. U ovom radu, abnormalno držanje tijela se primjenjuje samo na prednje-zadnje oblike fiziološke krivine kičme, dok su Maciałczik - Paprocka i sar. (2012) identifikovali pogrešan položaj tijela u smislu učestalosti abnormalnosti položaja tijela zasnovanoj na modifikovanoj tabeli nepravilnosti držanja tijela (Dega). Taj metod je subjektivan, a autori ukazuju da su abnormalnosti držanja tijela nađeni u 71,4% djevojčica (i kod čak 82,8% djevojčica uzrasta od 7 godina). Isti istraživački tim je ocijenio učestalost lošeg držanja tijela u odnosu na tjelesne težine. Oni su posmatrali anomalije držanja tijela u 85,5% prekomjerno teških (gojaznih) djevojčica. U istraživanju opisanom u ovom radu, autori su identifikovali loše držanje u 30,8% prekomjerno teških (gojaznih) djevojčica.

S obzirom na to da postoji sve veći procenat gojazne djece, rana korekcija nepravilnog držanja tijela može biti značajna, ne samo u spriječavanju lošeg držanja tiela, već i u prevenciji gojaznosti (Woinarowska, 2013). Liječenje bolesti povezanih sa gojaznošću predstavlja najveći dio troškova u zdravstvu (oko 7% ukupne potrošnje u zapadnim zemljama Evrope i 5% u Istočnoj Evropi). Zbog zdravstvenih i socijalnih posljedica, gojaznost je jedan od prioritetnih zdravstvenih problema u Evropi (SZO, 2005) i zabrinutost zbog zdravlja djece, pravilnog držanja tijela i pravilne kičmene krivine postaje značajan društveni problem.

Postoji hitna potreba za programe zdravstvenog obrazovanja i programe porodičnog vaspitanja koji će promovisati zdrav način života kao faktor koji podržava ispravno formiranje držanja tijela kod djece. Pravil-

6.7% of obese subjects. Mazur et al. (2001) diagnosed obesity in 10% of schoolgirls, while Smorczewska-Czupryńska et al. (2000) identified obesity in 12.3% girls aged 14, living in Białystok, Poland.

Obesity is one of the main risk factors for incidence of degenerative overload changes of the osteoarticular system. Overweight subjects suffer mainly from degenerative overload changes of knee and hip joints, as well as lumbar spine. These can lead to skeletal deformity. American estimates show that 50% of the obese suffer from joint pain, and lack of physical exercise leads to an increase in obesity (Skowrońska & Fichna, 2011).

There is little research devoted to a detailed analysis of body posture in relation to body mass. The authors of this paper showed that in the researched population of girls aged 7-15, 32.4% of subjects suffered from bad posture, which is a value lower than in research conducted by other authors in this subject matter. Undoubtedly, the inconsistent result stems from a different methodology of body posture assessment. In this paper, abnormal body posture is applied solely to front-back shape of physiological spine curvature, while Maciałczyk-Paprocka et. all (2012) identified incorrect body posture in terms of incidence of body posture abnormalities based on modified table of posture irregularities by Dega. That method is subjective, and authors indicated that posture abnormalities were found in 71.4% of girls (and as many as 82.8% of girls aged 7). The same research team assessed the incidence of bad posture in relation to body weight; they observed posture abnormalities in 85.5% of overweight/obese girls. In the research described in this paper, the authors identified bad posture in 30.8% of overweight/obese girls.

Considering the fact that there is an increasing proportion of overweight/obese children, early correction of bad posture may be significant not only in prophylaxis of bad body posture, but also in prevention of obesity (Woynarowska, 2013). Treatment of obesity-related diseases constitutes the biggest part of healthcare spending (approx. 7% of total spending in Western Europe countries and 5% in Eastern Europe). Due to its health and social consequences, obesity is one of the priority health problems in Europe (WHO, 2005), and concern over children's health, posture and correct spinal curvature becomes a significant social problem.

There is an urgent need for health education programs and family education programs which would promote healthy lifestyle as a factor which supports correct posture formation in children. Sensible diet, physical activity (especially water sports), seems to be one of the

na ishrana, fizička aktivnost (naročito vodeni sportovi), su izgleda jedni od najefikasnijih faktora promovisanja zdravlja (Łubkowska i sar., 2014).

Nepravilan položaj tijela je pronađen u 32,4% djevojčica uzrasta 7-15 godina. Prekomjerna težina i gojaznost su predispozicija za subjekte za nastajanje nepravilnog držanja kičme: abnormalna kičmena krivina je pronađena u 30,8% prekomjerno teških (gojaznih) devojaka.

most effective health-promoting factors (Łubkowska et al. 2014).

Bad posture was observed in 32.4% of girls aged 7-15. Overweight and obesity did predispose the subjects to bad posture: abnormal spine curvature was found in 30.8% of overweight/obese girls.

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Autori pridonijeli jednako.

Konflikt interesa
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Literatura / References

Barczyk, K., Demczuk-Włodarczyk, E., & Bieć, E. (1997). Kształtowanie się krzywizn przednio-tylnych kręgosłupa u 12-15 letnich dzieci. *Fizjoterapia,* 5 (1), 15-18.

Bendíková, E., & Kostencka, A. (2013). Health in terms of functional disorders of the musculoskeletal system. *Journal of Health Sciences*, 3 (13), 521-538.

Hedley, A. A., Ogden, C. L., Johnson, C. L., Carroll, M. D., Curtin, L. R., & Flegal, K. M. (2004). Prevalence of overweight and obesity among US children, adolescents, and adults, 1999-2002. *Jama*, *291*(23), 2847-2850. doi: 10.1001/jama.291.23.2847.

International Obesity Task Force. (2004). Childhood Report. IASO Newsletter. *Obesity Rev*, (69), 10-11.

Iwanowski, W. (1982). *Kształtowanie się fizjologicznych krzywizn kręgosłupa człowieka. Studium oparte na badaniach dzieci i młodzieży Wrocławia.* Wrocław: AWF.

Janiszewska, R., Tuzinek, S., Nowak, S., Ratynska, A., & Biniaszewski, T. (2009). Nieprawidłowości postawy ciała u dzieci 6-12 letnich – uczniów szkół podstawowych z Radomia – badania pilotażowe. *Probl Hig Epidemiol*, 90 (3), 342-346.

Kania – Gudzio, T., & Wiernicka, M. (2002). Ocena postawy ciała dzieci w wieku 7-15 lat na podstawie wybranej losowo szkoły podstawowej miasta Poznania. *Nowiny Lekarskie*, *71*, 151-159.

Kasperczyk, T. (1988). *Postawa ciała a wybrane cechy morfologiczne i funkcjonalne u dzieci w wieku 8-15 lat*. Akademia Wychowania Fizycznego im. B. Czecha w Krakowie.

Kotwicki, T. (2011). Wady postawy – wykrywanie i zasady postępowania. *In: Profilaktyka wad postawy i kształtowanie zachowań prozdrowotnych wśród dzieci.* Poznań, p. 21-26.

Lewandowski, J. (2011). Epidemiologia bólów dolnego odcinka kręgosłupa u dzieci i młodzieży miasta Poznania. In: *Profilaktyka wad postawy i kształtowanie zachowań prozdrowotnych wśród dzieci.* Poznań, p. 35-37.

Łabaziewicz, L. (1993). Skolioza piersiowo-lędźwiowa lewostronna najczęstsza wada postawy. In: NOWOTNY, J. (Eds.) *Dysfunkcje kręgosłupa. Diagnostyka i Terapia.* Katowice, p. 147-149.

Łubkowska, W. (2003). *Ocena fizjologicznych krzywizn kręgosłupa i jej znaczenie w praktyce szkolnego wychowania fizycznego. Rozprawa doktorska.* Gdańsk: AWFiS.

Łubkowska, W. (2012). Zakresy normatywne fizjologicznych krzywizn kręgosłupa dla szczecińskich dzieci i młodzieży. In: *Zeszyty Naukowe.* Prace Instytutu Kultury Fizycznej. Uniwersytet Szczeciński*,* 771 (28), 89-98.

Lubkowska, W., Paczynska-Jedrycka, M., & Eider, J. (2014). The significance of swimming and corrective exercises in water in treatment of postural deficits and scoliosis. *Central European Journal of Sport Sciences and Medicine*, *2*(2), 93–101.

Łubkowska, W., & Troszczyński, J. (2011a). Próba weryfikacji aktywności ruchowej jako kryterium oceny postawy ciała dziewcząt i chłopców w wieku 7-15 lat. In: *Zeszyty Naukowe. Prace Instytutu Kultury Fizycznej. Uniwersytet Szczeciński,* 631 (27), 27-40.

Łubkowska, W., & Troszczyński, J. (2011b). Wady postawy w płaszczyźnie strzałkowej u dzieci z bocznym skrzywieniem kręgosłupa. In:

Aktywność ruchowa ludzi w różnym wieku, (15), 149-153.

Maciałczyk-Paprocka, K., Krzyżaniak, A., Kotwicki, T., Kałużny, Ł., & Przybylski, J. (2011). Postawa ciała dzieci w wieku przedszkolnym. *Probl Hig Epidemiol*, *92*(2), 286-290.

Maciałczyk-Paprocka, K., Krzyżaniak, A., Kotwicki, T., Sowińska, A., Stawińska-Witoszyńska, B., Krzywińska-Wiewiorowska, M., & Przybylski, J. (2012). Występowanie błędów w postawie ciała u uczniów poznańskich szkół podstawowych. *Probl Hig Epidemiol*, *93*(2), 309-314.

Martínez-Lage, J. F., Cornejo, V. F., López, F., & Poza, M. (2003). Lumbar disc herniation in early childhood: case report and literature review. *Child's Nervous System*, *19*(4), 258-260.

Mazur, A., Małecka-Tendera, E., & Lewin-Kowalik, J. (2001). Nadwaga i otyłość u dzieci szkół podstawowych województwa podkarpackiego. *Ped. Pol*, *76*, 743-748.

Mrozkowiak, M. (2007). Zróżnicowanie występowania postaw ciała prawidłowych, wadliwych i skolioz u dzieci i młodzieży w wieku 4-19 lat w wybranych regionach Polski. *Aktywność Ruchowa Ludzi w Różnym Wieku*, (11 cz. 2), 99-109.

Mrozkowiak, M., Szark-Eckardt, M., Żukowska, H., & Zukow, W. (2014). Review of methods for assessing body posture. Part 2= Przegląd metod oceny postawy ciała. Część 2. *Journal of Health Sciences*, *4*(11), 371-382.

Nowakowski, A. (2011). Schorzenia kręgosłupa i narządu ruchu u dorosłych jako konsekwencje nieleczonych wad postawy. In: *Profilaktyka wad postawy i kształtowanie zachowań prozdrowotnych wśród dzieci.* Poznań, p. 37-40.

Obuchowicz, A. (2005). Epidemiologia nadwagi i otyłości-narastającego problemu zdrowotnego w populacji dzieci i młodzieży. *Endokrynologia, Otyłość i Zaburzenia Przemiany Materii*, *1*(3), 9-12.

Pivovarniček, P., Pupiš, M., Kitka, B., Švantner, R., Malý, T., & Bunc, V. (2013a). Úroveň akceleračnej rýchlosti elitných mladých futbalistov. Česká *kinantropologická společnost, 17* (3), 103-113.

Pivovarniček, P., Pupiš, M., Švantner, R., & Kitka, B. (2013b). Úroveň limitujúcich pohybových schopností obrancov futbalovej reprezentácie slovenskej republiky do 21 rokov. *Slovak Journal Of Sports Sciences*, *5* (2), 27-38.

Prętkiewicz-Abacjew, E., Sykut, L., & Zeyland-Malawka, E. (1992). Objawy asymetrii w postawie ciała u młodszych dzieci szkolnych. In: ŚLĘŻYŃSKI, J. (Eds.) *Postawa ciała człowieka i metody jej oceny.* Katowice, p. 175-179.

Pupišová, Z., & Pupiš, M. (2013). Rozvoj výbušnej sily dolných končatín plavcov. In Šport *a rekreácia 2013: zborník vedeckých prác.* Nitra: UKF, 191-196.

Pupišová, Z. (2013). *Rozvoj výbušnej sily dolných končatín a jej vplyv na efektívnosť štartového skoku v plávaní.* Krakov: SSP.

Pupišová, Z. (2014). Rozvoj a vplyv funkčných parametrov dýchania na výkon v plávaní. In *Kondičný tréning v roku 2014.* Banská Bystrica: SAKT a UMB, 234-241.

Skowrońska, B., & Fichna P. (2011). Otyłość u dzieci i młodzieży oraz jej powikłania. In *Profilaktyka wad postawy i kształtowanie zachowań prozdrowotnych wśród dzieci.* Poznań, 47-49.

Smorczewska-Czupryńska, B., Ustymowicz-Farbiszewska, J., & Karczewski, J. (2000). Ocena występowania nadwagi i otyłości u dzieci szkół podstawowych Białegostoku i okolic. *Przegl Ped., 30* (4), 303-306.

Standera, J. (1999). Analiza zaburzeń statycznych w obrębie miednicy oraz ich wpływ na powstawanie skoliozy. *Med. Manual., 3* (1–2), 28–34.

Starosta, W. (1993). Kształt kręgosłupa z punktu widzenia motoryki człowieka i motoryki sportowej. *Postępy Rehabilitacji, 7* (4), 19-32.

Stoliński, Ł. (2011). Kotwicki T. Wstępne wyniki analizy postawy ciała dzieci biorących udział w projekcie „Poznań stawia na zdrowie–profilaktyka wad postawy". *Profilaktyka wad postawy i kształtowanie zachowań prozdrowotnych wśród dzieci. Poznań*, 11-20.

Suder, A., Sobiecki, J., Kosciuk, T., & Pałosz, J. (2002). Sprawność motoryczna, a postawa ciała dzieci w wieku przedszkolnym. *Nowiny Lekarskie*, (71), 230-235.

Śliwa, W., Bugajski, A., & Czamara, A. (1995). Analiza postawy ciała dzieci ze środowiska miejskiego i wiejskiego. *Med. Sportu*, *43*, 13.

Šmída, L. (2015). Úroveň držania tela u žiakov druhého stupňa základnej školy (Posture level of pupils at primary school). In *Aktuálne problémy telesnej výchovy a športu IV*. Zborník vedeckých prác. Ružomberok: VERBUM, s. 215 – 223.

WHO. (2005). *The European health report 2005. Public health action for healthier children and populations.* Copenhagen, World Health Organization, Regional Office for Europe.

Wilczyński, J. (2006). *Najczęściej występujące wady postawy u chłopców w wieku 13-16 lat badanych komputerową metodą Moiré. Medycyna Pracy, 57* (4), 347-352.

Woynarowska, B. (2013). *Edukacja zdrowotna.* Warszawa: Wydawnictwo Naukowe PWN.

Żukowska, H. (2012). Bod*y posture features in the sagittal plane in firsty-year pupils from rural areas.* In Wilczewski, A. (Eds.) *Determinantes of the development of rural children and youth.* Józef Piłsudski of Physical Education in Warsaw, Faculty of Physical Education and Sport in Biała Podlaska, p. 176-184.

Żukowska, H., Szark-Eckardt, M., Muszkieta, R., & Iermakova, T. (2014). Characteristics of Body Posture in the Sagittal Plane and Fitness of First-Form Pupils from Rural Areas. *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports, 7*, 50-60.

Żukowska, H., Yermakov, S., Szark-Ekardt, M.,Mrozkowiak, M. (2014). Cechy postawy ciała w płaszczyźnie czołowej i poprzecznej chłopców z klas pierwszych ze środowiska wiejskiego. *Visnik Černigivs'kogo Nacional'nogo Pedagogičnogo Universitetu- Seria Pedagogični Nauki. Fizične Vihovannâ ta Sport, 118* (1), 119-122.

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Efekti kegelovih vježbi kod urinarne inkontinencije žena

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Sažetak: Cilj istraživanja je da se dokaže djelotvornost programa Kegelovih vježbi na liječenje blage do umjerene stresne urinarne inkontinencije kod žena. Istraživanje je obuhvatilo 43 pacijentice, liječene u konsultativno-specijalističkoj ambulanti Javne zdravstvene ustanove Dom zdravlja Laktaši. Pacijenticama su uzeti: opšti podaci, indeks tjelesne mase, ginekološka anamneza, socijalna anamneza, svim pacijenticama je urađen ginekološki pregled na dan javljanja u konsultativno-specijalističku ambulantu, procijenjen defekt prednje stijenke rodnice prema POP-Q klasifikaciji. Bolji uspjeh u liječenju inkontinencije smo postigli kod žena u pre i perimenopauzi, u odnosu na žene u postmenopauzi. Kod 14 (35%) pacijentica nismo dobili povlačenje tegoba, izazvane inkontinencijom. Takođe, kod 10 (25%) pacijentica koje su rađale krupniju djecu program Kegelovih vježbi nije dao rezultate. Kod 30 (75%) pacijentica koje su imale visoku, višu ili srednju stručnu spremu nakon odrađenih Kegelovih vježbi, smo dobili prestanak inkontinencije. Kod 10 (25%) pacijentica koje su bile domaćice i obavljale teške fizičke poslove nije došlo do oporavka od inkontinencije.
Na osnovu dobijenih rezultata, zaključili smo da su Kegelove vježbe efikasan način liječenja blage i srednje teške stres urinarne inkontinencije, ali da na efikasnost utiču brojni faktori, kao što su starosna dob žena, tjelesna težina, obrazovanje, broj poroda, težak fizički rad.
Ključne riječi: Kegelove vježbe, urinarna inkontinencija.

Uvod

International Continence Society (ICS) definiše inkontinenciju urina kao stanje nevoljnog oticanja mokraće, koje se može objektivno dokazati, a bolesnik je socijalni i higijenski problem (Abrams, Blaivas, Stanton i Andersen, 1998). Prevalencija poremećaja urinarne inkontinencije raste sa dobi, kod mlađih odraslih žena

Urinary Incontinence and the Effects of Kegel Exercises for Pelvic Muscles

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Abstract: The aim of research was to prove the effectiveness of programs Kegel exercises in treatment of mild to moderate stress urinary incontinence in women. The study included 43 patients treated in specialist outpatient consultative Public Health Institution Health Center Laktaši. The patients were taken: general data, body mass index, gynecological history, social history, all patients underwent gynecological examination on the day of occurrence in consultative specialist clinic, estimated defect of the front wall vagina to POP-Q classification. Better success in the treatment of urinary incontinence in women were achieved in the pre and perimenopausal stages in comparison to postmenopausal stage. In 14 (35%) patients did not get withdrawal symptoms caused by incontinence. Also, in 10 (25%) of women who gave birth to bigger babies the Kegel exercise program failed. In 30 (75%) patients who had high, college or high school education, after the Kegel exercises, we have got the cessation of incontinence. In 10 (25%) patients who were housewives and performed heavy physical work the recovery from incontinence did not occur. Based on obtained results, we concluded that the Kegel exercises effectively improved the condition with patients during mild to moderate stress urinary incontinence treatment, however the efficiency was influenced by numerous factors, such as age of the women, body weight, parity, number of births, heavy physical work, etc.
Keywords: Kegel exercises, urinary incontinence.

Introduction

The International Continence Society (ICS) defines urinary incontinence as a condition of involuntary leakage of urine, which can be objectively demonstrated, and presents the social and hygienic problem for the patient (Abrams, Blaivas, Stanton &Andersen, 1998). The prevalence of urinary incontinence increases with age, with

iznosi od 20-30%, u srednjoj dobi od 30-40%, a u starijoj dobi zahvata gotovo polovinu žena, čak 30-50% (DeLancey, 1992; Hunskaar, Burgio, Diokno et al 2002).

Uzroci inkontinencije urina su: urođena ili razvojna slabost veziva – to je najvažniji momenat u nastajanju descenzusa i prolapsa, što se posebno može primjetiti kao sklonost ovih poremećaja u nekim porodicama; kongenitalni prolaps je udružen sa spinom bifidom; ozljede koje nastaju pri porođaju. Naročito je izražena u slučaju produženog drugog porođajnog doba. Mišićno-vezivna struktura karlice pri tome je duže vrijeme rastegnuta, što dovodi do poremećaja krvotoka i ishemije sa nekrozom, ali i do pucanja mišića (m. levator ani) i naročito vezivnih karličnih fascija (pubocervikalnih i rektovaginalnih) koje su sastavljene od kolagenih i elastičnih vlakana i nisu sposobne izdržati preveliko rastezanje kojima ih izlaže produžen porođaj, te dolazi i do ozljede n. pudendusa. Prolaps materice i rodnice vrlo se rijetko nalazi kod žena koje su rađale carskim rezom (Petros i Ulmsten, 1990;Price, Dawood, Jaekson, 2010, Mant, Paintar, Vessey, 1997); u perimenopauzi, a naročito u postmenopauzi povećava se broj žena sa statičkom inkontinencijom. Popuštanje funkcije jajnika i pad vrijednosti polnih hormona, dodatno slabe mišićno-vezivne strukture karlice, nakon čega je i manji poremećaj dovoljan da spuštanje karličnih organa postane uočljivo. Gubitkom estrogena dolazi do atrofije sluznice, slabije prokrvljenosti submukuznog venskog spleta, te slabijeg tonusa glatkih mišića koji djeluju kao sfinkterski mehanizam uretre. Isto tako slabi prokrvljenost svih struktura u maloj karlici, što izaziva atrofiju organa i njihovo lakše oštećenje; slabost karlične muskulature, vezivnog tkiva i konstitucije bolesnika, operacija u području male karlice; povišenja intraabdominalnog pritiska. Najčešće je to posljedica teških fizičkih poslova, dizanja preteškog tereta, ali i hroničnih opstruktivnih bolesti disajnih organa sa čestim kašljem. Poremećaj probave sa otežanim pražnjenjem crijeva, također dovodi do učestalog i trajnog povišenja intraabdominalnog pritiska.

Inkontinenciju možemo podijeliti na više načina. Prema nastanku se dijele na urođene i stečene, prema uzroku na neurogene i neneurogene, prema mjestu na uretralne i ekstrauretralne, a prema načinu na apsolutne i relativne. Prema ICS (International Continence Society) statička inkontinencija mokraće definiše se kao neželjeno djelovanje mokraće kroz uretru istovremeno sa porastom intraabdominalnog pritiska, zbog kojeg intravezikularni pritisak nadvladava pritisak u uretri, uz odsutnu aktiv-

younger adult women is between 20-30%, in middle age from 30-40%, and in older age makes almost half of the women, even 30-50% (DeLancey, 1992; Hunskaar, Burgio, Diokno et al 2002).

The causes of urinary incontinence are: congenital or developmental weaknesses - that's the most important moment in the emergence of descent and prolapse, which may particularly be noticed as the tendency of these disorders run in families; Congenital prolapse is associated with spina bifida; injuries that occur during childbirth. It is particularly pronounced in the case of a prolonged second stage of labor. Musculo-bonding properties of the pelvis at the same time a longer time is stretched, which leads to ischemia and circulatory disorders with necrosis, as well as to cracking muscle (m. levator ani) as a binder and in particular pelvic fascia (pubocervical and rectovaginal) which are composed of collagen and elastic fiber and are not able to withstand the over-stretching which exposes them to the prolonged labor, and leads to the injury n. pudendus.Prolapse of the uterus and vagina are very rarely found in women who gave birth by caesarean section (Petros i Ulmsten, 1990; Price, Dawood, Jaekson, 2010, Mant, Paintar, Vessey, 1997); menopausal, and particularly postmenopausal women increases the number of the static incontinence. Give ovarian function and decrease the value of sex hormones, in addition to poor muscle-connective structure of the pelvis, followed by a smaller disorder sufficient to lower the pelvic organs become visible. The loss of estrogen leads to mucosal atrophy, poor blood circulation submucosal venous plexus, and the weaker tone of smooth muscles that act as urethral sphincter mechanism. It also weakens the blood supply of all structures in the pelvis, which causes atrophy of organs and damage them easier; the weakness of the pelvic muscles, connective tissue and constitution of the patient, the operations in the pelvis; increase intra-abdominal pressure. It is often the result of heavy physical work, heavy weith lifting, and chronic obstructive respiratory diseases with frequent cough. Indigestion with difficult bowel movement also leads to frequent and continuing increases of intra-abdominal pressure.

Incontinence can be categorized in several ways. According to the origin it can be divided into congenital and acquired, according to the cause of neurogenic and not neurogenic, the place of the urethral and extraurethral, and the manner in absolute and relative. According to ICS (International Continence Society) stress urinary incontinence is defined as involuntary urine leak through the urethra simultaneously with the increase in intra-abdominal pressure, for which intravesical pressure over-

nost detrusora (Shafik A i Shafik IA, 2003). To je najčešći oblik inkontinencije, kod kojeg se već anamnezom može sa velikom vjerovatnošću postaviti dijagnoza, jer bolesnice navode nekontrolisano mokrenje prilikom kihanja, kašljanja, trčanja i sličnih aktivnosti. Jačina stresne inkontinencije je klasifikovana od strane Stameya: 1) grade I: puštanje urina sa naglim porastom abdominalnog pritiska: kašljanje, kihanje ili smijanje 2) grade II: gubitak urina sa manjim stepenom stresa npr. hodanje ili stajanje 3) grade III: gubitak urina bez ikakve veze sa tjelesnom aktivnošću ili položajem npr. dok leži u krevetu (Orešković, 2003). Inkontinencija ne utiče samo na bolesnike nego i na njihove porodice, što predstavlja značajan medicinski, društveni i ekonomski problem Rortveist, Hannestad, Daltveit i Hunskaar (2001).

Kegelove vježbe su vježbe za jačanje mišića dna karlice i efikasne su u liječenju umjerene statičke inkontinecije, sa minimalnim anatomskim promjenama rodnice ili bez njih (Price, Dawood i Jaekson, 2010). Ovu metodu kao terapiju statičke urinarne inkontinencije prvi je osmislio Arnold Kegel 1950.godine(Kegel, 1951). Vježbe se takođe mogu primjeniti profilaktički, u postpartalnom periodu ili nakon operativnih zahvata u maloj karlici (Shafik A i Shafik IA, 2003). Po preporuci Cochrane Incontinence Group one bi trebale biti prva linija konzervativnog liječenja statičke inkontinencije (Hay-Smith, Berghmans, Hendriks et al, 2001). Za uspjeh Kegelovih vježbi od presudne važnosti je da se rade ispravno, redovno i dovoljno dugo od 3 do 4 puta dnevno, od 8 do 10 kontrakcija, zadržanih 3 sekunde. Poboljšanje se očekuje nakon razdoblja od 20 do 60 dana. Iako vježbe ne mogu anatomski korigovati uretralnu hipermobilnost, pomažu u liječenju statičke inkontinencije, jačanjem periuretralne muskulature i poboljšanjem njenog odgovora na porast intraabdominalnog pritiska (Park Seong-Hi i Chang-Bum, 2014)

Osnovni cilj istraživanje je bio dokazivanje djelotvornosti programa Kegelovih vježbi na liječenje blage do umjerene stresne urinarne inkontinencije kod žena.

Materijal i metode rada

Istraživanje je obuhvatilo 43 pacijentice liječene u konsultativno-specijalističkoj ambulanti Javne zdravstvene ustanove Dom zdravlja Laktaši. Istraživanje je sprovedeno od decembra 2014 do marta 2015 godine. U istraživanje su uključene pacijentice sa blagom i srednje teškom stres inkontinencijom. Pacijentice sa genitalnim descenzusom ili prolapsom većim od 2 stepena nisu uključene u istraživanje. Kontrolni pregled je obavljen nakon dva mjeseca.

comes the pressure in the urethra, with an absent detrusor activity (Shafik A i Shafik IA, 2003). It is the most common form of incontinence, in which the history plays relevant role. Patients referred uncontrolled urination while sneezing, coughing, running and other activities.

The severity of stress incontinence is classified by Stamey: 1) Grade I: the release of urine with a rapid increase in abdominal pressure: coughing, sneezing or laughing; 2) Grade II: loss of urine with a lower degree of stress for example walking or standing; 3) Grade III: Loss of urine without any connection to physical activity or position, for example while lying in bed(Oreskovic, 2003). Incontinence affects not only patients but also their families, which represent a significant medical, social and economic problem-Rortveist, Hannestad, Daltveit & Hunskaar (2001).

Kegel exercises are exercises to strengthen the pelvic floor muscles and are effective in the treatment of moderate static incontinence, with minimal anatomical changes of the vagina or without them (Price, Dawood & Jaekson, 2010). This method as static treatment of urinary incontinence was first coined by Arnold Kegel in 1950 (Kegel, 1951). Exercises can also be applied prophylactically, in the postpartum period or after surgery in the pelvis (Shafik A& Shafik IA, 2003). As recommended by the Cochrane Incontinence Group they should be the first line of conservative treatment of incontinence static (Hay-Smith, Berghmans, Hendriks et al, 2001).The success of Kegel exercises depends on them being done properly, regularly and long enough i.e. from 3 to 4 times a day, from 8 to 10 contractions, retained for 3 seconds. The improvement is expected after a period of 20 to 60 days. Although exercise can not anatomically correct urethral hypermobility, it can help the treatment of static incontinence, periurethral muscle strengthening and improve the response to an increase of the intra-abdominal pressure (Park Seong-Hi i Chang-Bum, 2014)

Research was done with the aim to prove the effectiveness of programs Kegel exercises in treatment of mild to moderate stress urinary incontinence in women.

Materials and Methods

The study included 43 patients treated in specialist outpatient consultative Public Health Institution Health Center Laktaši. The survey was conducted from December 2014 to March 2015. The study included patients with mild and moderate stress incontinence. Patients with genital descent or prolapse greater than 2 degrees are not included in the study. An inspection was carried out after two months.

Pacijenticama su uzeti: opšti podaci (starosna dob, tjelesna težina, visina); indeks tjelesne mase (izračunali smo tako što se tjelesna masa izražena u kilogramima podijeli kvadriranom tjelesnom visinom izraženom u kvadratnim metrima tjelesne mase (kg)/tjelesna visina^2 (m^2). Vrijednosti indeksa tjelesne mase (od 18,5-24,9 kg/m^2- normalna; od 25-29,9 kg/m^2 –suvišna tjelesne težina i indeks tjelesne mase od 30,3-34,0 kg/m^2- gojazni I kategorija); ginekološka anamneza (menstrualni ciklus, datum zadnje menstruacije, broj poroda, način porođaja, težina djece na porodu, operativni zahvat na genitalnim organima); socijalna anamneza (stručna sprema, obavljanje teških fizičkih poslova); svim pacijenticama je urađen ginekološki pregled na dan javljanja u konsultativno-specijalističku ambulantu i procijenjen defekt prednje stijenke rodnice prema POP-Q klasifikaciji.

Rezultati

Nakon urađenog ginekološkog pregleda, pažljivo uzete anamneze i fizikalnog pregleda, procijenili smo urinarnu inkontinenciju kod žena. Svim pacijenticama smo preporučili program Kegelovih vježbi u pisanom i slikanom obliku u trajanju od dva mjeseca.

Od 40 pacijentica, 1 (2,5%) je bila starosne dobi između 27 i 37 godina; 25 (62%) ih je bilo između 38 i 45 godina i 14 (35%) pacijentica je bilo između 46 i 55 godina. Sa povećanim indeksom tjelesne mase je bilo 15 (37%) pacijentica, a njih 25 (62%) su imale normalan indeks tjelesne mase. Prema hormonskom statusu u premenopauzi je bila 1 (2,5%) pacijentica, u perimenopauzi je bilo 25 (62%), a u postmenopauzi je bilo 14 (35%) pacijentica. Svih 40 pacijentica su imale više poroda i rađale su vaginalnim putem. Krupniju djecu (oko 4000 gr) je navelo 10 (25%) pacijentica. Operativne zahvate na genitalnim organima su imale 2 (50%) pacijentice. Sa visokom i višom stručnom spremom je bilo 5 (12%) pacijentica, sa srednjom 25 (62%) pacijentica i 10 (25%) su bile domaćice. Teže fizičke poslove je obavljalo 10 (25%) pacijentica.

Nakon odrađenog programa Kegelovih vježbi dobili smo sljedeće rezultate: kod 1 (2,5%) pacijentice u postpartalnom periodu smo nakon odrađenih Kegelovih vježbi u trajanju od dva mjeseca, dobili prestanak inkontinencije. Kod pacijentica između 38 i 45 godine, a bilo ih je ukupno 25 (62%) nakon odrađenog programa vježbi smo dobili: kod 15 (37%) pacijentica je došlo do povlačenja simptoma inkontinencije, kod 10 (25%) su se zadržale iste tegobe. Kod pacijentica između 46 i 55 godine, ukupno njih 14 (35%) nismo dobili poboljšanje ni nakon programa Kegelovih vježbi.

The patients were taken into consideration given: their general data (age, weight, height); body mass index (we calculated dividing the body weight in kilograms divided by the squared body height in meters squared of body weight (kg) / body height2 (m2).The values of body mass index (from 18.5 to 24.9 kg / m2 are normal, from 25 to 29.9 kg / m2 -superfluous body weight and body mass index of 30.3 to 34.0 kg / m2 are fat); gynecological history (menstrual cycle, date of last menstrual period, the number of delivery, mode of delivery, weight of children at birth, surgery on the genitalia); social history (degree, the performance of hard labor); all patients who underwent gynecological examination on the day of reporting to the consultative specialist clinics and estimated defect anterior wall of the vagina towards the POP-Q classification;

Results

After the gynecological examination, careful history and physical examination, we assessed the urinary incontinence in women. To all the patients we recommended a Kegel exercises program.

Out of 40 patients 1 (2.5%) aged between 27 and 37 years; 25 (62%) were between 38 and 45 years old and 14 (35%) of the patients were between 46 and 55 years old. The increased body mass index was found in 15 (37%) patients, and in 25 (62%) we found the normal body mass index. According to the hormonal status there were 1 (2.5%) of patientspre-menopausal, in perimenopausal 25 (62%) and 14 (35%) patients were postmenopausal women. All 40 patients had multiple births and gave birth vaginally. Large children (4,000 g) were reported in 10 (25%) patients.Operativne interventions on the genitalia had 2 (50%) patients. There were 5 (12%) patients with university or college degree, with a mean of 25 (62%) patients and 10 (25%) were housewives. Harder physical work is performed by 10 (25%) patients.

After completing the program of Kegel exercises we got the following results: in 1 (2.5%) patients in the postpartum period doing the Kegel exercises for a period of two months wehad a cessation of incontinence. Patients between 38 and 45 years of age and there were a total of 25 (62%) of them who after a period of exercise program got the results: in 15 (37%) patients there were the withdrawal symptoms of incontinence,while 10 (25%) patients retained the same problem. Patients between 46 and 55 years of age, 14 (35%) of them, did not feel improvement even after the program of Kegel exercises.

Tabela 1. *Efekat Kegelovih vježbi na urinarnu inkontinenciju u zavisnosti od starosne dobi učesnica*

Table 1. *The effect of Kegel exercises on urinary incontinence, depending on the age of participants*

Parametri / *Parameters*	**Povlačenje simptoma / *Withdrawal symptoms***	**Bez povlačenja simptoma / *No withdrawal symptoms***	**Ukupno / *Total***
Premenopauza (od 27 do 37 godina) / *Premenopauzal (age 27 to 37)*	1 (2.5 %)	0	1 (2.5 %)
Perimenopauza (od 38 do 45 godina) / *Perimenopauzal (age 38 to 45)*	15 (37%)	10 (25%)	25 (62 %)
Postmenopauza (od 46 do 55 godina) / *Postmenopauzal (age 46 to 55)*	0	14 (35%)	14 (35%)

Kod 15 (37%) pacijentica koje su imale povećan indeks tjelesne mase, program Kegelovih vježbi nije doveo do poboljšanja tegoba, dok smo kod pacijentica sa normalnim indeksom tjelesne mase postigli izlječenje.

In 15 (37%) patients who had significantly higher body mass index, Kegel exercise program did not help the problems as it was the case in patients with normal BMI.

Tabela 2. *Efekat Kegelovih vježbi na urinarnu inkontinenciju u zavisnosti od BMI učesnica*

Table 2. *The effect of Kegel exercises on urinary incontinence, depending on the BMI of participants*

Parametri / *Parameters*	**Povlačenje simptoma / *Withdrawal symptoms***	**Bez povlačenja simptoma / *No withdrawal symptoms***	**Ukupno / *Total***
Normalan BMI / *A normal BMI*	25 (62%)	0	25 (62%)
Povišen BMI / *Elevated BMI*	0	15 (37%)	15 (37%)

Kod 2 (0,5%) pacijentice koje su imale operativne zahvate na genitalnim organima došlo je do izliječenja. Bolji uspjeh u liječenju inkontinencije smo postigli kod žena u pre i perimenopauzi, u odnosu na žene u postmenopauzi. Kod 14 (35%) pacijentica nismo dobili povlačenje tegoba, izazvane inkontinencijom. Takođe, kod 10 (25%) pacijentica koje su rađale krupniju djecu program Kegelovih vježbi nije dao rezultate.

Kod 30 (75%) pacijentica koje su imale visoku, višu ili srednju stručnu spremu nakon odrađenih Kegelovih vježbi smo dobili prestanak inkontinencije. Kod 10 (25%) pacijentica koje su bile domaćice i obavljale teške fizičke poslove nije došlo do oporavka od inkontinencije.

In 2 (0.5%) patients who had surgeries of the genital organs, there was an improvement noted. Better results in the treatment of incontinence in women have been achieved in the pre and perimenopause, compared to the postmenopausal women. 14 (35%) patients did not get withdrawal problems caused by incontinence. Also, in 10 (25%) patients who gave birth to the larger children, the program of Kegel exercises failed.In 30 (75%) patients who had high, higher or secondary education doing the Kegel exercises we had the cessation of incontinence. In 10 (25%) of patients who were housewives and perform heavy physical labor no recovery from incontinence happened.

Tabela 3. *Efekat Kegelovih vježbi na urinarnu inkontinenciju u zavisnosti od obrazovanja učesnica.*

Table 3. *The effect of Kegel exercises on urinary incontinence, depending on the education of participants.*

Parametri / *Parameters*	**Povlačenje simptoma / *Withdrawal symptoms***	**Bez povlačenja simptoma *No withdrawal symptoms***	**Ukupno / *Total***
VSS / *University Dergree holders*	5 (12 %)	0	5 (12 %)
SSS / *High School holders*	25 (62 %)	0	25 (62 %)
Domaćice / *Housewifes*	0	10 (25 %)	10 (25 %)

Diskusija

Prema dostupnim podacima na svjetskom nivou do 8% stanovništva pati od povremene ili stalne inkontinencije. Kod svih kontinentnih žena sa normalnom uretrovezikularnom anatomijom, pritisak u proksimalnoj uretri

Discussion

According to the available data at the global level up to 8% of the population suffers from occasional or permanent incontinence. In all of continentwomen with a normal urethra-swine anatomy, the pressure in the proximal urethra is

je nepromjenljiv i uvijek je jednak ili nadmašuje pritisak u mjehuru. Iznenadno povećanje pritiska se prenosi na mjehur i proksimalne 2/3 uretre, održavajući pritisak u uretri jednakim ili većim od pritiska u bešici. Kod pacijentica sa urinarnom stress inkontinencijom pritisak u uretri u miru teži da bude niži, mada je još uvijek veći od pritiska u mjehuru. Kašalj pokreće uobičajenu razliku pritiska između uretre i mjehura. Pritisak u mjehuru postaje jednak ili premašuje pritisak u uretri pa se javlja curenje urina.Očigledno je da proksimalno 2/3 normalne uretre leži u abdomenu. Otuda iznenadno podizanje pritiska u abdomenu proizvodi prenošenje pritiska u proksimalne 2/3 uretre kao i u mjehuru. Kod pacijentica sa urinarnom stres inkontinencijom slabo podržana proksimalna uretra je pomjerena i leži van abdominalnog polja sila i ne može da se odupre povećanju pritiska u bešici. Estrogen održava submukozno tkivo širokim i snažnim. Nedostatak estrogena poslije menopauze ili obostrana adnexektomia (odstranjenje jajnika i jajovoda) može da smanji debljinu ovog sunđerastog sloja tkiva. Stoga je statička inkontinencija čest problem koji se javlja u 50 % žena u peri i postmenopauzi (Patel, Amrute i Badlani, 2006; Gabriel, Denschlag, Gobel, et al. 2005). Žene koje su imale dva ili više poroda su u većem riziku za urinarnu inkontinenciju, dok je relativni rizik za žene koje su se porodile carskim rezom (Rortveist, Daltveit, Hannestad i Hunskaar, 2003). Takođe, je bitan i broj poroda, kod višerotki se češće javljaju problemi stres inkontinencije (Shafik A i Shafik IA, 2003). I u našem istraživanju svih 40 pacijentica su imale veći problem sa inkontinencijom jer su imale više poroda i rađale vaginalnim putem. Kegelove vježbe jačaju mišiće dna karlice koje podržavaju matericu, tanko crijevo i rektum. One mogu unaprijediti djelovanje neuromuskularnih veza i refleksa u regiji mjehura i uretre (Sinciar i Ramsay, 2011). U našem istraživanju Kegelove vježbe su bile efikasne kod pacijentica mlađe životne dobi i kod pacijentica u potpartalnom periodu.

Zaključak

Disfunkcija mokraćnog mjehura predstavlja globalan problem koji osim funkcionalnog predstavlja problem odnosa sa partnerom, emocionalni i psihički problem, stoga ga treba staviti u prvi plan i uz kvalitetnu terapiju osigurati adekvatno liječenje.

Na osnovu dobijenih rezultata, zaključili smo da su Kegelove vježbe efikasan način liječenja blage i srednje teške stres urinarne inkontinencije, ali da na efikasnost utiču brojni faktori, kao što su starosna dob žena, tjelesna težina, obrazovanje, broj poroda, težak fizički rad.

unchanged and always equals or exceeds the pressure in the bladder. A sudden increase in pressure is transferred to the bladder and proximal urethra 2/3, maintaining the pressure in the urethra equal to or greater than the pressure in the bladder.Patients with urinary stress incontinence pressure in the urethra at rest tends to be lower, although still higher than the pressure in the bladder. Cough runs normal pressure difference between the urethra and bladder. The pressure of the bubble becomes equal to or exceeds the pressure in the urethra, therefore causing the leakage of urin. Obviously it is 2/3 that of the normal proximal urethra is located in the abdomen. Hence the sudden raising of pressure in the abdomen produces conveying pressure in the proximal 2/3 of the urethra and bladder as well. Patients with urinary stress incontinence poorly supported proximal urethra is shifted and lies outside the abdominal force fields and could not resist the increasing pressure in the bladder. Estrogen keeps submucosal tissue wide and strong. The lack of estrogen after menopause or bilateral adnexektomia (removal of the ovaries and fallopian tubes) can reduce the thickness of this layer of spongy tissue. Therefore, the static incontinence is a common problem that occurs in 50% of women in the peri and postmenopausal phase (Patel, Amrute i Badlani, 2006; Gabriel, Denschlag, Gobel, et al. 2005). Women who have had two or more births are at higher risk for urinary incontinence, while the risk is relative for women who gave birth by Caesarean section. (Rortveist, Daltveit, Hannestad &Hunskaar, 2003). Also, a significant number of births cuses that mothers are more likely to have problems of stress incontinence (Shafik A & Shafik IA, 2003). In our study, all 40 patients had a bigproblem with incontinence because they had worked hard and gave birth vaginally. Kegel exercises strengthen the pelvic floor muscles that support the uterus, small intestine and rectum. One can enhance the effect of neuromuscular connections and reflexes in the region of the bladder and urethra (Sinciar & Ramsay, 2011). In our study Kegel exercises were effective in younger patients and in patients in postpartum period.

Conclusion

The dysfunction of the bladder represents a global problem that represents a problem for functional relationship with a partner, emotional and psychological problem, so it should be placed in the righ place with intention to reach quality therapy to ensure adequate treatment.

Based upon these results, we concluded that Kegel exercises were the effective way of treating mild and moderate stress urinary incontinence, but the efficiency was influenced by numerous factors, such as age women, body weight, education, number of births, heavy physical work.

Izjava autora
Autori pridonijeli jednako.

Konflikt interesa
Mi izjavljujemo da nemamo konflikt interesa.

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The authors have contributed equally.

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Literatura / References

Abrams, P., Blaivas, J. G., Stanton, S. L., & Andersen, J. T. (1987). The standardisation of terminology of lower urinary tract function. The International Continence Society Committee on Standardisation of Terminology. *Scandinavian journal of urology and nephrology. Supplementum*, *114*, 5-19.

DeLancey, J.O. (1992). Anatomic aspect of vaginal everison after hysterectomy. *Am J Obstet Gynecol., 166,* 1717-1728.

Gabriel, B., Denschlag, D., Göbel, H., Fittkow, C., Werner, M., Gitsch, G., & Watermann, D. (2005). Uterosacral ligament in postmenopausal women with or without pelvic organ prolapse. *International Urogynecology Journal*, *16*(6), 475-479.

Hay-Smith EJ,; Bo K,; Berghmans LC,; Hendriks HJ,; De Bie RA,; van Waalwijk van Doorn ES. (2001). Pelvic floor muscle training for urinary incontinence in women. *Cochrane Database Syst Rev. 1.*

Hunskaar S, Burgio K, Diokno AC, et all. Epidemiology and natural history of urinary incontinence. In: Abrams PC, Khoury S, Wein A, editors. Incontinence: 2nd International Consultation on Incontinence. Plymouth, U.K.: Health Publications Ltd; 2002. pp. 165–201.

Kegel, A. H. (1951). Physiologic therapy for urinary stress incontinence. *Journal of the American Medical Association*, *146*(10), 915-917.

Mant, J., Painter, R., & Vessey, M. (1997). Epidemiology of genital prolapse: observations from the Oxford Family Planning Association Study. *BJOG: An International Journal of Obstetrics & Gynaecology*, *104*(5), 579-585.

Oreskovic S. Urogynecology. (2003). In: A. Wolf et al, eds. Gynecology and perinatology. Tonimir, Varaždinske spa, 2003: 435-56.

Park, S. H., & Kang, C. B. (2014). Effect of Kegel Exercises on the Management of Female Stress Urinary Incontinence: A Systematic Review of Randomized Controlled Trials. *Advances in Nursing*, *2014*.

Patel, P. D., Amrute, K. V., & Badlani, G. H. (2006). Pathophysiology of pelvic organ prolapse and stress urinary incontinence. *Indian Journal of Urology*, *22*(4), 310.

Petros, P. E., & Ulmsten, U. I. (1992). An integral theory and its method for the diagnosis and management of female urinary incontinence. *Scandinavian journal of urology and nephrology. Supplementum*, *153*, 1-93.

Petros, P. E. P., & Ulmsten, U. I. (1990). An integral theory of female urinary incontinence. *Acta Obstetricia et Gynecologica Scandinavica*, *69* (S153), 7-31.

Price, N., Dawood, R., & Jackson, S. R. (2010). Pelvic floor exercise for urinary incontinence: a systematic literature review. *Maturitas*, *67*(4), 309-315.

Rortveit, G., Daltveit, A. K., Hannestad, Y. S., & Hunskaar, S. (2003). Urinary incontinence after vaginal delivery or cesarean section. *New England Journal of Medicine*, *348*(10), 900-907.

Rortveit, G., Hannestad, Y. S., Daltveit, A. K., & Hunskaar, S. (2001). Age-and type-dependent effects of parity on urinary incontinence: the Norwegian EPINCONT study. *Obstetrics & Gynecology*, *98*(6), 1004-1010.

Shafik, A., & Shafik, I. A. (2003). Overactive bladder inhibition in response to pelvic floor muscle exercises. *World journal of urology*, *20*(6), 374-377.

Sinclair, A. J., & Ramsay, I. N. (2011). The psychosocial impact of urinary incontinence in women. *The Obstetrician & Gynaecologist*, *13*(3), 143-148.

Save M, & Dijakovic A Conservative treatment of urinary incontinence. (2008). In: (Ed. Oreskovic S, D Barisic, & Raić Z.). *The modern approach to the diagnosis and treatment of women with urinary incontinence and pelvic floor defects.* Zagreb: Medical Publishing, Faculty of Medicine.

Walters, M. D. (1989). Mechanisms of continence and voiding, with international continence society classification of dysfunction. *Obstetrics and gynecology clinics of North America*, *16*(4), 773-785.

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Razlike u percepciji, znanjima i stavovima studenata fizičkog vaspitanja i sporta o korišćenju nedozvoljenih supstanci u sportu

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Sažetak: Problem upotrebe zabranjenih supstanci (dopinga) u sportu je bio, jeste i biće aktuelan problem koji narušava sam duh sporta, ljepotu i zadovoljstvo, a vrlo često i zdravlje sportiste. Zbog toga je neophodno pristupiti rješavanju ovoga problema, ako je moguće i trajno, mada je to nekada jednostavno neizvodljivo. U istraživanju je učestvovalo ukupno 200 studenata Fakulteta fizičkog vaspitanja i sporta, od čega 100 studenata Univerziteta u Istočnom Sarajevu (Bosna i Hercegovina) i 100 studenata AMU Aligarh PU (Indija), starosne dobi od 18-26 godina. Od ukupnog uzorka 170 (85%) su bili ispitanici muškog pola, dok je 30 (15%) ženskog pola. Osnovni cilj istraživanja je bio da se provjeri nivo znanja i utvrde stavovi studenata i utvrde njihove međusobne razlike o upotrebi zabranjenih supstanci u sportu. Za prikupljanje neophodnih informacija korišćen je anonimni anketni upitnik sa 13 jasno definisanih pitanja, (11 pitanja zatvorenog i 2 pitanja otvorenog tipa) koja su se odnosila na određena znanja, stavove o dopingu u sportu. Dobijeni su relevantni rezultati koji su globalni pokazatelj informisanosti, znanja i stavova populacije studenata fizičkog vaspitanja i sporta o sve većem problemu današnjeg modernog sporta koga nazivamo doping. Od ukupnog uzorka, čak 85% studenata oba subuzorka su označili atletiku kao sport sa najviše doping afera, a zatim slijedi biciklizam (43%), bodi bilding i dizanje tegova (22%), dok su sportske igre sa (28%), Cricket (25%), Streljaštvo i Šah sa (19%), kao sportovi sa najmanjim brojem doping afera.
Ključne riječi: farmakološka sredstva, zdravstveno stanje, posljedice, prevencija, edukacija.

Differences in Perception, Knowledge and Attitudes Students Physical Education and Sport on Use of Prohibited Substances in Sport

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Abstract: The problem of the use of banned substances (doping) in sport has been, is and will be an ongoing problem that undermines the very spirit of sport, beauty and pleasure, and very often the health of athletes. Therefore, it is essential to solve this problem, if possible, permanently, although it is sometimes simply impossible to do. The research included total 200 students from Faculty of Physical Education and Sport, of which 100 students were from the University in Eastern Sarajevo (Bosnia and Herzegovina) and 100 students from the Department of Physical Education AMU Aligarh (India), aged 18-26 years. Of the total sample, 170 (85%) of the participants were males, while 30 (15%) were females. The main objective of the study was to test the level of differences in knowledge and identify students' attitudes about the use of prohibited substances in sport. To collect the necessary information has been used an anonymous questionnaire with 13 clearly defined questions (11 closed questions and two open-ended questions) that are related to specific knowledge, attitudes about doping in sport. The obtained results are relevant to the global indicator of awareness, knowledge and attitudes of the population of students about the problem of today's modern sport which is called doping. Of the total sample 85% of the students marked the athletics as a sport with the most doping scandals, followed by Cycling (43%) and Body building and Weightlifting (22%), while the Sports games (28%), Cricket (25%), Shooting and Chess (19%), as well as sports with the least number doping scandals.
Key words: pharmacological agents, health condition, consequences, prevention, education.

Uvod

Posmatrano kroz istoriju čovjek je uvijek nastojao da vještački poveća učinak u sportu, a prvi slučajevi dopinga su zabilježeni na Olimpijskim igrama, kada Filostrat opisuje da doping nije i nikada nije bio samo sportski fenomen, već su ljudi posezali za dopingom ili drogama gdje god bilo potrebno da budu vrlo moćni i jaki (Laure, Binsinger, & Lecerf, 2003). **Pioniri dopinga u modernom sportu su bili plivači, koju su na takmičenju 1865 preplivali Amsterdamski kanal i u Amsterdamu prednjačili u svim disciplinama.** Prve informacije o dopingovanim sportistima imamo na modernim OI iz St. Louisa kada je američki pobjednik maratona Hicks na medicinskoj njezi primio nekoliko potkožnih injekcija strihnin-sulfata (Pupiš Pupiš, & Polgar, 2006).

Međunarodni olimpijski komitet je 1975. godine je zabranio korišćenje svih oblika stimulanata. Istovremeno, bez obzira na deklarativno zalaganje za očuvanje sportskog duha, dobar dio sportskih saveza nastavio je sa razvojem hemijskih i bioloških sredstava, kao i metoda koje će omogućavati konstantno pomijeranje granica izdržljivosti i izvodljivog. Mnoge metode su krajnje nehumane i usmjerene samo ka zloupotrebi fizičkog i psihičkog integriteta sportiste/sportistkinje i raznih zakulisnih političkih igara (Živanović, 2000; Pavlović, 2006).

Najnovije oduzimanje medalja biciklisti i pobjedniku Tourn de France Lensu Armstrongu je svakako iznenađujući podatak ali i upozorava sve one koji se upuštaju u doping sredstva da će biti otkriveni i samim tim izgubiti mnogo više od medalje, ugled i čast u svijetu sporta.

Posljednje OI u Londonu su takođe obilježile doping afere nekih sportista, gdje je pred same igre diskvalifikovano 12 sportista (borilački sportovi, atletika, biciklizam, gimnastika, vodeni sportovi) a oduzete su i dvije medalje nakon igara. Zlato je oduzeto Bjeloruskoj bacačici kugle Nadzey-i Ostapchuk koja je testirana na methenolone i bronza rvaču Uzbekistancu Soslan Tigievu (Grohmann, 2012a). To se dogodilo iako je prije OI u Londonu bilo najavljeno da će polovina takmičara biti testirana na droge sa 150 naučnika, koji će uzeti uzorke do kraja Paraolimpijskih igara. Takođe je navedeno da će svaki takmičar koji osvoji medalju biti podvrgunt testiranju, a Olimpijski anti-doping laboratorij će testirati do 400 uzoraka svaki dan za više od 240 zabranjenih tvari, gdje će u toku samog takmičenja biti dostupni za testiranje bez bilo kakvog obaviještenja (BBC, 2012). Šokantan je podatak zvaničnika Svjetske anti-doping agencije (WADA), John Fahey, koja je objavila da je do 24. jula čak 107 sportista bilo kažnjeno zbog dopinga u proteklih šest mjeseci do 19. juna (Grohmann, 2012a,b).

Introduction

Looking through the history man has always tried to artificially enhance performance in sport, and the first cases of doping were reported in the Olympics, when Philostratus describes that the doping is not and has never been just a sports phenomenon, but the people resorted to doping or powerful and strong (Laure, Binsinger, & Lecerf, 2003). Pioneers of modern doping in sport were swimmers, they swam at the 1865 contest the Amsterdam channel and they were excelling in all disciplines. The first information about the doped athletes we have in the modern Olympics from St. Louis when American winner of the marathon Hicks while on medical care received several subcutaneous injections of strychnine sulphate (Pupiš and Polgar, 2006).

The International Olympic Committee in 1975 prohibited the use of all forms of stimulants. At the same time, regardless of the stated commitment to preserve the spirit of sport, most of the sports federations continued with the development of chemical and biological agents and methods that will enable consistently move the limits of endurance and feasible.

Many methods are extremely inhumane and only directed towards the misuse of physical and psychological integrity of sportsmen / sports women, of a variety of backroom political games (Živanović, 2000, Pavlović, 2006).

The latest seizure of medals from cyclist and Tour de France winner Lance Armstrong is certainly a surprising fact and warns all those who engage in doping substances to be detected and thus lose much more than medals, prestige and honor in the world of sports.

The last Olympics in London were also marked by doping scandals of some athletes, when before the start of the games itself 12 athletes were disqualified (martial arts, athletics, cycling, gymnastics, water sports) and two medals were seized after the games. Gold has taken from Belarusian Nadzeya Ostapchuk ball thrower who was tested on Methenolone and from Uzbeks wrestler Soslan Tigievu the bronze medal. This happened although before the Olympic Games in London was announced that half of the competitors will be tested for drugs with 150 scientists, which will take samples by the end of the Paraolympic Games. It was also stated that any athlete who wins a medal will undergo testing and Olympic anti-doping lab will test up to 400 samples per day for more than 240 banned substances, where in the course of the competition they will be available for testing without any notice (BBC, 2012). A shocking fact of the official of the World Anti-Doping Agency (WADA), John Fahey, who published that to 24 July 107 athletes were sanctioned for doping in the last six months to 19 June (Grohmann, 2012a,b).

Znanja i stavovi studentske populacije o problemu dopinga u sportu su bila predmet istraživanja nekih autora. Autori (Melia, Pipe, & Greenberg, 1996) su sproveli anketu u pet Kanadskih regija koja je obuhvatila 107 škola sa 16.119 učenika, nasumično odabaranih sa ciljem određivanja prevalencije upotrebe anaboličkih-androgenih steroida, njihovih stavova i znanja o dopingu. Rezultati su pokazali da je veći broj koristio zabranjene supstance u godini prije istraživanja. 29,4% ispitanika se izjasnilo da su ubrizgali neku supstancu, a 29,2% je dijelilo iglu u toku ubrizgavanja anabolički-androgeni steroida. Značajan broj ispitanika je izjavilo da koriste druge supstance (kofein, 27%; dodatne proteine, 27%; alkohol, 8,6%; protiv bolova, 9%; stimulanse, 3,1%; „doping metode", 2,3%; beta-blokatore, 1%) u pokušajima da poboljšaju sportski rezultat. Ovi rezultati su bili alarmantni i neočekivani za nastavnike, zdravstvene i sportske radnike. Švedski autori Kindlundh, Isacson, Berglund, & Nyberg, (1998) su sproveli istraživanje među adolecentima srednjih škola Uppsale kako bi utvrdili stepen uzimanja zabranjenih droga u sportu. Anonimni upitnik je obuhvatio 2742 učenika. Rezultati su pokazali da je 2,7% muškaraca i 0,4% djevojaka koristio doping u nekom trenutku svoga života. Kao glavni razlog korištenja dopinga su naveli poboljšnje fizičkog izgleda i poboljšanje sportskih performansi. Istraživanja korišćenja anaboličkih androgenih steroida (AAS) u slučajnom uzorku iz pet teretana su sproveli Kanajama i saradnici (Kanayama, Gruber, Pope, Borowiecki & Hudson, 2001). Dobijeni su rezultate da 3,5% ukupne populacije koristi AAS, od čega 5,4% obuhvata mušku populaciju.

Pojedini domaći istraživači su istraživali prevalencu korišćenja AAS na srpskoj populaciji Body bildera (Jovanović & Radovanović, 2001). Na uzorku rekreativnih body-bildera dobijeni su rezultati da je 5,23% ispitanih, bar jednom, koristilo AAS. Alarmantne rezultate istraživanja su dobili Poljski autori (Rachoń, Pokrywka, Suchecka-Rachoń, 2006). Oni su putem poznatih internet portala sproveli anketu tokom jednog mjeseca sa ciljem utvrđivanja prevencije upotrebe droga u sportu među mladima. Uzorak je obuhvatio 3687 (muškaraca 48,2%) i (žena 51,8%), dobi 19-20 godina. Pitanja su se odnosila na njihovu tjelesnu aktivnost, vježbe i ponašanje, nivo obrazovanja i korištenje anaboličkih androgenih steroida (AAS). Rezultati su pokazali da je učestalost upotrebe AAS kod muškaraca 6,2% i 2,9% kod žena. Muški AAS korisnici, u odnosu na nekorisnike, bili su češće zabrinuti zbog njihovog fizičkog izgleda, bili su manje obrazovani i često se bavili nekom sportskom aktivnošću. Među ženskim AAS korisnicima, nema značajne razlike u vezi

Knowledge and attitudes of university students about the problem of doping in sport has been the subject of research by other authors. The authors Melia, Pipe, & Greenberg, (1996) conducted a survey of five Canadian regions, which included 107 schools with 16,119 students, randomly selected in order to determine the prevalence of the use of anabolic-androgenic steroids, their attitudes and knowledge about doping. The results showed that most of them used banned substances in the year prior to the survey. 29.4% of respondents said they injected some substance, and 29.2% shared the needle during injection of anabolic-androgenic steroids. A significant number of respondents said they used other substances (caffeine, 27%, extra protein, 27%, alcohol 8.6%; for pains, 9%; stimulants, 3.1%; "doping methods", 2.3%, beta-blockers, 1%) attempting to improve sport performance. These results were unexpected and alarming for teachers, health and sports workers. Swedish authors Kindludh, Isacson, Berglund, et al. (1998) conducted a survey among high school adolescents Uppsala in order to determine the degree of taking banned drugs in sports. Anonymous questionnaire included 2742 students. The results showed that 2.7% of men and 0.4% of girls used the drug at some time in their lives. As the main reason for doping they cited the improvement of physical appearance and the improvement of athletic performances. The research of use of anabolic androgenic steroids (AAS) in a random sample from five gyms conducted Kanayama, Gruber, Pope, et al. 2001). They got the results that 3.5% of the total population uses AAS, of which 5.4% is the male population.

Some home researchers have investigated the prevalence of AAS use on the Serbian population (Jovanovic & Radovanovic, 2001). In a sample of recreational bodybuilders, there were obtained the results that 5.23% of bodybuilders, at least once, used the AAS. The alarming results of research obtained Polish authors (Rachon, Pokrywka, & Suchecka-Rachoń, 2006). They are through known internet portal conducted a survey during one month in order to determine the prevention of drug use among young people in sport. The sample consisted of 3687 (48.2% of men) and (women 51.8%), aged 19-20 years. Questions were related to their physical activity, exercise and behavior, level of education and the use of anabolic androgenic steroids (AAS). The results showed that the prevalence of AAS use among men 6,2% and 2,9% in women. Male AAS users, compared to non-users, were more concerned about their physical appearance, were less educated and often engaged in a sporting activity. Among female AAS users, there are no significant differences regarding lifestyle or sports participation. However, when compared to

životnog stila ili učestvovanja u sportu. Međutim, u odnosu na nekorisnike, ženski AAS korisnici su bili manje obrazovani, gdje se došlo do zaključka da je upotreba AAS stvarnost u Poljskoj i može postati ozbiljan zdravstveni problem među adolescentima i mladima. Grupa američkih autora u obimnoj studiji su prikazali rezultate nacionalne ankete koja je pokazala upotrebu anaboličkih steroida, učestalost korišćenja i njihove trendove među američkim studentima. Podaci su prikupljeni kroz ranije ankete preko 40.000 studenata sa 119 fakulteta u periodima 1993, 1997, 1999, 2001. Rezultati su pokazali da je u tom periodu 1993-2001 došlo do porasta upotrebe zabranjenih supstanci.

Wanjek, Rosendahl, Strauss, & Gabriel, (2007) su objavili rezultate istraživanja sprovednog 2004 u Tiringiji (Njemačka) na osnovu ankete u 16 osnovnih, 4 srednje, tri sportske i 4 strukovne škole sa ciljem trenutne situacije i mogućih intervencija kada je u pitanju upotreba nedozvoljenih supstanci. Od ukupnog broja 2287 učenika čak 15,1% koristilo zabranjen doping iz prethodne godine. Od toga je 0,7% konzumiralo anaboličke androgene steroide (AAS); 0,4% hormon rasta; 2,4% stimulanse; 13,2% kanabis; 0.1% diuretike; 2,2% kokain/heroin i 0,3% erythropoeitin. Šta više, 490 nesportista je potvrdilo da za 5% više koriste doping od rekreativnih sportista (N=1254) i gotovo tri puta više od sportista (N=497). Sve tri grupe nesportisti, rekretivci i sportisti imali su loše rezultate na testu znanja o dopingu u cjelini, s prosjekom ispod 60% u svakom slučaju. Nalazi studije upućuju na potrebu za poboljšanjem specifičnih znanja o dopingu među učenicima i studentima i da njihov stav prema dopingu mora biti promijenjen. Slična istraživanja su sprovedena u nekolike zadnje godine od strane Ukrajinskih autora koji su čak publikovali nacionalnu studiju u saradnji sa WADA-om (Bondarev, Ajitskiy, Galchinsky, Labskir, & Druz, 2008; Bondarev, Galchinsky, Labskir, Druz, & Ajitskiy, 2009; Bondarev, & Sirenko, 2010). Slična istraživanja koja su se bavila problemom znanja i prevencije o korišćenju nedozvoljenih doping supstanci na populaciji studenata fizičkog vaspitanja i sporta su realizovana od strane Pavlovic and Pupiš (2013), Pavlovic, & Idrizović (2013), i Khan et al. (2014).

Osnovni problem koji je definisan u ovom istraživanju jesu razlike u percepciji, stavovima i znanjima između studenata Fizičkog vaspitanja i sporta Univerziteta u Istočnom Sarajevu (Bosna i Hercegovina) i studenata AMU Aligarh PU (Indija) o upotrebi i mogućoj prevenciji dopinga u sportu.

non-users, female AAS users were less educated, where it was concluded that the use of AAS in Poland is reality and it can become a serious health problem among adolescents and young adults.

A group of American authors McCabe, Brower, Brady, et al. (2007), in extensive studies have presented the results of a national survey that showed the use of anabolic steroids, frequency of usage and trends among U.S. college students. Data were collected through earlier surveys with more than 40,000 students from 119 faculties in the periods 1993, 1997, 1999, 2001. The results showed that in the period 1993-2001 has been a surge in the use of prohibited substances. In 2007 the German authors Wanjek, Rosendahl, Strauss, et al. (2007) have published the results of research conducted in 2004 in Thuringia (Germany) based on a survey of 16 elementary, 4 high, three sports and 4 vocational schools with the aim of determining the current situation and possible intervention when it comes to the use of illegal substances. From the total number of 2287 students even 15.1% used a banned drug in the previous year. Of these, 0.7% consumed anabolic androgenic steroids (AAS), 0.4% of growth hormones, stimulants, 2.4%, 13.2% cannabis, 0.1% diuretics, 2.2% cocaine / heroin and 0.3% erythropoetin. More over, 490 non sportsmen confirmed that in 5% more they use doping from recreational athletes (N = 1254) and almost three times more than the athletes (N = 497). All three groups of non-athletes, recreational athletes and sportsmen had poor results on the test of knowledge about doping in general, with an average below 60% in every case. The findings indicate the need to improve specific knowledge of doping among students and their attitude toward doping has to be changed. Similar researches were carried out in the last few years by Ukrainian authors who have even published a national study in partnership with WADA (Bondarev, Ajitskiy, Galchinsky, Labskir, & Druz, 2008; Bondarev, Galchinsky, Labskir, Druz, & Ajitskiy, 2009; Bondarev, & Sirenko, 2010).

Similar to research that dealt with the problem of knowledge and prevention of the use of illegal doping substances in the population of students of physical education and sport are made by Pavlovic and Pupiš (2013), Pavlovic & Idrizović (2013), and Khan et al. (2014).

The main problem, which is defined in this study are differences in perception, attitudes and knowledge among students of Physical Education and Sport, University of East Sarajevo (Bosnia and Herzegovina) and students of AMU AligarhUP (India) on the use and possible prevention doping in sport.

Metod

U istraživanju je učestvovalo ukupno 200 studenata, od čega 100 studenata Fakulteta fizičkog vaspitanja i sporta iz Istočnog Sarajeva (Bosna i Hercegovina) i 100 studenata Fakulteta fizičkog vaspitanja AMU Aligarh PU (Indija). Obuhvaćeni su studenti starosne dobi 18-26 godine. Od ukupnog uzorka (N=200), 170 ispitanika su osobe muškog pola, a 30 ispitanika su osobe ženskog pola. U skladu sa prirodom problema i ciljem istraživanja primjenjena je metoda sistemsko-neeksperimentalnog istraživanja. Kao način prikupljanja neophodnih informacija korišćen je anonimni anketni upitnik (Pavlović i Pupiš, 2013) sa 13 jasno definisanih pitanja koja su se odnosila na određena znanja i stavove o upotrebi dopinga sredstava u sportu (jedanaest pitanja zatvorenog tipa i dva pitanja su bila otvorenog tipa). Anketa sa studentima je sprovedena u školskoj 2012/13; 2013/14; 2014/15 godini, i svi studenti su dobrovoljno učestvovali u anketiranju. Rezultati su izraženi u nominalnim i procentualnim vrijednostima.

Rezultati

Rezultati našeg istraživanja su predstavljeni Tabelarno i grafički (zastupljenost dopinga u sportovima). Na osnovu uvida u Tabelu 1 može se zaključiti da su studenti bili jedinstveni u 3 pitanja (pitanje br. 1,2,11) u kojima su imali skoro identične numeričke procentualne vrijednosti. Oko 58% svih studenata nije upoznato sa listom popisa zabranjenih supstanci i lijekova, a 67% studenata nije nikada došlo u kontakt sa bilo kojom doping supstancom, što je i ohrabrujući pozitivan podatak. Međutim, samo 55% studenata poznaju skraćenicu WADA, što je pokazatelj da još uvijek nisu dovoljno upoznati sa ovom problematikom oko dopinga. U drugim pitanjima mišljenja su bila podijeljena ali ipak se nisu dijametralno razlikovala u odgovorima. Dobijeni rezultati su izuzetno značajni, jer se radi o istim populacijama sa različitih geografskih oblasti. Na bazi rezultata ankete dobijena je jednu relna slika o stavovima i znanjima studentske populacije o (zlo) upotrebama dopinga u sportu.

Method

The study included a total of 200 students, 100 of which were students from the Faculty of Physical Education and Sports in Eastern Sarajevo (Bosnia and Herzegovina) and 100 students from the Department of Physical Education from AMU Aligarh UP (India). The students that were included were of 18-26 years of age. Of the total sample (N=200), 170 of the participants were males, while 30 were females. In accordance with the nature of the problem and the aim of the research it was applied systematically-non-experimental research method. As a way of gathering the necessary information, an anonymous questionnaire (Pavlović &Pupiš, 2013) was used with 13 clearly defined questions which were related to the specific knowledge and attitudes about the use of doping substances in sports (eleven were closed type questions and two questions were open type). The survey was conducted with students in the academic year 2012/13; 2013/14, 2014/15, and all of the students voluntarily participated in the survey. Results are expressed in nominal and percentage values.

Results

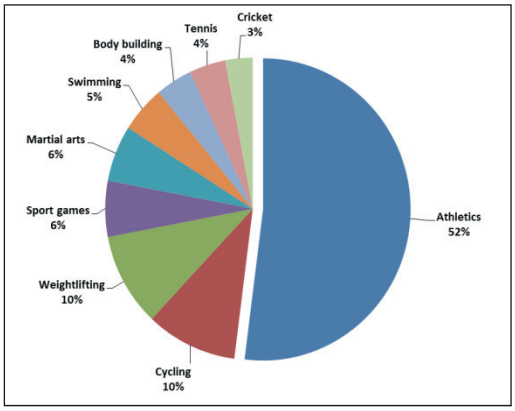
Results of this study are presented in tables and graphs (representation of doping in sports). Based on the findings in Table 1 it can be concluded that the students were the unique in three issues (Nos. 1,2,11) in which they had almost identical numerical percentage value. Around 58% of all students were not familiar with the list of the list of banned substances and drugs, and 67% of students had never come in contact with any doping substance, which is positive and encouraging data. However, only 55% of students know the acronym WADA, which is an indication that we still are not familiar with this issue about doping.

In other matters of opinion were divided but are not diametrically different in their responses. The results are great and extremely important, because it is about the same populations from different geographical areas. Based on the survey results obtained in a more realistic picture of the attitudes and knowledge of the student population on abuses of doping in sport.

Tabela 1 *Odgovori u anketnom upitniku izraženi kroz nominalne i procentualne vrijednosti*

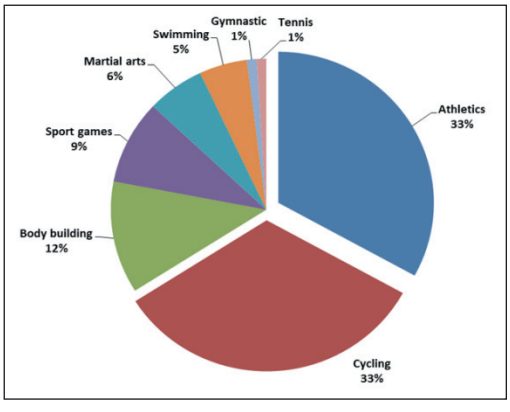
Table 1. *Answers to the questionnaire expressed through nominal and percentage values*

	Pitanja? / *Questions?*	Fakultet fizičkog vaspitanja i sporta, Univerzitet u Istočnom sarajevu, Bosna i Hercegovina / *Faculty Physical Education and Sport, University in East Sarajevo, Bosnia and Herzegovina*		Katedra fizičkog vaspitanja, Aligarh Muslimanski Univerzitet, Aligarh, P.U. Indija / *Department of Physical Education in Aligarh Muslim University, Aligarh, U.P. India*	
		YES %	NO%	YES%	NO%
1	Da li ste ikada došli u kontakt sa doping supstancom? *Have you ever come in contact with doping substances?*	32	68	34	66
2	Da li znate popis zabranjenih supstanci i lijekova? *Do you know the list of banned substances and drugs?*	43	57	42	58
3	Da li ste ikada uzeli zabranjenu supstancu? *Have you ever taken the banned substance?*	13	87	9	91
4	Da li bi vi ikada uzeli doping za ostvarenje ličnih rezultata? *Would you ever taken the drug to achieve personal results?*	36	64	14	86
5	Mislite li da su neki od sadašnjih najboljih sportista uzimali doping? / *Do you think that some of the current top athletes were taking drug?*	99	1	65	35
6	Jeste li upoznali nekoga a za koga ste znali da je uzimao doping? / *Have you met someone for whom you knew he was taking dope?*	65	35	30	70
7	Mislite li da je ispravno da pozitivnog na doping imate u svojoj blizini? / *Do you think it is right to have someone positive to doping near you?*	47	53	74	26
8	Mislite li da doping kontrola može 100% otkriti dopingovanog sportistu? / *Do you think that doping controls can detect 100% athletes who took dope?*	52	48	35	65
9	Mislite li da postoji način da se prevare testovi na doping kontrolu? / *Do you think there is a way to deceive the doping control tests?*	69	31	52	48
10	Postoje li neki od svjetskog anti-doping programa za podršku sportista u zemlji? / *Are there some of the world anti-doping program to support the athletes in the country?*	44	56	34	64
11	Da li znate šta je WADA? *Do you know what is WADA?*	56	44	55	45
12	Za koji sport mislite da je najviše obilježio doping afere? *Which sport do you think is the most marked by doping scandals?*	Slika 1 / *Graphs 1*		Slika 2 / *Graphs 2*	
13	Za koji sport mislite da je najmanje zaražen drogama? *Which sport do you think is the least marked by doping scandals?*	Slika 3 / *Graphs 3*		Slika 4 / *Graphs 4*	



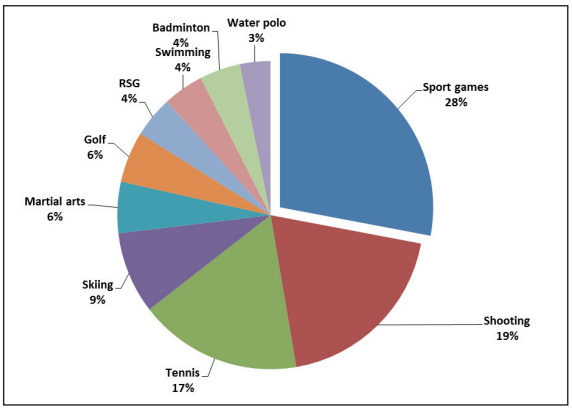
Grafikon 1. *Sport koji je najmanje obilježio doping afere (Istočno Sarajevo-BIH)*

Graphs 1. *Sports most marked by doping scandals (East Sarajevo-BIH)*



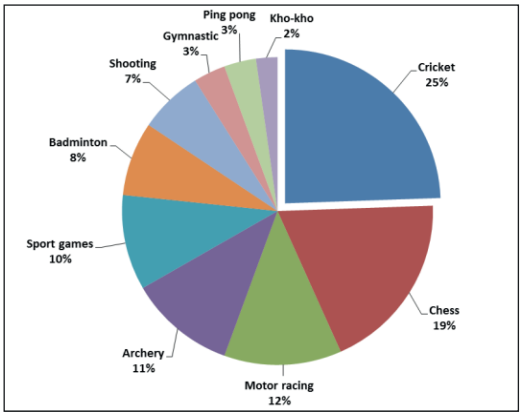
Grafikon 2. *Sport koji je najmanje obilježio doping afere (AMU Aligarh-INDIA)*

Graphs 2. *Sports most marked by doping scandals (AMU Aligarh-INDIA)*



Grafikon 3. *Sport koji je najmanje obilježio doping afere (Istočno Sarajevo-BIH)*

Graphs 3. *Sports least marked by doping scandals (East Sarajevo-BIH)*



Grafikon 4. *Sport koji je najmanje obilježio doping afere (AMU Aligarh-INDIA)*

Graphs 4. *Sports least marked by doping scandals (AMU Aligarh-INDIA)*

Grafikoni 1-4 predstavljaju stavove ispitanika o sportovima koje su najviše obilježile doping afere i onih koje su najmanje obilježile doping afere. Može se reći da je očekivano, da je doping najviše obilježio atletiku kao sport sa najviše doping afera u oba subuzorka ispitanika. Čak više od polovine Indijskih studenata (52%) i 33% BiH studenata je upravo nju označilo kao sport sa najviše doping afera. Na drugom mjestu kandidovan je biciklizam sa preko 40% ispitanika (33% BiH and 10% Indijskih studenata). Na trećem mjestu po korišćenju dopinga u sportu identifikovani su Body building i dizanje tegova sa preko 20% ispitanika (12% BiH i 10% Indija). Na osnovu rezultata upravo su ovi sportovi vrlo često u žiži medijske javnosti, jer čine više od ½ sportova po mišljenju Indijskih studenata i ¾ BiH studenata koji su obilježili neki doping skandali (Grafikon 1,2). Navedeni su još borilački sportovi, sportske igre, plivanje (ispod 6%).

Kao najmanje obilježeni sportovi doping aferma studenti BiH su naveli sportske igre (28%), a Indijski studenti Cricket (25%). Na drugom mjestu su streljaštvo (19% BiH) i šah (19% Indija), zatim tenis, moto trke, zimski sportovi, itd. (Grafikoni 3,4)

Diskusija

Istraživanje koje je realizovano imalo je za cilj da se provjere znanja i utvrde stavovi i razlike studenata fizičkog vaspitanja i sporta Istočnog Sarajeva (BIH) i AMU Aligarh UP (Indija) o upotrebi zabranjenih supstanci (droga) u sportu. Istraživanje može da bude značajno zbog populacije koja je obuhvaćena istraživanjem, jer se radi o mladoj populaciji, aktuelnim sportistima, subjektima u oblasti sporta kojima je imperativ prvenstveno pobjeda, a u drugi plan se stavlja njihovo zdravlje i obrazovanje po tom pitanju.

Graphs 1-4 represent the views of respondents on sports that are most marked doping scandal and those that are at least marked by doping scandals. It can be said that it was expected that the doping most celebrated athletics as a sport with the most doping scandals in both subsamples of respondents. Even more than half of the Indian students (52%) and 33% of BIH students just athletics marked as a sport with the most doping scandals. In the second place was nominated cycling with over 40% of respondents (33% of BIH and 10% of Indian students).

In third place on the use of doping in sport were identified bodybuilding and weight lifting with over 20% of respondents (12% BIH and 10% India). On the basis of just these sports are often the focuses of media to the public, because they are more ½ sports in the opinion of Indian students and ¾ of BIH students who have marked some doping scandals (Graphs 1, 2). These are still martial arts, sports games and swimming (below 6%). The least marked sports doping scandals students BIH they stated sports games (28%), and Indian students cricket (25%). In the second place are shooting (19% of Bosnia and Herzegovina) and Chess (19% India), then tennis, motor racing, skiing, etc. (Graphs 3, 4)

Disscusion

The research was aimed to verify the knowledge and identify the attitudes and differences of students of Physical Education and sports from East Sarajevo (BIH) and AMU Aligarh U.P (India) on the use of banned substances (drugs) in the sport. This research can be significant due to the population covered by the survey, because it is about young population, current or future athletes, subjects in the field of sport to which primarily imperative is victory, and in the second plan their health and education on this issue.

Vrlo često profesionalni sportisti su uzori adolescenata i mladih odraslih populacije, koji često oponašaju svoje ponašanje, uključujući i zloupotrebe droga (Baron, et al., 2007). U odnosu na dobijene rezultate ovog istraživanja među studentima, koji možda još uvijek nisu alarmantni, jer npr. istraživanja Jesalisa i saradnika (Yesalis, Michael, & Bahrke 2000) pokazuju da je 3-12% adolescenata muškaraca i 1-2% adolescenata žena priznalo da koristi AAS u nekom trenutku tokom svog života. Poredeći rezultate aktuelnog istraživanja sa istraživanjima (Pupiš & Polgar, 2006) koja su se bavila istom problematikom na populaciji studenata fizičkog vaspitanja i sporta, može se zaključiti da su ti rezultati u suprotnosti sa rezultatima ovog istraživanja. Studenti su imali identičan stav po pitanju upotrebe dopinga od nekih sadašnjih vrhunskih sportista, navodeći da su svi oni bar jednom uzeli doping u toku karijere i tako ostvarili najbolji rezultat.

Značaj problema dopinga je baziran na više činjenica, a prije svega na štetnim efektima na pojedine organske sisteme koje izaziva korišćenje doping supstanci (Mougios, 2001; Parssinen & Sepapala, 2002; Payne, Kotwinski & Montgomery, 2004; Hartgens & Kuipers, 2004; Dhar, Stout, Link, Homoud, Weinstock, & Estes 2005., Deligiannis, Björnstad, Carre, Heidbüchel, Kouidi, & Panhuyzen-Goedkoop, 2006; Hasson, Salem & Sayed, 2009).

Prema ovom istraživanju, samo 32% studenata Istočnog Sarajeva i 34% studenata AMU Aligarh je došlo u direktan kontakt sa zabranjenom supstancom, a skoro u prosjeku 68% studenta nije nikada bilo u kontaktu sa bilo kojom zabranjenom doping supstancom (Tabela 1).

Za razliku od istraživanja Melija i saradnika (Melia, et al., 1996), te Rahona i saradnika (Rachoń, et al., 2006), čiji su rezultati bili alarmantni i neophodne su bile hitne preventivne mjere, naši ispitanici su još u granicama tolerancije, odnosno još uvijek su pasivni kada je u pitanju upotreba zabranjenih supstanci, što je i dobro.

U novije vrijeme primjetan je porast broja neprofesionalnih sportista i mlađe populacije koji koriste doping (Michalák, & Kyselovičová, 2001; Erhnborg & Rosen, 2009). Dodatnu težinu daje i podatak o uzrastu korisnika dopinga koji kaže da je među mladim sportistima uzrasta od 10-15 godina procenat korisnika dopinga 0,7% (Wroble, Gray & Rodrigo, 2002) i da se prvi kontakt sa AAC obično javlja između 12 i 13 godine (Kokkevi, Fotiou, Chileva, Nociar & Miller, 2008) što je vrlo alarmantno. Znatna većina studenata ima negativan stav prema dopingu, i samim tim pokazuje da je doping neželjena supstanca koju ne treba konzumirati. Takođe, treba uzeti u obzir i podatak da njih skoro 57% ne zna popis zabranjenih supstanci i lijekova, što vjerovatno predstavlja

Very often, professional athletes are role models for adolescents and young adults, who often imitate their behavior, including drug abuse (Baron, et al., 2007). Compared to the results of this research among high school students, who may not yet be alarming, because, for example, the research of Yesalis and associates (Yesalis, Michael, & Bahrke 2000) show that 3-12% of adolescents men and 1-2% of adolescent women admitted they use AAS at some point during their lives. Comparing the results of this research with the research of (Pupiš & Polgar, 2006) which dealt with the same problem on the population of students of physical education and sport, it can be concluded that these results are in contrast with the results of this research. Students had the same attitude on the issue of doping from some of the current top athletes, stating that they all at least once took doping during their career and so achieved the best result.

The importance of the problem of doping is based on several facts, and above all on the harmful effects on individual organ systems caused by the use of doping substances (Mougios, 2001; Pärssinen & Sepapala, 2002; Payne, Kotwinski & Montgomery, 2004; Hartgens & Kuipers, 2004; Dhar , Stout, Link, Homoud, Weinstock, & Estes 2005, Deligiannis, Björnstad, Carre, Heidbüchel, Kouidi, & Panhuyzen-Goedkoop, 2006; Hasson, Salem & Sayed, 2009). According to this survey, only 32% East Sarajevo and 34% AMU Aligarh students came in direct contact with a prohibited substance, and almost 68% of the students had never been in contact with any of the prohibited doping substance (Table 1).

Unlike research of Melija and associates (Melia, et al., 1996), and Rahon and associates (Rachoni, et al., 2006), whose results were alarming and required urgent preventive measures, our respondents are still within the limits of tolerance, or they are still passive when it comes to the use of prohibited substances, which is good.

In recent years there has been a rise in the number of non-professional athletes and younger population who use doping (Michalák, & Kyselovičová, 2001; Erhnborg & Rosen, 2009). The extra concern gives the data on the age of the users of doping, which says that among young athletes aged 10-15 years, the percentage of users of doping is 0.7% (Wroble, Gray & Rodrigo, 2002) and that the first contact with AAC usually occurs between 12 and 13 years (Kokko, Fotiou, Chile Nociar & Miller, 2008) which is very alarming.

A substantial majority of students have a negative attitude towards doping, and therefore shows that the doping is unwanted substance that should not be consumed. It should also be taken into account the fact that nearly 57% of them

i problem jer je edukacija o dopingu nedovoljna, malo zastupljena na fakultetima i školama.

Neobavještenost o štetnom uticaju dopinga se ne dešava samo kod nas i može se reći da i ne iznenađuje. Postoje podaci koji pokazuju da je nekada i informisanost ljekara opšte prakse koji vrše testiranja sportista na nedovoljnom nivou, odnosno nisu upoznati sa zabranjenim proizvodima kao i negativnim efektima koje korišćenje dopinga proizvodi (Laure, et al., 2003). Iako postoje razlike između studenata Istočnog Sarajeva i AMU Aligarh po pitanju uzimanja zabranjenih supstanci, visok postotak (više od 87% BIH studenata a 91% AMU Aligarh studenata) ispitanika ovog istraživanja nikada nije koristio zabranjene supstance, samo njih oko 10% je uzelo neku zabranjenu supstancu. Može se konstatovati da je ovaj podatak ohrabrujući, a procent korišćenja dopinga zanemarljiv u poređenju sa sličnim istraživanjima (Rachoń, et al., 2006; Kokkevi, et al., 2008; Erhnborg & Rosen, 2009). Obzirom da se radi o studentima fizičkog vaspitanja, podatak od 10% koji su konzumirali doping je pomalo i očekivan, ako se uzme u obzir okruženje sredine, socijalno sazrijevanje, želja za dokazivanjem u sredini, poboljšnje fizičkog izgleda i poboljšanje sportskih performansi (Kindlundh, et al., 1998). Međutim, problem predstavlja i onih 10% koji su već konzumirali neku nedozvoljenu supstancu, vjerovatno (ne) svjesni eventualnih posljedica usljed nedovoljne informisanosti o štetnom djelovanju dopinga, (Parssinen & Sepapala, 2002; Payne, et al., 2004; Hartgens & Kuipers, 2004; Dhar, et al., 2006; Hasson, et al., 2009). Razlika između BIH i Indijskih studenata je evidenta i po pitanju korišćenja doping supstanci. Više od polovine ispitanih BiH studenata, (64%) je imalo negativan stav o eventualnom korišćenju zabranjenih supstanci za ostvarenje ličnih rezultata a njih 36% je podržavalo upotrebu zabranjenih supstanci, za razliku od Indijaca gdje je čak 86% imalo negativan stav a samo 14% je podržavalo korišćenje dopinga.Vrlo je važno da većina ispitanika studenata ima negativan stav po ovom pitanju i ne podržava uzimanje bilo kojih zabranjenih supstanci. Ovakav stav je u suprotnosti sa stavovima italijanskih srednjoškolaca koji su pokazali namjeru znatno višeg korišćenja dopinga i jačim uvjerenjem da će ih drugi podržati (Lucidi, Zelli, Mallia, Grano, Russo, & Violani, 2008).

Problem je vrlo često u samoj ličnosti sportiste koji je nezadovoljan učinkom i napredovanjem, jako izražena želja za postizanje vrhunskih rezultata, što je praćeno ogromnim zaradama, popularnošću i ugledom, vjerovanjem da i drugi koriste iste ili slične supstance kao i nedostatkom znanja o neželjenim efektima upotrebe dopinga (Petróczi, 2007). Interesantan je podatak i stav svih ispitanika

do not know the list of prohibited substances and drugs, which probably represents a problem because education on doping is insufficient, and it is poorly represented in faculty and school. Lack of information on the harmful effects of doping does not just happen to us and we can say that this is not surprising. There are data that show that sometimes the awareness of doctors, general practitioners who perform testing of athletes is at an insufficient level, regarding that they are not familiar with the restricted products as well as the negative effects of the use of doping products (Laure, et al., 2003). Although there are differences between students of East Sarajevo and AMU Aligarh in terms of taking banned substances, a high percentage (over 89%) of survey respondents had never used banned substances, only 10.63% of them had taken some banned substance. It can be noted that this data is encouraging, and the percentage of doping is negligible in comparison with similar studies (Rachoni, et al., 2006; Kokko et al., 2008; Erhnborg & Rosen, 2009). Given that this is students Physical education and Sports, the figure of 10% who consumed doping is somewhat expected, if we take into account the environment protection, social maturation, the desire to prove themselves in the social environment, the improvement of physical appearance and improvement of sport performances (Kindlundh, et al., 1998). However, the problem is the 10% of those who have already consumed an illicit substance, probably (not) aware of the potential consequences due to lack of information about the harmful effects of doping, (Pärssinen & Sepapala, 2002; Payne, et al., 2004; Hartgens & Kuipers, 2004; Dhar, et al., 2006; Hasson et al., 2009).

The difference between BIH and Indian students is evident also in terms of the use of doping substances**.**More than half of the respondent students BIH (64%) had a negative attitude about the possible use of banned substances to achieve personal results and 36% of them supported the use of banned substances unlike the Indian students, where 86% had a negative attitude and only 14% supported the use of drugs. It is very important that the majority of students have a negative attitude on this issue and does not support taking any banned substances. This attitude is in contrast to the views of Italian students who have demonstrated significantly higher intention to use doping and a stronger belief that others will support them (Lucidi, Zell, Mallia, Grano, Russo, & Violani, 2008).

The problem is very often in the personality of an athlete who is dissatisfied with the performance and progress, strongly expressed desire to achieve top results, followed by huge salaries, popularity and reputation, the belief that others are using the same or similar substances as well as the lack of knowledge about the unwanted effects of dop-

obuhvaćen ovim istraživanjem koji smatraju da su neki od sadašnjih najboljih sportista uzimali neku vrstu zabranjenih supstanci. Skoro svi studenti Istočnog Sarajeva (99%) su mišljenja da su neki od dosadašnjih najboljih sportista uzimali doping, dok je 65% Indijskih studenata podržalo ovu konstataciju. To potvrđuje pretpostavku da je negativna percepcija upotrebe dopinga u vrhunskom i profesionalnom sportu u ovoj mladoj populaciji, gdje je znatna većina angažovana u nekom sportu. Skoro identične rezultate su dobili i drugi autori (Pupiš, & Polgar, 2006; Bondarev & Sirenko, 2010; Pavlović & Idrizović, 2013). Oko poznavanja nekoga da je uzimao doping, mišljenja studenata su bila podijeljena. Čak 65% studenata Istočnog Sarajeva i 30% studenata AMU Aligarh je upoznalo nekoga ko je uzimao i koristio doping, što znači da su oni na određeni način upoznati sa djelovanjem ovih supstanci preko najčešće svojih poznanika ili prijatelja. Nešto drugačiji stav su imali i o tome da li je ispravno da pozitivnog na neku vrstu dopinga imaju u svojoj blizini. Od ukupnog broja studenata Istočnog Sarajeva, njih 53% je protiv takvih osoba da se nađu u njihovoj blizini a 74% studenata AMU Aligarh to odobrava, čime pokazuju određeni stepen tolerancije na doping u sportu. Jedan možda zanimljiv rezultat je dobijen u pitanju oko pouzdanosti testiranja na doping i moguće prevare. U odgovoru na ovo pitanje 48% ispitanika Istočnog Sarajeva i 65% AMU studenata, smatra da doping kontrole ne mogu uvijek otkriti dopingovanog sportistu, a njih 41% smatra da je to moguće.

Više od polovine svih ispitanih studenata (preko 60%) smatra da postoje načini da se „prevare" testovi za doping kontrolu. Ovaj procenat upućuje na zaključak da još uvijek među učenicima postoji dilema oko pouzdanosti antidoping kontrola i njihovog provođenja.

Na pitanje da li postoji u zemlji neki od antidoping programa koji bi pomagali sportistima, veća polovina uzorka Istočnog Sarajeva (56%) i 64% studenata AMU nije upoznata da u njihovoj zemlji postoji neki od svjetskih anti-doping programa za podršku sportistima, u smislu kontinuirane edukacije, seminara, konferencija itd, što je u suprotnosti sa istraživanjem (Pupiš & Polgar, 2006), a njih 34-44% je upoznato sa tim agencijama na nivou države. Ovaj podatak samo pokazuje da je informisanost ove populacije nedovoljna i da je neophodno sprovoditi dodatnu edukciju po ovom pitanju. U pogledu sporta koji je najviše obilježio doping afere (Grafikon 1) na prvom mjestu studenti su kandidovali atletiku i biciklizam. Dobijeni rezultati se podudaraju sa rezultatima slovačkih autora (Pupiš & Polgar, 2006) koji su takođe kandidovali atletiku i biciklizam, sa znatno većim procentom, kao vodeće u doping aferama. Generalno posmatrano, ovdje se

ing (Petróczi, 2007). An interesting fact is the attitude of all respondents included in this research who believe that some of the current top athletes were taking some sort of banned substances. Almost all the students of East Sarajevo (99%) are of the opinion that some of the current best athletes taking doping, while 65% the Indian students supported this statement. This confirms the assumption that is the negative perception of doping in elite and professional sport in this young population, where the vast majority is engaged in some sport. Nearly identical results were obtained by other authors (Pupiš, & Polgar, 2006; Bondarev & Sirenko, 2010; Pavlovic & Idrizović, 2013).About knowing that someone was taking doping, thought of the students were divided. Even 65% students of East Sarajevo and 30% students of AMU Aligarh met someone who was taking and using doping, which means that they are in some way familiar with the effects of these substances usually through their friends or acquaintances. Something different attitude they had about whether it is right to have someone who is positive to doping in their vicinity. Of the total number of students East Sarajevo, 53% is against such a person to be found in their vicinity and 74% students AMU Aligarh approve this, which shows a certain degree of tolerance for doping in sport. One result that might be interesting was obtained in terms of reliability of testing on doping and possible fraud. In answering this question, 48% of respondents of East Sarajevo and 65% AMU students, believe that doping controls cannot always detect athlete who used doping and 41% of them considered that this is possible. More than half all students (more 60%) of the respondents believe that there are ways to fraud tests for doping control. This percentage indicates that there is still among the students a dilemma about the reliability of the anti-doping controls and their implementation. On the question of whether there is in the country some of the anti-doping program to assist athletes, the higher half of the sample East Sarajevo (56%) and 64% AMU students, were not aware that in their country there is some of the world anti-doping program to support the athletes, in terms of continuing education, seminars, conferences, etc., which is in contrast with previous research (Pupiš & Polgar, 2006), and 34-44% of them are familiar with these agencies at the state level.

This data only shows that the knowledge of this population is insufficient and it is necessary to conduct further education in this matter. In terms of sport, which is most marked by doping scandals (Figure 1) in the first place, students nominated athletics and cycling. The obtained results coincide with the results of Slovak authors (Pupiš & Polgar, 2006), which also nominated athletics and cycling, with a significantly higher percentage, as leaders in dop-

radi o individualnim sportovima, gdje pretpostavka da se biciklizam i atletika identifikuju uglavnom sa stalnom medijskom pažnjom i sportistima iz ove grupe koji su najčešće i dio doping kontrole. S druge strane, postoji moć sportskih udruženja koja generalno percipiraju kao sportovi u kojima se doping prečesto koristi (Wilson, 2012). Kao sportove najmanje „zaražene" drogama najviše odgovora ispitanih učenika odnosilo se na sportske igre, kriket, streljaštvo, tenis čak i ako anketno pitanje nije bilo usmjereno specifično za sport, grupu sportova (Grafikon 2). U istraživanju Pupiš i Polgar (2006) sportske igre, sa 66%, su takođe označene kao sport koji je najmanje zaražen drogama. Koliko su rezultati ove sprovedene ankete na populaciji studenata Fizičkog vaspitanja i sporta, i pored nekih međusobnih razlika u odgovorima, ohrabrujući potvrđuju i dobijeni rezultati istraživanja, naročito u poređenju sa sličnim, koja su takođe za problem imala upotrebu doping sredstava u sportu.

Da bi se ovo razmišljanje studenata održalo u pozitivnom trendu, vrlo je važna borba protiv dopinga, svim mogućim sredstvima. Treba se zalagati za obrazovanje od početka organizovanja sportova i svih sportskih sekcija u školama. Zbog toga kod mladih, naročito školskog uzrasta, treba što više razvijati svijest o štetnim uticajima dopinga na organizam čovjeka, limitima organizma i granicama izdržljivosti, preko kojih se ne smije ići. Trenutna strategija za rješavanje povećanje korišćenja dopinga od strane adolescenata je višenamjenska i prvenstveno uključuje obrazovanje i prevenciju, zabrane i antidoping testiranja. Ukoliko doping ne prestane da bude mračna strana sporta, onda će sport u svakom pogledu izgubiti u potpunosti svaki smisao, mada dobrim dijelom već i jeste, i postaće tek samo grana proizvodnje, biznis, tržište farmaceutskih kompanija i ništa više, a aktivni sudionici upotrebe dopinga će postati njihove žrtve, bez obzira o kojoj populaciji je riječ.

Zaključak

Dobijeni rezultati ovog istraživanja mogu se prihvatiti kao globalni pokazatelj informisanosti, percepcije, znanja i stavova studenata Fizičkog vaspitanja i sporta o sve većem problemu današnjeg modernog sporta. Oni mogu biti relevantni za širu društvenu zajednicu BIH i Indije. Opšta informisanost studenata oba subuzorka po pitanju znanja o dopingu je vrlo skromna, stavovi i znanja o nekim pitanjima se dijametralno razlikuju (Tabela 1). Mogući uzrok pojedinih razlika subuzorka studenata može biti nedovoljna informisanost studenata u sredinama i fakultetima iz kojih dolaze, pa bi se trebalo više edukovati o ovom problemu. Međutim i pored određenih razlika u

ing scandals. Generally speaking, here is about individual sports, where the assumption is that cycling and athletics are identified mainly with the constant media attention and athletes in this group who are most often part of doping control. On the other hand, there is a certain power of sports associations which generally perceive as sports in which doping is too often used (Wilson, 2012).As sports least "infected", most responses of the students related to sports games, cricket, shooting, tennis, even if the poll question was not directed specifically for sports, group of sports (Graphs 2). In the study of Pupiš and Polgar (2006) the sports games, with 66%, are also marked as a sport that is least infected with drugs. How much are the results of the survey on the population of students Physical education and sports, despite the some of differences in the answers**,** encouraging also confirm the obtained results of research, especially when compared to similar, which also had for the problem the use of doping substances in sport.

In order to maintain this mindset of students in a positive trend, it is very important to fight against doping, by all possible means. It is necessary to advocate for education since the beginning of organizing sports and all sports sections in schools. Therefore, in young people, especially schoolchildren, should develop as much as possible awareness of the harmful effects of doping on the human organism, the organism limits and the limits of endurance, through which one must not go. Current strategy to address the increasing use of doping by adolescents is multipurposed and primarily involves education and prevention, prohibition and anti-doping testing. If doping does not cease to be a dark side of sport, then sport in every respect will completely lose all meaning, although largely already is, and will become merely a branch of production, business, the pharmaceutical companies market and nothing more, and active participants of doping will become their victims, regardless of the population in question

Conclusion

The results of this study can be accepted as a global indicator of awareness, perception, knowledge and attitudes of students of Physical education and Sport about the problem of today's modern sports. They may be relevant to the wider community BIH and India. General information of students bothsubsamples in terms of knowledge about doping is very modest and attitudes and knowledge about some of the issues are diametrically opposed (Table 1).Possible cause of individual differences subsample of students may be insufficient information of students in colleges and communities from which they come, we should be further educated about the problem.However,

odgovorima među studentima BIH i Indije, uočene su i neke sličnosti. Kao što se očekivalo, svi studenti smatraju da je doping najviše obilježio atletiku, biciklizam, što je doprinijelo da su ovi sportovi vrlo često u žiži medijske javnosti. Navedeni su još borilački sportovi, bodi bilding, dizanje tegova, plivanje i zimski sportovi. Kao najmanje obilježeni sportovi doping aferama su navedeni sportske igre, kriket, streljaštvo, tenis, vaterpolo, itd. Na osnovu dobijenih rezultata, naročito onih 33% koji su došli u kontakt, 19-13% koji su već uzeli neku zabranjenu supstancu i 14-36% koji bi uzeli zabranjenu supstancu za lične rezultate je ,'upozorenje''. Dobijeni rezultati studenata po pitanju stavova o upotrebi dopinga, znanja i informisanosti o negativnim efektima dopinga opravdava dalja slična istraživanja.

despite certain differencesin responsesamong studentsBiHand India, have been identifiedandsome similarities. As expected, all students believe that doping most marked the athletics and cycling, which contributed that these sports are often in the focus of media public. Stated are also martial arts, bodybuilding, weightlifting, swimming and winter sports. The least marked sports by doping scandals stated are sports games, cricket, shooting, tennis, tennis, water polo, etc. Based on the results, particularly those 33% who have come into contact with, 9-13% of which have already taken a banned substance and 14-36%, which would take a prohibited substance for personal results is ''warning''. The obtained results of students in terms of attitudes about the use of doping, knowledge and awareness about the negative effects of doping justify further similar studies.

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Literatura / References

Baron, A.D., Martin, D.M., &Magd, S.A. (2007). Doping in sports and its spread to at-risk populations: an international review. *World Psychiatry, 6* (2), 118–123.

BBC (15.07.2012). London 2012: All medallists to be drugs tested at Olympics. BBC News Online. Retrieved 28.07.2012, from http/:www.bbc.co.uk/sport/0/olympics/1884957.

Bondarev, D.V., Ajitskiy, K.Y., Galchinsky, V.A., Labskir, V.M., &Druz, V.A. (2008). Attitude towards doping of Sports students and students of Polytechnic Sciences. *Journal of Pedagogic, Pchology and Medico-Biologic Problems of Physical Training and Sport,* (5),18–24.

Bondarev, D.V., Galchinsky, V.A., Labskir, V.M., Druz, V.A., & Ajitskiy, K.Y. (2009). Doping prevalence and knowledge among high school students. *Proceedings of the International scientific conference Actual problems of developing Sport for All,* (pp. 293–295). Ternopil.

Bondarev, D.V., & Sirenko, R.R. (2010). Doping amongst students: Knowledge, Attitude, Behaviour. *Proceedings of the 1-st scientific conference Physical Education and Sport Improving among Sevastopol Youth*, (pp.10–25). Sevastopol: SevastopolNationalTechnicalUniversity and World Anti-Doping Agency.

Dhar, R., Stout, C.W., Link, M.S., Homoud, M.K., Weinstock, J., & Estes, N.M. (2005). Cardiovascular toxsicites of performance-enhancing substances in sport. *Mayo Clinic Proceedings*, 80 (10), 1307–1315.

Deligiannis, A., Björnstad, H., Carre, F., Heidbüchel, H., Kouidi, E., Panhuyzen-Goedkoop, N.M. (2006). ESC study group of sports cardiology position paper on adverse cardiovascular effects of doping in athletes. *European Journal of Cardiovascular Prevention & Rehabilitation, 13*(5), 687–694.

Erhnborg, C., & Rosen, T. (2009). The psychology behind doping in sport. *Growth Hormone & IGF Research,* 19, 285–287.

Grohmann, K. (07.11.2012a). Doping-IOC strips Uzbek wrestler of Olympic bronze. Reuters. Retrieved 04.08.2012, from http//:www.reuters.com/article/2012/117077us-doping-olympics-wrestler-idUSBRE8A617120121107

Grohmann, K. (24.07.2012b). Testers nab more than 100 athletes - WADA. Reuters. Retrieved 04.08.2012, from http//:www.reuters.com/London-olympics-2012/articles72012/07/247testers-nab-more-100-athletes-prior-london-wada.

Hartgens, F., & Kuipers, H. (2004). Effects of androgenic-anabolic steroids in athletes. *Sports Medicine, 34*(8), 513–554.

Hasson, N., Salem, M., & Sayed, M. (2009). Doping and effect of anabolic androgenic steroids on the heart:histological, ultrastructural, and echocardiographic assessment in strength athletes. *Human & Experimental Toxicology, 28*(5), 273–283.

Jovanović, D., & Radovanović, D. (2001). *Doping i sport* [Doping and sport. In Serbian]. Niš: Roller print.

Kindlundh, A.M., Isacson, D.G., Berglund, L., Nyberg, F. (1998). Doping among high school students in Uppsala, Sweden: A presentation of the attitudes, distribution, side effects, and extent of use *Scandinavian Journal of Public Health, 26*(1), 71–74.16.

Kanayama, G., Gruber, A.J., Pope, H.G., Jr., Borowiecki, J.J., &Hudson, J.I. (2001). Over-the-counter drug use in gymnasium: an unrecognized substance abuse problem? *Psychoter Psychosom*, 70 (3), 137–140.

Khan, Z., Singh, S.P., Ali, A.B, & Khan, N.A. (2014). Attitudes of Students of Sports Participants about Doping in Sports. *International Journal of African and Asian Studies-An Open Access International Journal*, Vol.5, 40-44.

Kokkevi, A., Fotiou, A., Chileva, A., Nociar, A., & Miller, P. (2008). Dailiy exercise and anabolic steroids use in adolescents: a cross-national European study. *Substance Use and Misuse, 43* (14), 2053–2065.

Laure, P., Binsinger, C., & Lecerf, T. (2003). General practitioners and doping in sport: attitudes and experience. *British Journal of Sports Medicine,* 37, 335–338.

Lucidi, F., Zelli, A., Mallia, L., Grano, C., Russo, M.P, & Violani, C. (2008). The social-cognitive mechanisms regulating adolescents' use of doping substances. *Journal of Sports Sciences, 26* (5), 447–456.

Mc Cabe, E.S., Brower, K,J., Brady, T., West, B.T., Toben, F., Nelson, T.T., Wechsler, H. (2007). Trends in non-medical use of anabolic steroids by U.S. college students: Results from four national surveys. *Drug Alcohol Depend, 90* (2-3), 243–251.

Melia, P., Pipe, A., Greenberg, L. (1996). The use of anabolic-androgenic steroids by Canadian students. *Clinical Journal of Sport Medicine, 6*(1), 9–14.

Michalák, K., and Kyselovičová, O. (2001). Užívanie anabolík počas kondičného tréningu rekreačne športujúcich mužov [Taking anabolic steroids during conditioning training recreational athletes. In Slovak]. *Telesna výchova a šport, 11* (2), 17–21. Bratislava.

Mougios, V. (2001). Doping abuse in recreational sports. In C. Peters, T. Schulz., & H.Michina (Eds.), *Biomedical side effects of doping* (pp.183–191). Bonn: Bundesinstitut fur sportwissenschhaft.

Pupiš, M, & Polgar,V. (2006). Znalosti športujúcej mládeže o dopingu a možnosti dopingovej prevencie [Knowledge sportmen zouth of doping and possible doping prevention. In Slovak] In: *Proceedings of the International Scientific Seminar of Doctoral Candidates: a humanistic form of sport and physical education,* (pp. 46). Bratislava: UK FTVŠ.

Pupiš, M., & Korčok, P. (2004). Vytrvalostný šport a doping [Endurance sport and doping. In Slovak]. *Slovenská chôdza, 8* (4), 36.

Parssinen, M., & Sepapala,T. (2002). Steroid use and long-term health risk in former athletes. *Sports Medicine, 32*(2), 83–94.

Payne, J.R., Kotwinski, P.J., &Montgomery, H.A. (2004).Cardiac effects of anabolic steroids. *Heart, 90*, 473–475.

Pavlović, R. (2006). *Atletika-antropološka obilježja*. [Athletics-anthropologicalcharacteristics. In Serbian] Istočno Sarajevo:Fakultet fizičke kulture.

Pavlović, R., & Pupiš, M. (2013). Student attitudes and knowledge of physical education and Sports on use doping in sport. *Sport Science, 6* (2), 21–28.

Pavlović, R., & Idrizović, K. (2013). Attitudes of students of physical education and sports about doping in sport. *FACTA UNIVERSITATIS Series: Physical Education and Sport, 11*(1), 103–113.

Petroczi, A. (2007) Attitudes and doping: A structural equation analysis of the relationship between athletes' attitudes, sport orientation and doping behaviour Substance Abuse: *Treatment, Prevention, and Policy, 2*(1), art. no. 34

Rachoń, D., Pokrywka, L., & Suchecka-Rachoń, K. (2006). Prevalence and risk factors of anabolic-androgenic steroids (AAS) abuse among adolescents and young adults in Poland. *International Journal of Public Health, 51*(6), 392–398.

Živanović, N. (2000). *Prilog epistemiologiji fizičke kulture*. [Contribution epistemology of physical education. In Serbian] Panoptikum Niš

Wanjek, J.B., Rosendahl, B., Strauss, H., & Gabriel, H (2007). Doping, Drugs and Drug Abuse among Adolescents in the State of Thuringia (Germany): Prevalence, Knowledge and Attitudes. *International Journal of Sports Medicine, 28*(4), 346–353.

Wroble, R.R., Graay, M., & Rodrigo, J.A. (2002). Anabolic steroids and preadolescent athletes: prevalence, konwledge and attitudes. *Sport Journal, 5*(3), 1–8.

Wilson, S. (13.08.2012). "Belarus shot putter stripped of Olympic gold".Associated Press. Retrieved11.10.2012,fromhttp://www.canada.com/sporta/all/Belarusian+shot+putter+Nadzeya+Ostapshuk+stripped+Olympic+gold+medal/7082246/story.html.

Yesalis, C,E., Michael, S., & Bahrke, M.S. (2000). Doping among adolescent athletes. *Best Practice & Research Clinical Endocrinology & Metabolism, 14*(1), 25–35.

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Review paper

Kondicioni trening u svijetlu najnovijih naučnih saznanja

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Sažetak: Čovjek je oduvijek bio svjestan da mu više fizičke aktivnosti, uz optimalnost drugih parametara kakvi su odmor i ishrana, donosi nadmoć u odnosu na ostale pripadnike njegove uže i šire zajednice. Primarno je to bilo vezano za vještine lova i ratničke vještine. Sa druge strane u periodima mira i blagostanja, čovjekova iskonska potreba za dokazivanjem i dominacijom nad drugima oko sebe, biće demonstrirana u različitim oblicima nadmetanja u čovjekovim fizičkim potencijalima, prije svega snazi i brzini. Znanja o mogućnosti povećanja tih potencijala putem upražnjavanja različitih oblika fizičke aktivnosti, odnosno vježbanja, a koja su stečena u prethodnim periodima, počeće se organizovano primjenjivati. To će se prije svega desiti u vojnim strukturama, a kasnije i kao dio dešavanja koja su prepoznata kao daleki počeci onoga što danas predstavlja sport. Koja su najnovija naučna saznanja o tome?
Ključne riječi: kondicioni trening, ogledalo neurona, genetika.

Uvod

Čovjek je oduvijek bio svjestan da mu više fizičke aktivnosti, uz optimalnost drugih parametara kakvi su odmor i ishrana, donosi nadmoć u odnosu na ostale pripadnike njegove uže i šire zajednice. Ta svoja znanja započeće primjenjivati u osposobljavanjima za sve svoje obaveze u kojima je morao pokazati viši stepen fizičkih kvaliteta od onih koji su bili dovoljni za svakodnevni život. Primarno je to bilo vezano za vještine lova i ratničke vještine. Sa druge strane u periodima mira i blagostanja, čovjekova iskonska potreba za dokazivanjem i dominacijom nad drugima oko sebe, biće demonstrirana u različitim oblicima nadmetanja u čovjekovim fizičkim potencijalima, prije svega snazi i brzini. Znanja o mogućnosti povećanja tih potencijala putem upražnjavanja različitih oblika fizičke aktivnosti, odnosno vježbanja, a koja su stečena u prethodnim

Physical Conditioning Training in the Light of the Latest Scientific Knowledge

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Abstract: A man has always been aware that more physical activities, together with optimality of other parameters such as leisure and nutrition, bring him supremacy over other members of his wider community. This was primarily linked to the skills in hunting and warfare. On the other side, in times of peace and abundance, a man's aboriginal need for an boastfulness and dominance over other people around him will be demonstrated in various shapes of competitions in the area of man's physical capacities, a strength and speed first of all. The knowledge about the possibility of the increase of these capacities by practicing of different shapes of a physical activity, namely an exercising, attained in the previous periods, will start to be applied in an organized manner. First of all, it will occur in military structures, and then as a part of events recognised as the very beginnings of what sport today is. Which is the latest knowledge about that?
Key words: physical conditioning, miror neurons, genomics.

Introduction

A man has always been aware that more physical activities, together with optimality of other parameters such as leisure and nutrition, bring him supremacy over other members of his wider community. His mentioned knowledge will start to be applied in the preparations for all his obligations where he had to show a higher degree of physical qualities than those qualities which were sufficient for everyday life. This was primarily linked to the skills in hunting and warfare. On the other side, in times of peace and abundance, a man's aboriginal need for an boastfulness and dominance over other people around him will be demonstrated in various shapes of competitions in the area of man's physical capacities, a strength and speed first of all. The knowledge about the possibility of the increase of these capacities by practicing of different shapes of a physical activity, namely an exercising, attained in the previous periods, will start to

periodima, počeće se organizovano primjenjivati. To će se prije svega desiti u vojnim strukturama, a kasnije i kao dio dešavanja koja su prepoznata kao daleki počeci onoga što danas predstavlja sport.

Čustonja i Jajčević (2003) u svom pregledu razvoja kondicione pripreme navode osnovne podatke koji govore o prethodnom. „Postoje dokazi o primjeni kondicionog treninga (tačnije treninga snage sa opterećenjima) u mnogim ranim civilizacijama. Takav trening je bio vrlo raznolik i primjenjivao se kako za razvoj sposobnosti sportista, tako i u vojne svrhe (Todd, 1985). U egipatskim grobnicama (oko 2500 g.p.n.e.) otkriveni su umjetnički radovi na zidovima koji su prikazivali razne manifestacije snage i nadmetanja u snazi... Stanovnici antičke Irske su se takmičili u bacanju kamena još prije 3800 godina. Na drugoj strani svijeta u Kini su se upotrebljavali testovi snage za vrijeme dinastije Chou (1122-255. g.p.n.e.). Sasvim je izvjesno da su mnoge civilizacije prije samih Grka ili Rimljana trenirali i koristili snagu u svrhu zabave ili vojnih potreba... Poznati grčki ljekar Galen (129-199.) vjerovatno je prvi ljekar koji je govorio o efektima treninga snage, promoviše upotrebu tereta i opisuje vježbe jačanja (Kreamer i Hakkinen, 2002)... Grci prvi organizuju trening prema određenim periodima. Tako na olimpijskim igrama nisu mogli učestvovati oni koji nisu mogli potvrditi da su se barem 10 mjeseci spremali za učešće na olimpijskim igrama... Lucije Flavije Filostrat (170-244/249.) napisao je djelo o grčkom sportu i antičkim olimpijskim igrama u kojem govori o svojevrsnim sportskim zvijezdama onog doba, prikazuje način života i rada trenera i sportista, kao i njihove međusobne odnose. Filostrat, nam između ostalog, govori o tome kako trener koji prenosi svoja bogata iskustva na svoje učenike treba posjedovati veliko znanje o trenerskoj nauci, ... koja nije ni u čemu nižeg roda od ostalih nauka... “

Tokom narednih perioda manje ili više, dobro ili manje dobro, kondiciona priprema je nastavljala da se koristi svim onim saznanjima do kojih je dolazila nauka, kao i oblika i metoda rada koje je potvrđivao praktičan rad. Uglavnom, druga polovina devetnaestog vijeka, kao i cjelokupan dvadesti vijek donijeli su ogroman broj novih aplikativnih informacija, kao i potvrdu nekih ranijih, koje su već stotinama, pa i hiljadama godina imale upotrebu.

U posljednjoj deceniji, naučna produkcija je dosegla nekada nezamisliv nivo, međutim, sa druge strane, veliki broj istraživanja na svim svjetskim meridijanima ne daje istovremeno i proporcionalno odgovarajući broj novih saznanja. Uglavnom se radi o istraživanjima

be applied in an organized manner. First of all, it will occur in military structures, and then as a part of events recognised as the very beginnings of what sport today is.

Čustonja and Jajčević (2003), in their review of the development of conditioning preparation, name the basic data which tell about the abovementioned. “There are the evidences about the application of a conditioning training (more accurately, strength training with ballasts) in many early civilisations. Such a training was a very versatile and was applied both in the development of athletes and for military purposes (Todd, 1985). In the Egyptian tombs (about 2500 BC) the artificial works showing the various manifestations of a strength and competitions in a strengthwere found on walls… The settlers of the antique Ireland performed competitions in a stone throwing even 3800 years ago. On the other side of the world, in China, strength tests were carried out in the times of Chou dynasty (1122-255 BC). It is quite obvious that many civilisations before the Greekshad trainings and used a strength for the purposes of entertaining or military needs… Famous Greek physician Galen, (129-199) was probably the first physician who had told about the effects of strength training, promoted the use of a ballasts and described the exercises for strengthening (Kreamer and Hakkinen, 2002). The Greeks were the first who organised a training according to certain periods. So, those who could not prove that they had been training for the Olympic games for at least ten months could not participate in the Olympic games… Lucie Flavije Filostrat (170-244/249) wrote a book about the Greek sport and antique Olympic games where he writes about certain athlete stars of those times, showing the life styles and works of athletes and their coaches, and their mutual relations. Filostrat, among the rest, argues that a coach which transfers his abundant skills to his students should have a great knowledge about the coaching science, … which in no case is of a value lower than other sciences...“

More or less, during the following periods, good or less good, a conditioning preparation had continued to use both all those knowledge obtained by the sciences and forms and work methods that ascertained a practical work. Mostly, the second half of the nineteenth century, and complete the twentieth century, brought a huge number of new applicative findings, and a proof for some earlier ones which had been in use for hundreds or even thousands of years.

In the last decade, the scientific production had reached a level which was unfathomable in these times, however, on the other side, a big number of researches at all world meridians do not simultaneously give a propor-

koja su oslonjena na već postojeće naučne činjenice i sagledavaju ih sa stanovišta koja povremeno budu nova. Uglavnom veliki broj radova, moglo bi se reći renovira, ili inovira već postojeća znanja. Takođe, nova tehnološka rješenja, zatim promjene pravila, kao i promjene koja ona donose u pojedine sportske discipline, omogućavaju naučnim radnicima da istražuju nova, do tada ne- istražena polja.

Cilj ovog rada je da predstavi dvije naučne aktivnosti, koje su došle do informacija koje će u kondicionom treningu budućnosti imati sigurno veoma značajno mjesto, odnosno kako će se kondicioni trening u svijetlu tih informacija dalje razvijati.

Dvije nove osnove za kondicioni trening

Prva: Strukturu motoričkog ponašanja čovjeka sačinjavaju njegov motorički razvoj (permanentno sticanje novih motoričkih znanja i razvoj motoričkih sposobnosti), motorička kontrola (proces tokom kojeg ljudi koriste svoj neuromuskularni sistem za aktivaciju i koordinaciju mišićne aktivnosti i aktivnosti djelova tijela koji su uključeni u savladavanje i manifestaciju motoričkih znanja) i motoričko učenje. Motoričko učenje podrazumijeva niz procesa povezanih sa tjelesnim vježbanjem kroz koje vježbač usvaja nova motorička znanja, a svoje motoričke sposobnosti podiže na veći nivo. Klasičan pristup u razumijevanju motoričkog učenja, odnosno procesa usvajanja nove motoričke vještine pretpostavlja tri uzajamno povezane faze: 1. kognitivnu fazu (učenje pravila specifične motoričke vještine); 2. asocijativnu fazu (raščlanjivanje motoričkog zadatka na elementarne motoričke komponente, razdvajanje značajnih i neznačajnih informacija za izvođenje zadatka) i 3. Automatizaciju ili automatsku fazu (uvježbanost i iskustvo u izvođenju motoričkog zadatka, tako da se zadatak izvodi automatski). Saznanja do kojih se došlo posljednjih godina, a koja se upravo tiču čovjekovog motoričkog ponašanja dovode u pitanje ovakvo mišljenje.

Buccino i Riggio (2006) ističu da spoznaje o motoričkom sistemu kod čovjeka, kao i kod čovjekolikih majmuna, u novije su se vrijeme radikalno promijenile te se danas smatra da uključuje velik broj područja mozga. Jedno od njih, područje F5 ventralne premotoričke kore mozga čovjekolikih majmuna, sadrži motoričku reprezentaciju prema cilju usmjerenih radnji ustiju i šaka (Rizzolatti i sar., 1988). U tom je području otkrivena skupina neurona kod kojih je prisutno izbijanje i kad sama životinja izvodi specifičnu, cilju usmjerenu radnju (npr. posezanje za komadom hrane), ali i u slučaju kad ona samo posmatra jednaku ili sličnu radnju u izvođenju

tionally adequate number of a new findings. These are mostly the researches based on already existing scientific facts, considering them from the standpoints which are new sometimes. It could be said that, mostly, a big number of works renovate or improve already existing findings. Also, new technological solutions, like the changes of provisions, and the changes brought with them in certain sport disciplines, enable the scientific workers to research the new fields, unexplored so far.

The goal of this paper is to represent two scientific activities, which obtained the findings which surely will have a very important place in a future conditioning training, namely to define in which way a conditioning training will further develop in the light of these findings.

Two new bases for a physical conditioning training

The first. The structure of men's motor behaviour is made of his motor development (a permanent state of a new motor knowledge and development of motor abilities), motor control (a process during which men use their neuromuscular system both for an activation and the coordination of a muscle activity and activities of body parts included in attaining and manifestation of motor knowledge) and motor learning. The motor learning purports to the series of processes related to body exercises through which an athlete adopts new motor skills, and raise his motor abilities on a higher level. The classical approach in the understanding of motor learning, namely a process of adoption of a new motor skill, supposes three mutually related phases: 1. Cognitive phase (learning of rules of a specific motor skill), 2. Associative phase (dividing of a motor task into elementary motor components, dividing the important and unimportant information for the execution of a task) and 3. Automation or automatic phase (skill and experience in the execution of a motor task, so as to a task is automatically carried out). The skills attained during the last years, and those which are just related to men's motor behaviour challenge this opinion.

Buccino and Riggio (2006) highlight that the knowledge about a man's motor system, and of man-like monkeys' motor system, have radically been changed during the last years and, today, it is considered that it includes a big number of brain areas. On of them, an area of F5 ventral pre-motor brain crust of man-like monkeys, contains a motor representation according to a goal of directed activities of mouth and hands (Rizzolatti et al., 1988). In this area there was discovered the group of neurons with present emergence even when an animal preforms a specific goal-directed activity (for example a grabbing of a piece of food), and also in a case when an

druge životinje ili pak istraživača (Gallese i sar., 1996; Rizzolatti i sar., 1996). Ti se neuroni nazivaju ogledalo neuronima jer se ima utisak kao da se posmatrana radnja "reflektuje" u posmatračevoj motoričkoj reprezentaciji iste radnje, kao u ogledalu. Od samog otkrića, pretpostavljalo se da ogledalo neuroni igraju važnu ulogu, kako u prepoznavanju radnje, tako i u motoričkom učenju (Jeannerod, 1994). Te je pretpostavke u potpunosti poduprlo skorije elektrofiziološko istraživanje (Umiltà i sar., 2001). Jedan od novijih eksperimenata pokazao je da oko 15% ogledalo neurona, osim na vizuelna svojstva, reagira i na prezentaciju specifičnog zvuka određene radnje. Ti se neuroni nazivaju audio-vizuelnim ogledalo neuronima (Kohler i sar., 2002).

Sve je više dokaza o postojanju sistema ogledalo neurona i kod čovjeka (Buccino i Riggio, 2006). Oni dalje navode da prvi, iako samo indirektni, dokaz o postojanju sistema ogledalo neurona kod čovjeka pruža istraživanje u kojem je primijenjena transkranijalna magnetska stimulacija (TMS) kod zdravih dobrovoljaca koji su posmatrali istraživača u izvođenju različitih, cilju usmjerenih, kretanja šake (Fadiga i sar., 1995). Ti su rezultati nedavno potvrđeni (Strafella i Paus, 2000; Gangitano i sar., 2001). Naredna istraživanja na tom području koristila su se magnetoencefalografijom (MEG) (Hari i sar., 1998), kvantifikovanom elektroencefalografijom (Cochin i sar., 1999) i trajno implantiranim subduralnim elektrodama (Tremblay i sar., 2004).

Generalno, istraživanja su pokazala da se tokom zadataka motoričkog zamišljanja značajno aktiviraju različita područja, uključujući ona koja pripadaju sistemu ogledalo neurona. To upućuje na postojanje složenog distribuiranog neuralnog kruga motoričke zamišljanja koji uključuje i različita kortikalna područja u osnovi uključena u izvođenje i opažanje radnje (Buccino i Riggio, 2006).

Učestvovanje sistema ogledalo neurona u imitaciji nedavno je dokazano nizom istraživanja metodama prikaza mozga (Koski i sar., 2002; Grèzes i sar., 2003; Heiser i sar., 2003, prema Buccino i Riggio, 2006). U nedavnom istraživanju proučavalo se motoričko učenje novog motoričkog obrasca posmatranjem kretanja (Buccino et al., 2004). Od muzički needukovanih ispitanika zatraženo je da nauče odsvirati različite gitarističke akorde na osnovu posmatranja i oponašanja profesionalnog gitariste koji je svirao akorde. Uočeno je da je sistem ogledalo neurona bio aktivan u svim fazama procesa motoričkog učenja, odnosno od opažanja primjera do samog izvođenja primjera od strane ispitanika. Ti rezultati snažno podupiru teoriju prema kojoj učenje novog motoričkog obrasca

animal only observes the same or similar activity performed by other animal or even by a researcher (Gallese et al.,1996; Rizzolatti et al., 1996). These neurons are called the mirror neurons because they incite an impression like the observed activity is "reflected" in an observer's motor presentation of the same activity, like in a mirror. Since this discovery, it have been supposed that the mirror neurons play an important role both in a recognition of an activity and in a motor learning (Jeannerod, 1994). These assumptions were entirely supported by a recent electro-physiological research (Umilta et al., 2001). One of the latest experiments has shown that about 15% of mirror neurons, except on visual properties, react also on the presentation of the specific sound of particular activity. These neurons are called audio-visual mirror neurons (Kohler et al., 2002).

There are more and more proofs about the existence of the mirror neuron system in a man (Buccino and Riggio, 2006). They further argue that the first, although only indirect, proof about the existence of the system of mirror neurons in a man is given in the research where the transcranial magnetic stimulus (TMS) was applied on health volunteers who observed the researcher executing the various, goal-directed, hand motions (Fadigra et al., 1995). These results have been ascertained lately (Strafella and Paus, 2000;Gangitano et al., 2001). The next researches in that area used a magnetoencephalography (MEG) (Hari et al., 1998), by a quantified electroencephalography (Cochin et al., 1999) and the permanently implanted subdural electrodes (Tremblay et al.,, 2004).

Generally, during the task of motor imagination, the researches have shown that different areas are activated, including those belonging to the mirror neuron system. This indicates to an existence of a complex distributed neural circle of motor thinking which also includes various cortical areas basically included in the execution and noticing of an activity (Buccio and Riggio, 2006).

The participation of the mirror neuron system in an imitation has been lately ascertained by a series of exploration of methods for a brain presentation (Koski et al., 2002; Grezes et al., 2003; Heiser et al., 2003, according to Buccino and Riggio, 2006). The recent research dealt with the studying of a motor learning of a new motor pattern by the observation of motion (Buccino et al., 2004). Amusically uneducated person was asked to learn to play different guitar accords on the basis of an observation and imitation of a professional guitarist who played accords. It was noticed that the system of mirror neurons was active in all phases of the process of a motor learning, namely since the perception of an example to the very performing of an example by the examinee.

podrazumijeva preraspodjelu osnovnih motoričkih kretnji koje ga sačinjavaju radi uklapanja u zadani model. Čini se da je to operacija koju mozak izvodi u potpunosti unutar motoričkog sistema, bez uključivanja specifičnih asocijativnih područja (Buccino i Riggio, 2006).

Druga: Malacko i Doder (2008) navode da istraživanja antropološke (humane) genetike, a naročito genetike u sportu, ukazuju na to da se vrhunski rezultati u sportu ne mogu postići samo primjenom savremenih metoda treninga, već da oni zavise i od genske uslovljenosti pojedinih antropoloških osobina, sposobnosti i karakteristika sportista, čime sportsko antropološka genetika dobija još važnije mjesto u u području sportske antropologije.

Isti autori takođe navode da postoje dva značajna elementa u istraživanju genske uslovljenosti antropoloških karakteristika: *mehanizam nasljeđivanja*, koji se odnosi na broj i način prenošenja gena sa roditelja na djecu i *fenomen nasljednosti*, koji se odnosi na udio genskog faktora u odnosu na faktor sredine u fenotipskoj promjenljivosti osobina.

Začetnikom moderne genetike se smatra naučnik Gregor Johann Mendel (1822-1884). Gregor Mendel je bio češki sveštenik, botaničar i zoolog, koji se zapravo smatra ocem genetike, jer je dokazao paritkularno nasljeđivanje. Pod partikularnim nasljeđivanjem se podrazumijeva da su osobine definisane nasljednim faktorima koji se prilikom prenošenja sa roditelja na potomstvo ne miješaju, već se pri nastanku gameta prvo razdvajaju, a potom nezavisno kombinuju u procesu oplođenja.

Genetika je nauka koja proučava nasleđivanje i promjenljivost osobina. Skup svih osobina jednog organizma je *fenotip* (skup svih osobina jedne ljudske individue, koji predstavlja rezultat interakcije nasljednih faktora i vanjske sredine), a skup svih gena je *genotip* (manifestacija specifičnog sklopa bazičnih jedinica nasljednosti, gena). Pojmove fenotip i genotip je prvi koristio danski botaničar Wilhelm Johannsen (1857–1927). Gen je osnovna materijalna i funkcionalna jedinica genetičkog materijala, odnosno biološkog nasljeđivanja.

Genom nekog organizma su svi njegovi nasljedni podaci kodirani u DNK. Time su obuhvaćeni kako geni tako i ne-kodirajuće sekvence DNK. Izraz genom je osmislio njemački botaničar Hans Karl Albert Winkler (1877-1945) 1920. godine, kao složenicu, koju je sastavio od riječi gen i hromosom.

Genomika je nauka koja izučava strukturu i organizaciju genoma. Prema tome, genomika je nauka o genomu i mogućnostima njegovih arteficijelnih izmjena,odnosno ciljane rekompozicije. To predstavlja područje genetike koje pročava metode rekombinantne

These results strongly support the theory saying that the learning of a new motor pattern purports to the distribution of basic motor motions which made it because of a fitting in the given task. It seems that this is an operation performed by a brain completely inside the motor system, without the inclusion of specific associative areas (Buccino and Riggio, 2006).

The second. Malacko and Doder (2008) say that the researches of anthropologic (human) genetics, especially a genetics in sport, suggest that the top results in sport cannot be accomplished only by the use of contemporary methods of training, but they also depend on the genetic condition of some anthropologic traits, abilities and characteristics of sport, by which the sport anthropologic genetics attains a more important place in the area of a sport anthropology.

The same authors also argue that there are two important elements in the research of condition for the anthropologic characteristics: *mechanism of inheritance*, related to the number and way of transferring of genes from parents to children and *phenomenon of inherited*, related to the share of a genetic factor in relation to the factor of an environment in a phenotype changeability of properties.

Gregor Johann Mendel, a scientist, (1822-1884) is considered to be the founder of modern genetics. Gregor Mendel was a Czech bishop, botanist and zoologist which is actually considered to be the father of genetics, because he had ascertained the particular inheritance. This term means that the traits are defined by inheritance factors which do not mix during the transfer from parents to children, but firstly separate in the development of a gamete and then independently combine into the process of fertilisation.

Genetics is a science dealing with an inheritance and changeability of traits. An aggregate of all properties of an organism is a *phenotype* (aggregate of all properties of one human individual representing the result of interaction of inherited factors and external environment), and the aggregate of all genes is a *genotype* (manifestation of a specific system of basic units of inheritance, genes). The terms phenotype and genotype were firstly used by Danish botanist Wilhelm Johansen (1857-1927). A gene is a basic material and functional unit of a genetic material, namely a biological inheritance.

A genome of any organism represents all his inheritance data coded in DNA. This comprises not only genes but also non-coding sequences of DNA. The term genome was coined by German botanist Hans Karl Albert Winkler (1877-1945) as a compound made of words *gene* and *chromosome.*

Genomics is a science dealing with the structure and organisation of genomes. Therefore, genomics is a

DNK, metode analize DNK i bioinformatiku sekvenci, montažu i analizu strukture i funkcije genoma (u cjelokupnom sistemu DNK unutar jedne ćelije organizma) (Culver i sar., 2002).

Analiza pojedinačnog genoma do sada se uglavnom usredsređivala na istraživanje porijekla, statusa prenosilaca kritičniih gena, zdravstvenih rizika ili odgovora na farmakološka sredstva. Sa druge strane, sport predstavlja relativno novo područje primjene genetske analize u cilju identifikacije urođenih kapaciteta pojedinca za vrhunsko sportsko dostignuće, ili rizika od povrede. Trenutno su genetska istraživanja, koja su povezana sa sportskim dostignućem, relativno rijetka (Swan, 2012, prema Ostojić i sar., 2013).

Brojnim pokušajima u posljednjih nekoliko godina da otkriju genetske varijante povezane sa elitnom sportskom izvedbom, ili preciznije vrhunskim sportskim statusom, došlo je do određenog napretka zahvaljujući malom broju koordiniranih istraživačkih napora koji su se uglavnom oslanjali na gene kandidate odnosno mali broj jednonukleotidnih polimorfizama (SNP) i strukturnih varijanti. Trenutno je identifikovano 52 varijante (polimorfizama) kod 36 gena podijeljenih u pet kategorija sportskog dostignuća: izdržljivost, mišićne karakteristike, kapacitet kardiorespiratornog sistema, metaboličke karakteristike i kvalitet tetivno-ligamentnog sistema (Roth i sar., 2012).

Slično kao i u drugim područjima istraživanja, porodične analize parova blizanaca su u početku bile glavni predmet istraživanja genetske osnove sposobnosti i izvedbe čovjeka (Pitsiladis i sar., 2013). U istraživanju 4488 odraslih britanskih blizanaca, heritabilnost „sportskog statusa“ se procjenjuje na 66% (De Moor i sar., 2007).

Napredak u molekularnoj tehnologiji omogućio je naučnicima široko usmjeren pristup povezanosti genoma (genom-wide association GWAS) na ljudske osobine. GWAS istražuje povezanost genetskih varijacija sa ishodom odnosno fenotipom koji je predmet interesovanja, analizirajući od 100 000 do nekoliko miliona različitih polimorfizama bez ikakvih prethodnih pretpostavki o mogućim mehanizmima.

Genotipizacija sportista najvišeg ranga i performansi kao što su svjetski rekorderi, svjetski prvaci, olimpijci, vrlo je poželjna, ali do sada je provedeno malo kohortnih analiza sportista svjetske klase (Pitsiladis i sar., 2013).

U ovom trenutku postoji oko 20 međunarodnih preduzeća/laboratorija koja nude genetsko profilisanje u cilju prepoznavanja sportskiih potencijala. Standardizacija dijagnostičkih procedura nije usaglašena i manje od 25%

science about a genome and contingencies of its artificial changes, namely a target re-composition. This represents the area of genetics studying the methods of recombinant DNA, methods of analysis of DNA and bioinformatics of sequences, assembly and analysis of a structure and function of genomes (in an entire system of DNA, inside one cell of an organism) (Culver et al., 2002).

The analysis of an individual genome have so far been focused mostly on the research of an origin, the status of transmitter of critical genes, health risks or answers toto pharmacological means. On the other side, sport represents a relatively new area of use of genetic analysis for the purpose of an identification of inborn capacities for top sport achievement, or risks form an injury. The genetic researches related to sport accomplishments currently are relatively rare. (Swan, 2012, according to Ostojić et al., 2013).

A certain advancement was accomplished during last several years by numerous efforts to discover genetic variances related to an elite sport performance, or, more precisely, to a top sport status, thanks to a small number of coordinated researching efforts mostly based on gene candidates, namely on a small number of one-nucleotide polymorphisms (SNP) and structural variances. 52 variances (of polymorphisms) are currently identified for 36 genes divided into five categories of a sport accomplishment: endurance, muscular characteristics, capacity of cardio respiratory system, metabolic characteristics and a quality of a hamstring-ligament system (Roth et al., 2012).

Like in other areas of research, the family analyses of pairs of tweens were in the beginning a main topis of research of a genetic basis of ability and creation of a man (Pitsiladis et al., 2013). In the research of 4488 adult British tweens, heritability of “sport status” is estimated to be 66% (De Moor et al., 2007).

An advancement in the molecular technology provided the scientists with an approach of (*genome-wide association* GWAS) on human properties. The GWAS researches the association of genetic variances with the result, namely a phenotype which is the topic of interest, analysing from 100 000 to several millions of different polymorphisms without any previous assumptions about many mechanisms.

The genotyping of athletes of the highest ranking and performances like world record-holders, world champions, Olympics games participants, is very desirable, but a little cohort analyses of world class athletes have been carried out so far (Pitsiladis et al., 2013).

In this moment, there are about 20 international enterprises/laboratories offering a genetic profiling for the purpose of recognition of sport potentials. The standardi-

laboratorija posjeduje AABB i CLIA standarde kvaliteta. Sami testovi se veoma razlikuju po obimu, cijeni i načinu uzimanja uzoraka (Wagner i Royal, 2012). Osim etičkih ograničenja genetskog profilisanja, testovnim procedurama nedostaje i apsolutna metrijska valjanost, odnosno rezultati se ne odnose na cjelokupnu ljudsku populaciju, jer su zasnovani na istraživanjima genotipizacije osoba evropskog porijekla (nedostaju podaci drugih etničkih i rasnih grupa), niti obuhvataju analizu poligenskih interakcija (Wagner i Royal, 2012).

Tabela 1. *Glavni geni kandidati povezani sa ljudskim performansama (Lippi i sar., 2010)*

KAPACITETI IZDRŽLJIVOSTI
PPARD
Ćelijski respiratorni faktori (NRF2)
PGC-1 alfa
HIF-1 alfa
EPAS-1 i HIF-2 alfa
Hemoglobin
Glikogen sinteza skeletnog mišića (GYS1)
ADRB2
CHRM2
VEGF
MIŠIĆNEPERFORMANSE
CK-MM
ACTN3
MLCK
ACE
AMPD1
IGF-1
VEZIVNI APARAT
ABO krvna grupa
COL1A1 i COL5A1
TNC
PSIHOLOŠKA SPOSOBNOST
Serotonin transporter gen (5HTT)
BDNF
UCP2

sation of diagnostic procedures is not determined and less than 25% of laboratories possesses the AABB and the CLIA quality standards. The tests are very different by a volume, price and a way of sample taking (Wagner and Royal, 2012). Except ethical constraints of a genetic profiling, the test procedure lacks an absolute metric validity, namely the results are not related to the entire human population, because they are based on the researches of a genotyping of persons with the European origin (there are no data about other ethic and racial groups), and they also do not comprise an analyses of polygene interactions (Wagner and Royal, 2012).

Table 1. *Major candidate genes associated with human athletic performances (Lippi et al., 2010).*

ENDURANCE CAPACITY
PPARD
Nuclear respiratory factors (NRF2)
PGC-1 alfa
HIF-1 alfa
EPAS-1 i HIF-2 alfa
Hemoglobin
Skeletal muscle glycogen synthase (GYS1)
ADRB2
CHRM2
VEGF
MUSCLE PERFORMANCE
CK-MM
ACTN3
MLCK
ACE
AMPD1
IGF-1
TENDON APPARATUS
ABO blood group
COL1A1 i COL5A1
TNC
PSYCHOLOGICAL APTITUDE
Serotonin transporter gene (5HTT)
BDNF
UCP2

Zaključak

Budućnost kondicionog treninga će se neminovno kao i do sada usmjeravati i razvijati u skladu sa najnovijim naučnim saznanjima i praktičnim postignućima. Pored, u ovom radu navedenih saznanja, svakako da će se pojaviti i neka nova, koja će takođe, kondicionom treningu, pružiti informacije na osnovu koji će biti moguće poboljšati već postojeće metode i oblike rada.

Kao zaključak na dva saznanja koja su predstavljena u ovom radu, prije svega je potrebno istaći da rezultati dosadašnjih istraživanja jasno pokazuju da motorički sistem nije uključen samo u izvođenje aktivnosti, nego i u druge, kognitivne motoričke funkcije. Savladavanje novih motoričkih struktura, bi takođe, moglo predstavljati, kombinovanje osnovnih motoričkih kretnji, koje ga sačinjavaju na sada nov, odnosno inoviran način. Izgleda da se to rekombinovanje zbiva unutar sistema ogledalo neurona, bez uključivanja specifičnih asocijativnih područja.

Sa druge strane, procedurama moderne molekularne biologije pokušava se doći do genetskih markera, gena, polimorfnih varijacija, i faktora koji određuju fenotipe svih funkcionalno-motoričkih sposobnosti. Veoma složena mapiranja traju i permanentno se sprovode nova istraživanja, iako je postavka pojedinih koncepata genetske mape vrhunskih sportista djelimično utvrđena i prezentirana u mnogim naučnim radovima (Williams i Folland, 2008; Bray i sar., 2009; Bouchard i Hoffman, 2011).

Dakle, više se ne može postavljati pitanje da li su sposobnosti čovjeka genetski zavisne, već koji konkretno genetski faktori to uslovljavaju. Traganje i mapiranje genetskih markera neminovno će se nastaviti i u budućnosti. Do kada, jednog dana će se saznati.

Conclusion

The future of a conditioning training will unavoidably, like so far, be directed and developed in accordance with the newest scientific findings and practical achievements. Beside this, in this work of mentioned knowledge, it is obviously that some new findings which also give information to the conditioning training will emerge and, on the basis of these findings, it will be possible to improve the existing methods and ways of work.

As the conclusion of two findings presented in this work, it is, first of all, necessary to mention that the results of previous researches obviously show that the motor system is included not only in the execution of activities, but also in other cognitive motor functions. The learning of new motor structures would also present the combination of the basic motor activities, which make it in now a new, namely innovated manner. It seems that this recombination occurs inside a system of mirror neurons without the inclusion of specific associative areas.

On the other side, there are efforts to reach to the genetic markers, genes, polymorph variances and factors determining the phenotypes of all functional-motor abilities with the procedures of a modern molecular biology. A very complex mappings lasts and new researches are permanently being carried out, although the assumption of some concepts of a genetic map of elite athletes is partly determined and presented in many scientific works (Williams and Folland, 2008; Bray et al., 2009; Bouchard and Hoffman, 2011).

Therefore, the question asking if the man's abilities are related cannot be raised any longer, but it should be asked which concrete factors condition this. The search and mapping of genetic markers will unavoidably be continued in the future. One day it will be obvious to which moment it will last.

Literatura / References

Bouchard, C., Hoffman, E. (2011). *The Encyclopaedia of Sports Medicine: An IOC Medical Commission Publication, Volume XVIII, Genetic and Molecular Aspects of Sports Performance*. Blackwell Publishing Ltd.

Bray, M.S., Hagberg, J.M., Pérusse, L., Rankinen T., Roth, S.M., Wolfarth, B. & Bouchard, C. (2009). The human gene map for performance and health-related fitness phenotypes: The 2006-2007 update. *Medical Science of Sports and Exercise, 41*, 35-73.

Buccino, G., Vogt, S., Ritzl, A., Fink, G.R., Zilles, K., Freund, H.J., & Rizzolatti, G. (2004). Neural circuits underlying imitation learning of hand actions: an event-related fMRI study, Neuron, 42, 323-334.

Buccino, G. and Riggio, L. (2006). The Role of the Mirror Neuron System in Motor Learning. *Kinesiology, 38*(1), 5-15.

Cochin, S., Barthelemy, C., Roux, S., & Martineau, J. (1999). Observation and execution of movement: similarities demonstrated by quantified electroencephalography. *European Journal of Neuroscience, 11*, 1839-1842.

Culver K. W. et al. (2002): Genomics. In Robinson R. (Ed.) Genetics. Macmillan Science Library. Macmillan Reference USA.

Čustonja, Z. i Jajčević, Z. (2003). Pregled razvoja kondicijske pripreme. U D. Milanović i I. Jukić (Ur.) *Kondicijska priprema sportaša, Zbornik radova međunarodno znanstveno – stručnog skupa, Zagreb, 21- 22. 2. 2003*. (str. 33-40). Zagreb: Kineziološki fakultet Sveučilišta u Zagrebu, Zagrebački športski savez.

De Moor, M. H., Spector, T. D., Cherkas, L. F., Falchi, M., Hottenga, J. J., Boomsma, D. I., et al. (2007). Genome-wide linkage scan for athlete status in 700 British female DZ twin pairs. Twin Research and Human Genetics, 10(6), 812–820.

Fadiga, L., Fogassi, L., Pavesi, G., & Rizzolatti, G. (1995). Motor facilitation during action observation: a magnetic stimulation study. *Journal of Neurophysiology, 73*, 2608-2611.

Filostrat, L.F. (1928). *O trenerskoj nauci* (prevod Bora Jovanović). Budapest: Stephaneum.

Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti, G. (1996). Action recognition in the premotor cortex. *Brain, 119*, 593-609.

Gangitano, M., Mottaghy, F.M., & Pascual-Leone, A. (2001). Phase-specific modulation of cortical motor output during movement observation. Neuroreport, 12, 1489-1492.

Hari, R., Forss, N., Avikainen, S., Kirveskari, E., Salenius, S., & Rizzolatti, G. (1998). Activation of human primary motor cortex during action observation: a neuromagnetic study. *Proceedings of National Academy of Science USA*, 95, 15061-15065.

Jeannerod, M. (1994). The representing brain: neural correlates of motor intention and imagery. *Behavioral Brain Research, 17*, 187-245.

Koehler, E., Keysers, C., Umilta', M.A., Fogassi, L., Gallese, V., & Rizzolatti, G. (2002). Hearing sounds, understanding actions: action representation in mirror neurons. *Science, 297*, 846-848.

Kreamer, W., Hakkinen, K. (2002). *Strength Training for Sport*. Blacwell Science Ltd.

Lippi G., Longo, U., Maffulli, N. (2010). Genetics in sport. *British Medical Bulletin, 93,* 27-47.

Malacko, J., i Doder, D. (2008). *Tehnologija sportskog treninga i oporavka*. Pokrajinski sekretarijat za sport i omladinu, Sportski savez Vojvodine.

Ostojić, M.S., Calleja – Gonzalez, J., Jukić, I. (2013). Genomika u sportu: Ultimativna dijagnostika XXI stoljeća? U I. Jukić, C. Gregov, S. Šalaj, L. Milanović i Wertheimer, V (Ur.) *Kondicijska priprema sportaša, Zbornik radova međunarodno znanstveno – stručnog skupa, Zagreb, 22- 23. 2. 2013*. (str. 19-20). Zagreb: Kineziološki fakultet Sveučilišta u Zagrebu, Zagrebački športski savez.

Pitsiladis, Y., Wang, G., Wolfarth, B., Scott, R., et al. (2013). Genomics of elite sporting performance: what little we know and necessary advances. *British Journal of Sports Medicine, 47*(9), 550–555.

Rizzolatti, G., Camarda, R., Fogassi, L., Gentilucci, M., Luppino, G., & Matelli, M. (1988). Functional organization of inferior area 6 in the macaque monkey: II. Area F5 and the control of distal movements. *Experimental Brain Research, 71*, 491-507.

Rizzolatti, G., Fadiga, L., Gallese, V., & Fogassi, L. (1996). Premotor cortex and the recognition of motor actions. *Cognitive Brain Research, 3*, 131-141.

Roth, S.M., Rankinen, T., Hagberg, J.M., Loss, R.J., Pérusse, L., Sarzynski, M.A., Wolfarth, B. & Bouchar, C. (2012). Advances in exercise, fitness, and performance genomics in 2011. *Medicine and Science in Sport and Exercise, 44*(5), 809-817.

Šalaj, S. i Brusač, M. (2013). Genetska istraživanja u sportu: Rezultati i primjena u selekciji sportaša. *Kondicijski trening, 11*(1), 7-13.

Strafella, A., & Paus, T. (2000). Modulation of cortical exitability during action observation: a transcranial magnetic stimulation study. *Neuroreport, 11*, 2289-2292.

Swan, M. (2012). Applied genomics: personalized interpretation of athletic performance genetic association data for sports performance capability and injury reduction. *The Journal of Bioscience and Medicine, 2*(1), 1-10.

Todd, T. (1985). The myth of muscle-bound lifter. *NSCA Journal. 7*(3), 37-41.

Tremblay, C., Robert, M., Pascual-Leone, A., Lepore, F., Nguyen, D.K., Carmant, L., Bouthillier, A., & Theoret, H. (2004). Action observation and execution: intracranial recordings in a human subject. *Neurology, 63*, 937-938.

Umilta', M.A., Koelher, E., Gallese, V., Fogassi, L., Fadiga, L., Keysers, C., & Rizzolatti, G. (2001). I know what you are doing: a neurophysiological study. *Neuron, 31*, 155-165.

Wagner, J.K., Royal, C.D. (2012). Field of Genes: An Investigation of Sports-Related Genetic Testing. *Journal of Personalized Medicine, 2*(3), 119-137.

Williams, A.G., Folland, J.P. (2008). Similarity of polygenic profiles limits the potential for elite human physical performance. *Journal of Physiology, 586*(1), 113-21.

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Short notice

Prognostički kvaliteti eurofit baterije motoričkih testova u odnosu na specifične strukture kretanja u sportskim igrama

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Sažetak: Istraživanje je provedeno na uzorku od 120 ispitanika-učenika Mješovite srednje tehničke škole u Travniku, uzrasne dobi 15 do 16 godina. Svi učenici koji su predstavljali uzorak ispitanika redovno su pohađali nastavu tjelesnog i zdravstvenog odgoja u toku školske godine, bez izraženih motoričkih i psihičkih aberacija. U istraživanju je primijenjena Eurofit baterija motoričkih testova, definisanih kao prediktorski skup varijabli i skup od dvanaest varijabli za procjenu usvojenosti specifičnih struktura kretanja u sportskim igrama svedenih na prvu glavnu komponentu, definisanih kao kriterij.

Osnovni cilj istraživanja bio je utvrđivanje statističke značajnosti i veličina relativnih uticaja Eurofit baterije motoričkih testova, kao prediktora na nivo usvojenosti specifičnih struktura kretanja u sportskim igrama, definisanih kao kriterij. Za utvrđivanje statističke značajnosti i veličine relativnih uticaja Eurofit baterije motoričkih testova na nivo usvojenosti specifičnih struktura kretanja u sportskim igrama (košarka, rukomet, odbojka i nogomet) svedenih na prvu glavnu komponentu primijenjena je linearna regresiona analiza.

Rezultati regresione analize ukazuju na visok prognostički kvalitet Eurofit baterije motoričkih testova na kvalitet realizacije specifičnih struktura kretanja u sportskim igrama (košarka, rukomet, odbojka i nogomet), a najznačajniji prognostičke kvalitete ostvarili su testovi snage u svim njenim manifestacijama, testovi segmentarne brzine, testovi agilnosti i opšte izdržljivosti.

Dobijeni rezultati mogu biti od koristi izvođačima nastave tjelesnog i zdravstvenog odgoja kao dobra osnova kvalitetnijeg programiranja nastavnih sadržaja sportskih igara, odabira nastavnih sredstava, praćenja i kontrole efekata nastavnih sadržaja na antropološki status učenika, kao i objektivnog vrednovanja i ocjenjivanja postignutih rezultata u nastavnom procesu.

Ključne riječi: Eurofit baterija testova, složene strukture kretanja, sportske igre.

Forcasting Quality of Eurofit Battery in Motor Tests as Related to Specific Movement Structures in Sports Disciplines

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Abstract: The research was conducted on the sample of 120 participants – the students of Combined technical high school in Travnik, age from 15 to 16 years old. All the students from the sample regularly attended physical and health education classes during the school year, and didn't have noticeable 'motor and psychological aberrations'. The research utilized Eurofit motor test battery defined as a predictor group of variables and a group of twelve variables for evaluation of acquisition of specific movement structures in sports disciplines, reduced to the first main component, and defined as a criterion.

The main goal of the research was to determine statistically significant differences and the scope of the relative influence of Eurofit motor test battery, as a predictor of the level of specific movement structures acquisition in sports disciplines, defined as a criterion. To determine the statistical significance and the scope of the relative impact of Eurofit motor test battery on the level of specific movement structures acquisition in sports disciplines (basketball, handball, volleyball and football) reduced to the first main component, we applied linear regression analysis.

The regression analysis results indicate high forecasting quality of Eurofit motor test battery on the quality of realization of specific movement structures in sports disciplines (basketball, handball, volleyball and football), and the most important forecasting quality was shown in strength tests in all their manifestations, segmental speed tests, agility and general endurance tests.

The results can be useful to physical and health education teachers as a good basis for higher quality syllabi for sports disciplines, choice of teaching equipment, monitoring and controlling of education effects on anthropological status of students, as well as for a more objective evaluation of students' achievements in education.

Key words: Eurofit battery in motor tests, complex movement structures, sports disciplines.

Uvod

Uspjeh u nastavi tjelesnog i zdravstvenog odgoja zavisi od velikog broja antroploških karakteristika učenika. Njihovi međusobni odnosi su različiti, baš kao i njihov uticaj na usvojenost određenih nastavnih sadržaja, te je poznavanje tih odnosa od velike važnosti za nastavnika tjelesnog odgoja koji je najodgovorniji za pravilno programiranje i realizaciju nastavnih sadržaja (Hadžikadunić, 2004; Findak, 2001). Poznavanje veličine i smjera uticaja motoričkih sposobnosti učenika na uspjeh u savladavanju programskih sadržaja nastave tjelesnog i zdravstvenog odgoja moguće je saznati neprekidnim praćenjem i provjeravanjem antropoloških karakteristika učenika. Za svako proučavanje uticaja bilo kojeg segmenta antropološkog prostora na uspjeh u nastavnom procesu vrlo je važno na koji način se procjenjuje nivo usvojenosti programiranih nastavnih sadržaja, tj. učeničkog dostignuća (Ražanica, 2006). Iz toga proističu i sve veći zahtjevi u planiranju i programiranju nastavnih sadržaja koji treba da budu maksimalno približeni učenicima i prilagođeni njihovim sposobnostima i interesima (Hadžikadunić, 2004; Findak, 2003; Jašarević, I., 2006).

U ranijim radovima (Ismail i Gruber, 1965; Katić, 1986 i 1988), koji su se bavili istraživanjem uticaja motoričkih sposobnosti na opšti školski uspjeh i uspjeh u tjelesnom odgoju utvrđena je značajna povezanost motoričkih sposobnosti i opšteg uspjeha u školi, odnosno uspjeha u tjelesnom odgoju. U pomenutim radovima se konstatuje da se u motoričkom prostoru sa svakim motoričkim testom može predvidjeti uspjeh u tjelesnom odgoju i da su to najbolji prediktori za predikciju uspjeha. U latentnom prostoru za uspjeh je odgovoran faktor kortikalne regulacije sa primjenom regulisane sile.

Osnovni cilj ovog istraživanja bio je da se utvrde statističke značajnosti i veličina relativnih uticaja Eurofit baterije motoričkih testova, kao prediktora na nivo usvojenosti specifičnih struktura kretanja u sportskim igrama, definisanih kao kriterij.

Metod rada

Uzorak ispitanika

Istraživanje je provedeno je na uzorku od 120 ispitanika – učenika prvog i drugog razreda Mješovite srednje tehničke škole u Travnika koji su u školskoj 2013/2014. godini pohađali nastavu tjelesnog i zdravstvenog odgoja. Ukupan uzorak od 120 učenika nije zasnovan ni na kakvim kriterijima koji bi mogli biti u korelaciji sa manifestnim antropološkim dimenzijama. Jedini kriterij po kojem su učenici stekli pravo da budu dio uzorka je da su bili u nastavnom procesu i potpuno zdravi (svi učenici koji su bili bolesni u vrijeme testiranja nisu uključeni u uzorak iako su redovno pohađali nastavu). Istraživanje je provedeno u redovnim uslovima nastave tjelesnog i zdravstvenog odgoja.

Introduction

The success in the physical and health education depends on numerous anthropological characteristics of students. Their mutual relations are different, as well as their influence on the acquisition of certain teaching units, so the knowledge of those relations is very important for teachers of physical education who are the most responsible for the appropriate planning and realization of teaching syllabus (Hadžikadunić, 2004; Findak, 2001). The knowledge of size and direction of influence of students' motor abilities on the success in acquisition of physical and health education teaching units is possible to find out by continuous monitoring and checking of students' anthropological characteristics. For each study of influence of any segment of anthropological space on the students' success in education, the manner in which one evaluates the level of acquisition of teaching units, that is, students' achievements is very significant (Ražanica, 2006). This implies more demanding planning of the teaching syllabus which has to be maximally fitted and adapted to students' abilities and interests (Ražanica, 2006). In the earlier studies (Ismail & Gruber, 1965; Katić, 1986 & 1988) that dealt with the influence of motor abilities on general success in school and success in physical education, a significant connection was found among motor abilities and general success in school, namely, the success in physical education. In the mentioned studies the conclusion was that within the motor space it is possible to predict success in physical education via motor tests and those tests would be the best predictors of success. A factor of cortical regulation together with the application of regulated force is responsible for success in the latent space.

Methodology

The research sample

The research was conducted on the sample of 120 participants – students of the first and second grade of Combined technical high school in Travnik who attended physical and health education classes during the 2013/2014 school year. The total sample of 120 participants wasn't based on any criteria that could correlate to the manifest anthropological dimensions. The only criterion for the students to participate in the study was for them to be completely healthy during their classes (all the students who proved to be sick while the testing was in session were left out of the research sample even though they regularly showed up for classes). The research took place during the regular physical and health education lessons.

nici koji su u periodu mjerenja i testiranja bili bolesni, a dolazili su i pored toga na nastavu, bili su izostavljeni iz uzorka). Istraživanje je provedeno na redovnoj nastavi iz predmeta tjelesnog i zdravstvenog odgoja.

Uzorak varijabli za procjenu motoričkih sposobnosti (prediktorski sistem)

Za procjenu bazičnih motoričkih sposobnosti primijenjene su varijable po prijedlogu Eurofit baterije testova. Opredjeljenje za ovu bateriju testova je iz razloga što je ona često primjenjivana u utvrđivanju morfološkog i motoričkog statusa učenika osnovnoškolskog i srednjoškolskog uzrasta. Prilikom izbora varijabli vodilo se računa da odgovaraju uzrasnim karakteristikama ispitanika, materijalnim uslovima i raspoloživom instrumentariju. Prediktorski sistem varijabli čine: skok u dalj iz mjesta (MFESDM), ležanje – sjed (MRCDTL), pokretljivost u zglobu kuka (MFLPRK), taping rukom (MBFTAP), trčanje tamo – ovamo 10 x 5 m (ŠATL10x5), izdržaj u zgibu (MSAVIS), ravnoteža „flamingo“ (FLAMIN), dinamometrija šake (MBFDIN) i trčanje na 20 m tamo – ovamo sa progresivnim ubrzavanjem (ŠATL 20).

Uzorak varijabli za procjenu specifičnih struktura kretanja u sportskim igrama (kriterijski sistem)

Za procjenu specifičnih struktura kretanja košarke primijenjeni su testovi pomoću kojih se utvrdilo poznavanje osnovnih elemenata tehnike: bacanje i hvatanje lopte o zid za 30“ (SMKBLZ), vođenje lopte u slalomu (SMKVLS) i ubacivanje lopte u koš za 30“ (SMKBLK).

Za procjenu specifičnih struktura kretanja rukometa primijenjeni su testovi pomoću kojih se utvrdilo poznavanje osnovnih elemenata tehnike rukometa: izvođenje sedmerca(SMRSED), bacanje i hvatanje lopte o zid za 30“ (SMRBLZ) i vođenje lopte u slalomu (SMRVLS).

Za procjenu specifičnih struktura kretanja odbojke primijenjeni su testovi pomoću kojih se utvrdilo poznavanje osnovnih elemenata tehnike odbojke: gađanje cilja preko mreže iz osnovnog stava (SMOGCI), odbijanje podlakticama (čekić) u krugu za 30“ (SMOČEK) i donji „školski“servis (SMOSRV).

Za procjenu specifičnih struktura kretanja nogometa primijenjeni su testovi kojima se utvrdilo poznavanje osnovnih elemenata tehnike nogometa: snaga udarca po lopti nogom(SMNSNO), vođenje lopte u slalomu (SMNVLS) i žongliranje loptom (SMNŽON).

Statistička obrada podataka

U cilju formulisanja valjanih zaključaka izračunati su osnovni centralni i disperzioni parametri, ali zbog

A variable sampling for evaluation of motor abilities (predictor system)

In order for the basic motor abilities to be evaluated, the research utilized variables suggested by the Eurofit test battery. The reason for choosing this test battery was due to the fact that it is very often used in determination of morphological and motor status of primary and secondary school aged students. A special attention was dedicated toward the selection of variables that fit the age characteristics of the participants, material conditions and available instruments. Predictor system of variables consists of: standing long jump (MFESDM), sit-ups (MRCDTL), flexibility – movement in hip joint (MFLPRK), hand tapping (MBFTAP), 10 x 5 meter shuttle run (SATL10x5), pull-up endurance (MSAVIS), Flamingo balance test (FLAMIN), handgrip test (MBFDIN), and 20 meter shuttle run with progressive acceleration (SATL 20).

A variable sampling for evaluation of specific movement structures in sports disciplines (the criterion system)

In order to evaluate specific movement structures in basketball, we applied tests to determine the knowledge of the basic technical elements: throwing the ball against the wall and catching it in 30” (SMKBLZ), slalom dribbling (SMKVLS), and shooting in 30” (SMKBLK).

In order to evaluate specific movement structures in handball, we applied tests to determine the knowledge of the basic technical elements in handball: 7-meter throw (SMRSED), throwing the ball against the wall and catching it in 30” (SMRBLZ) and slalom dribbling (SMRVLS).

In order to evaluate specific movement structures in volleyball, we applied tests to determine the knowledge of the basic technical elements of volleyball: aiming for the target across the net from the basic position (SMOGCI), bumping the ball in a circle for 30” (SMOCEK) and underhand serve (SMOSRV).

In order to evaluate specific movement structures in football, we applied tests to determine the knowledge of the basic technical elements of football: the power of kicking the ball (SMNSNO), leading the ball in slalom dribbling (SMNVLS) and juggling a ball (SMNZON).

Statistical data analysis

With the aim of determining the valid conclusions, basiccentral and dispersionparameterswere calculated, but because of limited space the tables were not be displayed. . To determine the statistical significance and the

ograničenosti prostora tabele neće biti prikazane. Za utvrđivanje statističke značajnosti i veličine relativnih uticaja Eurofit baterije motoričkih testova (prediktorski skup varijabli) na nivo usvojenosti specifičnih struktura kretanja u sportskim igrama (košarka, rukomet, odbojka i nogomet; kriterijski skup varijabli) svedenih na prvu glavnu komponentu primijenjena je linearna regresiona analiza.

Rezultati i diskusija

Regresiona analiza prve glavne komponente košarke u prostoru motoričkih sposobnosti

Regresiona analiza kriterijske varijable prve glavne komponente specifičnih struktura kretanja (tehnike) košarke o uticaju primijenjene Eurofit baterije motoričkih testova na uspjeh izvođenja tretirane kriterijske varijable prikazana je u tabeli 1. Uvidom u datu tabelu može se vidjeti da koeficijent multiple korelacije iznosi R = .46, što predstavlja povezanost cjelokupnog sistema prediktorskih varijabli sa kriterijskom varijablom. Cijelim sistemom prediktora objašnjeno je 21% zajedničke varijanse kriterija. Povezanost ova dva sistema je statistički značajna na nivou p=0.002. Ostalih 79 % u objašnjavanju zajedničkog varijabiliteta može se pripisati drugim karakteristikama i sposobnostima ispitanika koje u ovom radu nisu primijenjene.

Analizom uticaja pojedinačnih varijabli (tabela 2) može se zaključiti da najveći i statistički značajan uticaj na specifične strukture kretanja košarke imaju varijable: taping rukom (MBFTAP), skok u dalj iz mjesta (MBFSDM) i izdržaj u zgibu(MSAVIS).Ovo navodi na zaključak, što je i razumljivo, da postoji značajan uticaj motoričkih sposobnosti na cjelokupni sistem specifičnih struktura kretanja (tehnike) košarke.

Uočljivo je da najveći uticaj na rezultate specifičnih košarkaških testova imaju varijable za procjenu brzine pokreta rukama i snage u svim svojim oblicima ispoljavanja.To govori da su učenici kod kojih je bila ispoljena veća brzina i snaga, posebno eksplozivna, postizali bolje rezultate u situacionim testovima košarke. Ovakav rezultat je i logičan, jer je poznato da je košarka dinamična igra, sa puno dionica brzog trčanja i agilnosti što potvrđuju i prethodna istraživanja (Ražanica, 2006; Aruković, Huskić i Mekić, 2011; Bajrić S., Bajrić, O. I Mandić, 2011), koja ističu značajan uticaj motoričkih sposobnosti na rezultatsku uspješnost u specifičnim košarkaškim testovima.

scope of the relative impact of Eurofit motor test battery (predictor variable) on the level of specific movement structures acquisition in sports disciplines (basketball, handball, volleyball and football- criterion variables) reduced to the first main component, we applied linear regression analysis.

Results and discussion

Regression analysis of the first main component of basketball in the space of motor abilities

Regression analysis of criterion variable of the first main component involving specific movement structures (technical elements) in basketball about the influence of Eurofit motor test battery on the success of execution of the criterion variable is shown in Table 1. It can be seen from the table that the coefficient of multiple correlation is R = .46, which represents relationship of the entire system of predictor variables to the criterion variable. The predictor system explains for the 21% of the common criteria variance. The relationship between these two systems is statistically significant at the level of p = 0.002. The rest of 79% in explanation of the common variability can be ascribed to other characteristics and abilities of participants that haven't been examined in this research.

Analysis of the influence of specific variables (Table 2) shows that the variables with the biggest and statistically most significant influence onthe specific structure of the movement of basketball are: hand tapping (MBFTAP), standing long jump (MBFSDM) and pull-up endurance (MSAVIS). This leads to a logical conclusion that there is a significant influence of motor abilities on the entire system of specific movement structures (technical elements) in basketball.

It is obvious that the variables for evaluation of hand movement speed and power in all their manifestations have the biggest influence on the results of specific basketball tests. This tells us that students who were faster and had more strength, especially the explosive one, achieved better results in situational basketball tests. This result is logical, because it is well-known that basketball is a dynamic game, involving a lot of fast running and agility which is confirmed by the previous research (Ražanica, 2006; Aruković, Huskić & Mekić, 2011; Bajrić S., Bajrić, O. & Mandić, 2011), that emphasize the significant influence of motor abilities on the results in certain basketball tests.

Tabela 1. *Regresiona analiza prve glavne komponente KOŠARKE u prostoru motoričkih testova*

Table 1. *Regression analysis of the first main component of basketball in the space of motor tests*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.456	.208	.143	.92559889

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24,903	9	2,767	3,230	**,002**
	Residual	95,097	111	,857		
	Total	120,000	120			

Tabela 2. *Uticaj pojedinačnih varijabli motoričkih sposobnosti na specifične strukture kretanja u košarci*

Table 2. *Analysis of the influence of specific variablesonthe specific structure ofthe movementof basketball*

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	B	Std. Error
FLAMIN	.049	.045	.104	1.082	.281
MBFTAP	-.026	.012	-.210	-2.093	**.039**
MFLPRK	-.018	.015	-.122	-1.265	.208
MBFDIN	.014	.017	.082	.870	.386
MFESDM	.013	.005	.276	2.507	**.014**
MRCLDT	-.022	.027	-.081	-.796	.428
MSAVIS	.002	.001	.241	2.385	**.019**
SATL10×5	-.008	.009	-.095	-.939	.350
SATL 20	-.019	.016	-.141	-1.165	.246

Regresiona analiza prve glavne komponente rukometa u prostoru motoričkih sposobnosti

Rezultati regresione analize prve glavne komponente rukometa prikazani su u tabelama 3 i 4. Kao što se može vidjeti iz tabele 3, koeficijent multiple korelacije iznosi R = .49,a objašnjeni dio zajedničke varijanse 25% (R square). Povezanost tretiranih prostora je na nivou statističke značajnostI p=0.00. Analizom uticaja pojedinačnih varijabli (tabela 4) može se vidjeti da najveći i statistički značajan uticaj na kriterij imaju varijable:taping rukom(MBFTAP),skok u dalj iz mjesta (MBFSDM) i trčanje sa progresivnim ubrzanjem(ŠATL 20).Ovo navodi na zaključak, što je i razumljivo, da postoji značajan uticaj tretiranih motoričkih sposobnosti na cjelokupni sistem kriterija. Uočljivo je da najveći uticaj na rezultate rukometnih testova imaju varijable za procjenu brzine pokreta rukama, eksplozivne snage nogu i opšte izdržljivosti. Ovakav rezultat je i logičan jer je poznato da je rukometna igra vrlo dinamična, zahtijeva brza trčanja sa promjenom ritma i progresivnim ubrzanjima. Za uspješno izvođenje specifičnih kretnih struktura u rukometu visoku značajnost imaju eksplozivnost, brzina frekvencije pokreta i agilnost (Bolanča, Čavala i Rogulj, 2010).

Regression analysis of the first main component of handball in the space of motor abilities

The results of regression analysis of the first main component of handball are shown in Tables 3 and 4. Table 3 shows that coefficient of multiple correlation is R = .49, and the explained part of the common variance is 25% (R square). The relationship of examined spaces is at the level of statistical significance p=0.00. The analysis of the influence of specific variables (Table 4) shows that the following variables have the biggest statistically significant influence: hand tapping (MBFTAP), standing long jump (MBFSDM) and running with progressive acceleration (SATL 20). This leads to a conclusion, which is understandable, that there is a significant influence of the examined motor abilities on the entire system of criteria. It is noticeable that the biggest influence on the results of the handball tests comes from the variables for evaluation of hand movement speed, explosive power of legs and general endurance. This result is logical because it is well-know that handball is a very dynamic game; it requires fast running with the change of rhythm and progressive accelerations. Explosiveness, speed frequency of motion and agilityare important characteristics for successful playing of handball(Bolanča, Čavala & Rogulj, 2010).

Tabela 3. *Regresiona analiza prve glavne komponente RUKOMETA u prostoru motoričkih testova*

Table 3. *Regression analysis of the first main component of handball in the space of motor tests*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.499	.249	.188	.90120825

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29,848	9	3,316	4,083	**,000**
	Residual	90,152	111	,812		
	Total	120,000	120			

Tabela 4. *Uticaj pojedinačnih varijabli motoričkih sposobnosti na specifične strukture kretanja urukometu*

Table 4. *Analysis of the influence of specific variables on the specific structure of the movement of handball*

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	B	Std. Error
FLAMIN	-.010	.044	-.022	-.231	.817
MBFTAP	-.026	.012	-.210	-2.152	**.034**
MFLPRK	-.006	.014	-.042	-.447	.656
MBFDIN	.010	.016	.056	.617	.538
MFESDM	.009	.005	.184	1.714	**.089**
MRCLDT	.027	.026	.103	1.033	.304
MSAVIS	5.70E-005	.001	.006	.057	.955
SATL10×5	-.019	.008	-.227	-2.308	**.023**
SATL 20	-.005	.016	-.040	-.341	.734

Regresiona analiza prve glavne komponente odbojke u prostoru motoričkih sposobnosti

Regresiona analiza kriterijske varijable prve glavne komponente specifičnih struktura kretanja (tehnike) odbojke o uticaju Eurofit baterije motoričkih testova na uspjeh izvođenja tretirane kriterijske varijable prikazana je u tabeli 5.

Uvidom u datu tabelu može se vidjeti da koeficijent multiple korelacije iznosi R = .38, što predstavlja povezanost cjelokupnog sistema prediktorskih varijabli sa kriterijskom varijablom. Cijelim sistemom prediktora objašnjeno je 14% zajedničke varijanse kriterija. Povezanost ova dva sistema je statistički značajna na nivou p=0.03. Ostalih 86 % u objašnjavanju zajedničkog varijabiliteta može se pripisati drugim karakteristikama i sposobnostima ispitanika.Pregledom uticaja pojedinačnih varijabli (tabela 6) može se zaključiti da najveći i statistički značajan uticaj na kriterij ima varijabla skok u dalj iz mjesta (MBFSDM), kojom se procjenjuje eksplozivna snaga nogu. I ovdje se pokazalo da je eksplozivna snaga od velikog značaja za uspjeh u sportskim igrama, što je vrlo značajna informacija za proces selekcije i usmjeravanja učenika za dalje bavljenje sportom.

Regression analysis of the first main component of volleyball in the space of motor abilities

Regression analysis of the criterion variable of the first main component related to specific movement structures (technical elements) in volleyball about the influence of Eurofit motor test battery on the success of execution of the examined criterion variable is shown in Table 5.

Table 5 shows that the coefficient of multiple correlation is R = .38, which represents relationship of the entire system of predictor variables to the criterion variable. The predictor system explains for the 14% of the common criteria variance. The relationship between these two systems is statistically significant at the level of p = 0.003. The rest of 86% of the common variability explanation can be ascribed to other characteristics and abilities of participants. Analysis of the influence of specific variables (Table 6) shows that the variable with the biggest and statistically most significant influence on the criterion is standing long jump (MBFSDM), which is used to evaluate explosive power of legs. It is also evident here that the explosive power is of great importance for the success in sports disciplines, which is very significant information for the process of selection and direction of students in their further sports practice.

Tabela 5. *Regresiona analiza prve glavne komponente ODBOJKE u prostoru motoričkih testova*

Table 5. *Regression analysis of the first main component of volleyball in the space of motor tests*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.380	.144	.075	.96187345

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.303	9	1.923	2.078	**.037**
	Residual	102.697	111	.925		
	Total	120.000	120			

Tabela 6. *Uticaj pojedinačnih varijabli motoričkih sposobnosti na specifične strukture kretanja u odbojci*

Table 6. *Analysis of the influence of specific variables on the specific structure of the movement of volleyball*

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	B	Std. Error
	1.326	3.117		.426	.671
FLAMIN	.057	.047	.122	1.227	.222
MBFTAP	-.018	.013	-.148	-1.419	.159
MFLPRK	-.017	.015	-.112	-1.118	.266
MBFDIN	-.011	.017	-.060	-.621	.536
MFESDM	.009	.005	.193	1.685	**.055**
MRCLDT	.015	.028	.057	.537	.592
MSAVIS	.001	.001	.091	.863	.390
SATL10×5	-.010	.009	-.123	-1.171	.244
SATL 20	.008	.017	.063	.501	.617

Regresiona analiza prve glavne komponente nogometa u prostoru motoričkih sposobnosti

Rezultati regresione analize prve glavne komponente nogometa procjenjivane na osnovu tri testa u prostoru motoričkih sposobnosti prikazani su u tabelama 7 i 8. Uvidom u prikazane tabele može se vidjeti da je koeficijent multiple korelacije R =,46 što predstavlja povezanost cjelokupnog sistema prediktorskih varijabli sa kriterijskom varijablom. Cijelim sistemom prediktora objašnjeno je 21% zajedničke varijanse kriterija. Povezanost tretiranih prostora je na nivou značajnosti p=0.001.

Analizom uticaja pojedinačnih varijabli (tabela 8) može se zaključiti da najveći i statistički značajan uticaj na kriterij imaju varijable: taping rukom (MBFTAP) i trčanje sa promjenom pravca – agilnost (ŠATL10X5). Ovo navodi na zaključak, što je i razumljivo, da postoji značajan uticaj motoričkih sposobnosti na rezultate specifičnih struktura kretanja (tehnike) u nogometu. Uočljivo je da najveći uticaj na rezultate nogometnih testova imaju varijable za procjenu segmentarne brzine i brzine trčanja sa promjenom pravca, što je i te kako značajno za uspješno igranje nogometa. Ovakav rezultat je i logičan jer je poznato da nogometna igra zahtijeva brza trčanja

Regression analysis of the first main component of football in the space of motor abilities

Results of the regression analysis of the first main component of football evaluated on the basis of three tests in the space of motor abilities are shown in Tables 7 and 8. These tables show that the coefficient of multiple correlation is R =.46, and the explained part of the common variance is 21% (R square). Relationship of the examined spaces is at the level of significance p=0.001.

Analysis of the influence of specific variables (Table 8) shows that the variables with the biggest and statistically most significant influence on the criterion are: hand tapping (MBFTAP) and shuttle running – agility (SATL10X5). This leads to a clear conclusion, that there is a significant influence of motor abilities on the results of the specific movement structures (technical elements) in football. It is noticeable that the variables with the biggest influence on the results of the football tests are those for the evaluation of segmental speed and speed of shuttle run, both of which are very important for successful playing of football. This result is logical too because it is well-known that football requires fast running of high intensity with frequent changes of direction

visokog intenziteta sa čestim promjenama pravca i ritma, tj. agilnost. Ovi rezultati su saglasni sa prethodnim istraživanjimakoji ističu posjedovanje upravo ovih osobina za uspješno igranje nogometa (Jelešković i Alić, 2013; Bajrić, O., Selimović, Bajrić, S. i Srdić, 2015).

and rhythm, that is, agility. These results are in accordance with the previous researches which stress the importance of these characteristics for successful playing of football(Jelešković & Alić, 2013; Bajrić, O., Selimović, Bajrić, S. & Srdić, 2015).

Tabela 7. *Regresiona analiza prve glavne komponente NOGOMETA u prostoru motoričkih testova*

Table 7. *Regression analysis of the first main component of football in the space of motor tests*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.465	.216	.152	.92065654

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.915	9	2.879	3.397	**.001**
	Residual	94.085	111	.848		
	Total	120.000	120			

Tabela 8. *Uticaj pojedinačnih varijabli motoričkih sposobnosti na specifične strukture kretanja u nogometu*

Table 8. *Analysis of the influence of specific variables on the specific structure of the movement of football*

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	B	Std. Error
FLAMIN	.061	.045	.129	1.356	.178
MBFTAP	-.021	.012	-.170	-1.706	**.091**
MFLPRK	-.001	.014	-.007	-.068	.946
MBFDIN	-.009	.016	-.054	-.577	.565
MFESDM	.003	.005	.054	.490	.625
MRCLDT	.020	.027	.073	.722	.472
MSAVIS	.000	.001	.015	.146	.884
SATL10×5	-.025	.009	-.291	-2.896	**.005**
SATL 20	.016	.016	.116	.968	.335

Rezultati regresione analize prve glavne komponente u testovima specifičnih struktura kretanja sportskih igara (košarka, rukomet, odbojka, nogomet), u prostoru motoričkih sposobnosti ukazuju da je između tretiranih prostora ostvarena značajna multipla korelacija, što navodi na zaključak da primijenjeni prediktorski sistem motoričkih varijabli (Eurofit baterija motoričkih testova) ima visok i značajan uticaj na uspješnu realizaciju specifičnih struktura kretanja (tehničkih znanja) sportskih igara (košarka, rukomet, odbojka i nogomet), koje predstavljaju značajne programske sadržaje u nastavi tjelesnog i zdravstvenog odgoja. Od primijenjene Eurofit baterije motoričkih testova najveći i statistički značajan uticaj ostvarile su sljedeće motoričke varijable: taping rukom (MBFTAP), skok u dalj iz mjesta (MFESDM), izdržaj u visu zgibom (MSAVIS), trčanje tamo-ovamo sa progresivnim ubrzanjem (ŠATL20), trčanje tamo-ovamo (ŠATL10X5). Na osnovu dobijenih rezultata regresione analize može se konstatovati da prediktorski sistem motoričkih varijabli ima statistički značajan uticaj na

The results of regression analysis of the first main component in tests of specific movement structures of sports disciplines (basketball, handball, volleyball and football), in the space of motor abilities show significant multiple correlation among the examined spaces, which leads to the conclusion that the applied predictor system of motor variables (Eurofit motor test battery) has a big and significant influence on successful realization of specific movement structures (technical elements) of sports disciplines (basketball, handball, volleyball and football), which have a significant part unphysical and health education. When it comes to the applied Eurofit motor test battery, the motor variables with statistically most significant influence are: hand tapping (MBFTAP), standing long jump (MFESDM), pull-up endurance (MSAVIS), shuttle run with progressive acceleration (SATL20), shuttle run (SATL10X5). Based on the results of regression analysis it can be concluded that the predictor system of motor variables has statistically significant influence on the first main component of sports disciplines (basketball, handball, volley-

prvu glavnu komponentu sportskih igara (košarka, rukomet, odbojka i nogomet), koje predstavljaju značajne programske sadržaje nastave tjelesnog i zdravstvenog odgoja. Mekić, Hadžić, Mirvić i Bukvić (2008) su također utvrdili visok i značajan uticaj bazičnih motoričkih sposobnosti na rezultatsku uspješnost u sportskim igrama kod učenica Učiteljske škole. Jašarević, Z., Jašarević, I. I Bajrić (2013) su pratili dinamiku usvojenosti kretnih struktura u toku jedne nastavne godine kod učenica uzrasta 11-14 godina i utvrdili da je najveća dinamika prirasta motoričkih znanja u uzrastu od 11 do 12 godina. Kao razlog navode fenomen ubrzanog rasta i razvoja koji se reflektuje na narušavanje koordinacije, kao značajnog uslova za visok nivo manipulisanja loptom kod ostalih uzrasta.

Zaključak

Istraživanje je provedeno na uzorku od 120 učenika srednje škole uzrasta 15 do 16 godina, sa ciljem utvrđivanja prognostičkih kvaliteta Eurofit baterije motoričkih testova na uspješnost izvođenja složenih struktura kretanja u sportskim igrama (košarka, rukomet, odbojka i nogomet). U istraživanju je primijenjen skup od 9 varijabli za procjenu motoričkih spoosbnosti po programu Eurofit baterije testova, kao prediktorski skup varijabli i dvanaest testova za procjenu specifičnih struktura kretanja (tehničkih znanja) sportskih igara košarke, rukometa, odbojke i nogometa svedenih na prvu glavnu komponentu, kao kriterijski skup varijabli. Za utvrđivanje prognostičkih kvaliteta Eurofit baterije motoričkih testova na rezultatsku uspješnost situaciono-motoričkih strutura kretanja u sportskim igrama primijenjena je regresiona analiza.

Rezultati regresione analize pokazuju da postoji statistički značajan prognostički kvalitet Eurofit baterije motoričkih testova na uspješnu realizaciju situaciono-motoričkih struktura kretanja u sportskim igrama, kao važnih programskih sadržaja u nastavi tjelesnog i zdravstvenog odgoja. Statistički najznačajniji uticaj pokazuju varijable snage u svim njenim manifestacijama, segmentarne brzine, agilnosti i opšte izdržljivosti. Na osnovu dobijenih rezultata može se konstatovati značajna prognostička vrijednost Eurofit baterije motoričkih testova na uspješnu realizaciju specifičnih struktura kretanja (tehničkih znanja) sportskih igara planiranih u nastavi tjelesnog i zdravstvenog odgoja.

Dobijeni rezultati mogu biti od koristi izvođačima nastave-nastavnicima tjelesnog i zdravstvenog odgoja u smislu kvalitetnijeg programiranja nastavnih sadržaja sportskih igara, praćenja i kontrole efekata nastavnih sadržaja na antropološki status učenika, kao i pravilnog vrednovanja i ocjenjivanja postignutih rezultata u nastavnom procesu.

ball and football), which represent important part of physical and health education. Mekić,Hadžić, Mirvić & Bukvić(2008) also discovered a high and significant influence of the basic motor abilities on the successfulness of students in sports disciplines at a certain high school (Učiteljska škola). Jašarević, Z., Jašarević, I. & Bajrić (2013) followed the dynamics of movement structures acquired in the course of one academic year at girls aged 11-14 years and found that the highest growth dynamics of motor skills in age from 11 to 12 years. The reason cited phenomenon of rapid growth and development that reflects the distortion of coordination as an important condition for a high level of manipulation ball with other children.

Conclusion

The research was conducted on the sample of 120 high school students, age from 15 to 16 years old with the aim of determining forecasting quality of Eurofit motor test battery on the successfulness of execution of complex movement structures in sports disciplines (basketball, handball, volleyball and football. The research utilized a group of 9 variables defined as a predictor group of variables that were used for evaluation of motor abilities following the Eurofit test battery program and a group of twelve variables and twelve tests for evaluation of specific movement structures (technical knowledge) in sports disciplines of basketball, handball, volleyball and football, reduced to the first main component as a criterion group of variables. Regression analysis was applied in order for us to determine the forecasting quality of Eurofit motor test battery on the resulting successfulness of situational-motor movement structures in sports disciplines.

The results of regression analysis show that Eurofit motor test battery has a statistically significant forecasting quality on the successful realization of situational-motor movement structures in sports disciplines, as important parts of syllabus in the physical and health education. Variables of power showed the most significant influence statistically in all their manifestations, segmental speed, agility and general endurance. Based on these results, the conclusion is that Eurofit motor test battery has a significant forecasting value on the successful realization of specific movement structures (technical knowledge) of sports disciplines that are included in physical and health education.

The results can be useful to teachers of physical and health education for better quality of planning of syllabi that involve sports disciplines, for monitoring and controlling of the effects of teaching units on the anthropological status of students, as well as for a more objective evaluation of achievements in education.

Literatura / References

Aruković, Z., Huskić, S., &Mekić, M. (2011). Latentna struktura bazično motoričkog statusa košarkaša uzrasta 14-16 godina. U Zbornik radova *4. Međunarodni simpozijum „Sport i zdravlje“*, str. 323-326. Tuzla: Fakultet tjelsnog odgoja i sporta.

Arunović, D. (1978). Uticaj nastave košarke na razvitak nekih motoričkih sposobnosti učenika uzrasta 15-16 godina. *Fizička kultura,no. 4,* Belgrade.

Bajrić, O., Bajrić, S., Lolić, D., & Lolić, N. (2012). Faktorska analiza strukture motoričkog znanja sportskih igara učenika završnih razreda srednje stručne škole. U Zborniku radova *5. Međunarodni simpozijum „Sport i zdravlje“*, p. 128-132. Tuzla: College for physical education and sport.

Bajrić, O., Jovanović, M., & Mandić, P. (2013). Faktorska analiza strukture bazičnih motoričkih sposobnosti učenika srednjoškolaca. U Zborniku radova *VI Međunarodni simpozijum ''Sport i zdravlje''*,p. 294-298. Tuzla: College of physical education and sport.

Bajrić, O., Selimović, N., Bajrić, S.,& Srdić, V. (2015). Efekti primjene programa nogometa na transformaciju antropoloških obilježja mladih nogometaša. *U Knjiga sažetaka 1. st International, Sport, Science, Education and Development Conference 2015 (1. InSSED),* str. 15, Travnik.

Bajrić, S., Bajrić, O., & Mandić, P. (2011). Analiza uticaja motoričkih sposobnosti učenika srednje škole na rezultate u nekim košarkaškim testovima. U Zborniku radova I međunarodne konferencije *„Sportske nauke i zdravlje*“. Banja Luka: Pan-European University „Apeiron“.

Findak, V., &Prskalo, I. (2003). Kineziološko gledište o suvremenoj odgojno-obrazovnoj

Bolanča, M., Čavala, M.,& Rogulj, N. (2010). Razlike motoričkih sposobnosti učenica rukometašica i onih koje se ne bave sportom. U Zborniku radova *2. Međunarodni naučni kongres „Antropološki aspekti sporta, fizičkog vaspitanja i rekreacije“* str. 170-174. Banja Luka: Fakultet fizičkog vaspitanja i sporta.

Findak, V., & Prskalo, I. (2005). *Nove paradigme u stvaranju kvalitetnih škola.* Zagreb: Alineja.

Findak, V. (2001). Kineziološki pogledi na uspješnu školu. U Zborniku radova *''Uspješna škola''*, p. 23-31. Zagreb: Hrvatski pedagoško-književni zbor.

Hadžikadunić, M., &Mađarević, M. (2004). *Metodika nastave tjelesnog odgoja sa osnovama fiziologije tjelesnog vježbanja.* Zenica: Pedagogical college of University in Zenica.

Hadžikadunić, M. (1987). Kanoničke relacije motoričkih sposobnosti i zbirnih rezultata usvojenosti nastavne građe pedagoških ciklusa atletike, košarke i odbojke. *Fizička kultura*, *br. 5,* Beograd.

Jašarević, I. (2006). *Dinamika razvoja bazičnih motoričkih sposobnosti, morfoloških karakteristika, i motoričkog znanja dječaka i djevojčica uzrasta 11-14 godina*. Unpublished PhD dissertation. Mostar: Nastavnički fakultet (College for Teachers) – Odsjek za sport (Sports' department).

Jašarević, Z. (2004). *Uticaj, odnosi i relacije morfoloških karakteristika i bazično - motoričkih sposobnosti sa rezultatima situaciono - motoričkih testova usvojenosti nastavne građe.* Unpublished PhD dissertation. Sarajevo: College of sport and physical education.

Jelešković, E., Alić, H. (2013). Structural difference in basic motor skills of footbal players competing on different levels of competition, *Sport science 6 (2013) 2,* 156-164. Travnik.

Katić, R. (1984). Relacije između morfoloških karakteristika i uspjeha u predmetu tjelesni odgoj u usmjerenom obrazovanju. *Fizička kultura, no.* 5: 334-7.

Katić, R. (1986). Relacija između motoričkih sposobnosti i uspjeha u predmetu tjelesni i zdravstveni odgoj kod učenica srednje škole, *Fizička kultura,* 2/86.

Mekić, M., & Hadžić, R. (2006). Uticaj bazične motorike na snagu udarca po lopti nogom i glavom u nogometnoj igri. . U Zborniku radova *II kongresa i III međunarodne naučna koferencija Crnogorske sportske akademije*, br. 10-11/IV, Podgorica, p. 160-166.

Mekić,M., Hadžić, R., Mirvić, E., &Bukvić, O. (2008). Uticaj bazičnih motoričkih sposobnosti i konativnih obilježja na rezultatsku uspješnost u nekim sportskim igrama kod učenica učiteljske škole. U Zborniku radova *IV kongresa i V međunarodne naučne koferencije Crnogorske sportske akademije*, br. 15, 16, 17/VI, Podgorica, p. 829-832.

Ražanica, F. (2006). Utjecaj motoričkih sposobnosti i konativnih regulativnih mehanizama na rezultatsku uspješnost u sportskim igrama. U Zborniku radova *II kongresa i III međunarodne naučna koferencija Crnogorske sportske akademije*, no. 10-11/IV, Podgorica, p. 95-99.

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Short notice

Utjecaj motoričkih sposobnosti na natjecateljsku uspješnost u stolnom tenisu

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Sažetak: Osnovni cilj ovog istraživanja bio je utjecaj pojedinih motoričkih sposobnosti na natjecateljsku uspješnost stolnotenisača. Uzorak ispitanika činilo je 48 najboljih seniora uzrasta 17-36 god (reprezentativni uzorak) u Bosni i Hercegovini. Uzorak ispitanika je odabran na osnovu kvalifikacionog turnira svih registriranih stolnotenisača Bosne i Hercegovine. Mjerni instrumenti za ovo istraživanje su: dvanaest varijabli za procjenu bazičnih motoričkih sposobnosti i jedna varijabla za procjenu natjecateljske uspješnosti u stolnom tenisu. Metode obrade rezultata uključivale su deskriptivne statističke procedurei multiplu regresijsku analizu.
Motorički prediktori primjenommultiple regresijske analize značajno su objasnili kriterijsku varijablu natjecateljska uspješnost stolnotenisača.Na osnovu rezultata multiple regresijske analize koja je sprovedena na šest neovisnih, prediktorskih varijabli iz skupa bazične motoričke sposobnosti i pozicije ispitanika na rang ljestvici stolnotenisača (BODRNG), kao i ovisnom varijablom natjecateljske uspješnosti, uz korištenje enter metode, dobivena je jedna statistički značajna regresijska funkcija. To ukazuje na to da između navedenih varijabli postoji linearna povezanost. Dobiveni koeficijent multiple korelacije je statistički značajan i iznosi R=.65, što govori da se oko 41% varijance rezultata varijable pozicija ispitanika na rang ljestvici stolnotenisača (BODRNG), može objasniti uz pomoć uključenih prediktorskih varijabli.
Kao ukupno gledano najznačajniji prediktor može se izdvojiti varijabla tapinga rukom, to jest varijabla za procjenu frekvencije pokreta. Međutim, ne treba zanemariti i varijable za procjenu eksplozivne snage i to kako onih za procjenu apsolutne, tako i procjenu relativne eksplozivne snage.
Ključne riječi: stolnotenisači, motoričke sposobnosti, multipla regresijska analiza, natjecateljska uspješnost.

Influence of Motor Abilities on Competitive Efficacy in Table Tennis

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Abstract: The aim of this research was the influence of basic motor skills of table tennis players on their performance efficacy. The sample of participants was made by 48 elite seniors aged 17-36 yr (representative sample) in Bosnia and Herzegovina. The sample of participants was chosen based on the qualification tournament of all registred table tennis players in Bosnia and Herzegovina. The measuring instruments in the research are 12 variables for evaluation of basic motor skills and 1 variable for evaluation of competitive efficacy of table tennis. Analyzing results methods included descriptive statistic procedures and multiple regression analysis.
The motor predictors of applying multiple regression analysis significantly explain the criterion variable competitive success of table tennis players. Based on the results of multiple regression analysis, which was conducted on six independent, predictor variables from a set of basic motor skills and position subjects the ranking table tennis (BODRNG) as the dependent variable and competitive performance, using the enter method showed a single statistically significant regression function. This indicates that between these variables a linear relationship. The resulting multiple correlation coefficient is statistically significant and amounts to R=.65, which indicates that about 41% of variance in variable position of respondents to the ranking table tennis (BODRNG), can be explained with the help of predictor variables involved.
In most regression analysis, the motor factors significantly explained criterion variables of technical-tactical efficacy of table tennis players. In general, it can be said that the most important factor is hand tapping variable or in other words the variable evaluating the movement frequency. But we cannot forget variables evaluating explosive strength both evaluating total and relative explosive strength.
Keywords: table tennis, motor abilities, multiple regression analysis, competitive success.

Uvod

Stolni tenis kao sportska igra, pripada prema kriteriju strukturalne složenosti grupi polistrukturalnih kompleksnih sportova u kojima dominiraju otvorene ili poluotvorene kretne strukture koje se izvode u varijabilnim uvjetima.

Specifičnost stolnoteniske igre dovela je do toga da stolnotenisači za razliku od drugih sportaša pokazuju u prostoru motorike veću fleksibilnost, superiornost u eksplozivnoj snazi, bržu frekvenciju pokreta, agilnosti, superiornost u situacionoj preciznosti, (Đokić, 2007b.).

Osnovna karakteristika stolnoteniske igre je brzina izmjene udaraca i pokreti koji se u velikoj mjeri izvode u promjenjivim uvjetima. Suvremena stolnoteniska igra se karakterizira brzinom segmentarnih pokreta (ekstremiteta), eksplozivnom snagom, brzinom reakcije udarca uz optimalno savladavanje (poznavanje) rotacije loptice koja u velikoj mjeri utječe na samu izvedbu pojedinih udaraca - topspin elemenata u cijelom prostoru igre (Kondrič, i sur. 2007.). Brzina i spin su dva ključna elementa modernog sporta koji se igra s reketom. Brzina loptice je relativno vidljiva i od strane samog gledatelja, ali rotaciju loptice ili spin nije lako detektirati (Chiu i Tu, 2006.). Ovo bi istraživanje trebalo doprinijeti boljem razumjevanju pojedinih sistema stolnoteniske igre te omogućiti dobivanje važnih saznanja o motoričkim znanjima potrebnim za postizanje uspjeha u ovom sportu.

Konkretno, istraživanja koja su se bavila problematikom motoričkih sposobnosti i natjecateljske uspješnosti postoje, ali se u pravilu radi o studijama koje su provjeravale razlike između igrača različitih kvalitativnih razina (Toriola i sur. 2004.; Munivrana, 2011.; Malagoli i sur. 2011.; Bankosz, 2012.). Iz navedenih razloga zanimljivo je ponoviti koji su motorički faktori bitni za natjecateljsku uspješnost u stolnom tenisu.

Osnovni cilj ovoga istraživanja je utvrđivanje utjecaja primijenjenih motoričkih sposobnosti na natjecateljsku uspješnost stolnotenisača.

Metod rada

Uzorak ispitanika

Uzorak ispitanika čini 48 najboljih seniora uzrasta od 17 do 36 god. (reprezentativni uzorak) u Bosni i Hercegovini. Uzorak ispitanika je odabran temeljem kvalifikacijskog turnira svih registriranih stolnotenisača Bosne i Hercegovine. Najboljih 48 stolnotenisača s kvalifikacija su izborili sudjelovanje na državnom prvenstvu.

Introduction

As a sports game, based on the criterion of structural complexity, table tennis belongs to a group of semistructural complex sports in which opened or semi-opened movement structures made in variable conditions are dominated.

A unique table tennis play has made table tennis players, unlike other athletes, more flexible in the area of motor skills, more superior in explosive strength and it has led them to a higher movement frequency, agility and situational preciseness superiority. (Đokić, 2007b.).

The main characteristic of table tennis game is the speed of hits exchange and movements which are mostly done in variable conditions.Modern tabel tennis game is characterised by segmented movements speed (extermities), explosive strength, the speed of hits reaction with the maximum overcoming (knowing) of ball rotation which has a great influence on the performance of individual hits-topspin elements in the whole game area. (Kondrič, i sur. 2007.). Speed and spin are two key elementsof modern sport played with racket. The ball speed is relatively visible by the viewer but the ball rotation or spin is not easy to detect (Chiu i Tu, 2006.).This research should help better understanding of individual table tennis systems and it should enable getting important knowledge about motor knowledge necessary for success achievement in this sport.

There are researches which dealt with the problem of motor abilities and competitive efficacy but they are mostly studies which checked differences between players of different quality levels (Toriola i sur. 2004.; Munivrana, 2011.; Malagolii sur. 2011.; Bankosz, 2012.). For the mentioned reasons, it is interesting to repeat motor factors important for competitive efficacy in table tennis.

The main aim of this research is to establish the influence of applied motor abilities on competitive efficacy of table tennis players.

Research method

Participant sample

The sample of participants was made of 48 elite seniors aged 17-36 yr (representative sampel) in Bosnia and Herzegovina. The sample of participants was chosen based on the qualification tournament of all registred table tennis players in Bosnia and Herzegovina.The best 48 table tennis players from the qualifications have won participation in the national championship.

Uzorak varijabli

Izbor varijabli izvršen je temeljem dosadašnjih istraživanja problematike slične ovoj (Đokić, 2001.; Dong, 2005.) a imajući u vidu njihov značaj za uspješnost odigravanja elemenata tehnike i taktike u suvremenom stolnom tenisu.

Testovi motoričkih sposobnosti

Za mjerenje bazičnih motoričkih sposobnosti upotrijebljeni su standardizirani testovi (Ahmetović, 1987.; Hadžikadunić, 2000.; Mikić, 2000.). Testovi su kroz dosadašnja istraživanja pokazali zadovoljavajuće metrijske karakteristike.

Za procjenu eksplozivne snage primijenjeni su sljedeći testovi:

- (MFESDM) - skok u dalj s mjesta
- (MFE20V) - trčanje iz visokog starta na 20 metara
- (MESFOR) - bacanje medicinke 1kg imitacijom forhend tehnike
- (MFEBML) - bacanje medicinke iz ležanja na leđima

Za procjenu repetitivne snage primijenjeni su testovi:

- (MRCDLC) - ležanje i podizanje u sijed za 30 sec.
- (MRCIST) - ispravljanje trupa

Za procjenu koordinacije – agilnosti primijenjeni su testovi:

- (MAGTUP) - trčanje u pravokutniku – koverta test
- (MAGKUS) - koraci u stranu

Za procjenu brzine frekvencije pokreta primijenjeni su testovi:

- (MBFTAP) - taping rukom
- (MBFTAN) - taping nogom

Za procjenu fleksibilnosti primijenjeni su testovi:

- (MFLDSI) - dohvat u sijedu
- (MFLISK) - iskret s palicom

Varijabla za procjenu natjecateljske uspješnosti

Za procjenu natjecateljske uspješnosti korištena je jedna varijabla:

- (BODRNG) - broj bodova na rang ljestvici (pozicija na rang ljestvici).

Metode obrade rezultata

Obrada rezultata provela se u nekoliko faza.

Primjenjeni su deskriptivni pokazatelji varijabli za procjenu motoričkih sposobnosti stolnotenisača.

Izračunata je serija linearnih korelacijskih analiza Personovog tipa i izračunati su numerički pokazatelji korelacijskih koeficijenata.

Variable sample

Variables are chosen based on the previous researches dealing with similar problems (Đokić, 2001; Dong, 2005.) and considering their influence on efficacy of playing technique and tactics elements in modern table tennis.

Motor skills tests

Standard tests were used for measuring basic motor skills (Ahmetović, 1987; Hadžikadunić, 2000; Mikić, 2000.). In previous researches the tests have showed satisfying metric characteristics.

The following tests were used for assesing explosive strength:

- (MFESDM) - distance jump from one place
- (MFE20V) - high start running on 20 meters
- (MESFOR) - throwing of a 1kg ball imitating forhend technique
- (MFEBML) - throwing of a ball by lying on the back

The following tests for assesing repetative strength were used the:

- (MRCDLC) - lying and getting up into the sitting position in 30 seconds
- (MRCIST) - body correction

The following tests were used for assesing coordination/agility:

- (MAGTUP) - square running-envelope test
- (MAGKUS) - side steps

The following tests were used for assesing speed frequency movement:

- (MBFTAP) - hand tapping
- (MBFTAN) - leg tapping

The following testswere used for assesing flexibility:

- (MFLDSI) - reach in the sitting position
- (MFLISK) - bat movement

Varible assesing competitive efficacy

For assesing competitive efficacy one variable was used:

- (BODRNG) -number of points on the rank scale (ranking position).

Analysing results methods

Result analysis was done in several stages.

Descriptive characteristics of variables assesing motor skills of table tennis players were used. Multiple regression analysis were calculated (Bartlet, 1947.) in order to establish the influence of predictor variables (motor skills) on criterion variable (competitive efficacy of

Izračunate su multiple regresijske analize (Bartlet, 1947.), kako bi se utvrdio utjecaj prediktorskih varijabli (motoričke sposobnosti) na kriterijsku varijablu (natjecateljska uspješnost stolnotenisača).

Korištena je razina značajnosti od 95%.

Za sve obrade korišten je paket SPSS ver. 17.0.

Rezultati i diskusija

Raspršenje rezultata na svim varijablama je relativno nisko, osim kod varijable ispravljanje trupa (MRCIST) (*Tabela 1.*). Varijabla trčanje iz visokog starta 20 metara (MFE20V), je negativno asimetrična, pa je primjenjena logaritamska transformacija uz refleksiju rezultata.

Tabela 1. *Deskriptivni pokazatelji varijabli za procjenu motoričkih sposobnosti stolnotenisača*

Calculated by a series of linear correlation analysis Person type and calculate the numerical parameters of correlation coefficients.

The level of significance of 95% was used. The package SPSS ver. 17.0 was used for each processing.

Results and Discussion

Result spreading on each variable is relatively low, except with body correcting variable (MRCIST) (*Table1.*). High start running on 20 meters variable (MFE20V), is negatively asymmetric ,and therefore logarithmic transformation with the result reflexion was used.

Table 1. *Descriptive characteristics of variables assessing motor skills of table tennis players*

	N	M	σ	S_k	K	Min	Maks	W	p
Skok u dalj s mjesta / *Distance jump*	48	232.91	21.19	-.85	.14	180.00	261.00	.97	.44
Sprint iz visokog starta 20m / *High start sprint 20m*	48	3.38	.25	1.29	8.79	2.24	4.01	.98	.45
Bacanje med.1kg.forh. / *Throwing of a.1kg.ball forh.*	48	13.91	2.01	-.53	1.11	10.10	16.90	.96	.06
Bacanje medicinke iz lez. / *Throwing of a ball from lying position.*	48	7.59	1.02	-.04	-.35	5.36	9.80	.98	.84
Lezanje-sijed 30 sec. / *Lying-sitting in 30 sec.*	48	27.37	5.39	1.82	5.89	20.00	50.00	.97	.08
Ispravljanje trupa / *Body correcting*	48	34.06	9.31	.74	.03	20.00	60.00	.96	.78
Koverta test / *Envelope test*	48	24.72	.96	.05	-.64	22.73	26.80	.98	.63
Koraci u stranu / *Side steps*	48	7.55	.64	.70	-1.01	6.82	8.90	.96	.07
Taping rukom / *Hand tapping*	48	44.54	5.87	.07	-1.05	34.00	55.00	.96	.14
Taping nogom / *Leg tapping*	48	21.80	1.76	.24	-.19	18.00	26.00	.96	.24
Dohvat u sijedu / *Reach in sitting position*	48	11.00	4.32	.37	-.30	1.00	20.00	.96	.78
Iskret s palicom / *Bat movement*	48	87.29	9.89	.44	.47	65.00	110.00	.96	.19

Legenda: *N – broj ispitanika; M – aritmetička sredina; σ – standardna devijacija; Sk – zakrivljenost (Skewness); K – zaravnjenost (kurtosis) Min – minimalna vrijednost; Maks – maksimalna vrijednost. W – Shapiro-Wilkov test; p – nivo značajnosti*

Legend: *N - number of respondents; M - mean; σ - standard deviation; Sk - curvature (Skewness); K - flatness (kurtosis) min - the minimum value; Max - maximum value. W-- Shapiro-Wilkov test; p - level of significance*

Primjenom navedene transformacije asimetričnost i spljoštenost su umanjene. Vrijednost koeficijenta asimetrije nakon transformacije je Sk=-0.31, a kurtosisa K=4.5. Pored normalizacije spomenute varijable napravljene su još i normalizacije na varijablama: bacanje medicinke 1kg forhend (MESFOR), ležanje-sijed 30 sec. (MRCDLC), koraci u stranu (MAGKUS). Pregled vrijednosti koeficijenata asimetrije i spljoštenosti za sve varijable koje su bile objektom fitovanja dat je narednoj tablici. (*Tabela 2.*).

Applying the mentioned transformation, asymmetry and flatness are minimized. The value of asymmetry coefficient after transformation is Sk=-0.31, and the value of curtosis (kurtosisa) is K=4.5. Besides normalizing the mentioned variable, normalization of other variables was also done: throwing of a 1kg ball forehand (MESFOR), lying-sitting in 30 sec. (MRCDLC), side steps (MAGKUS). Survey of coefficient values of asymmetry and flatness for all variables subjected to the fitting is shown in the following table. (*Table 2.*).

Tabela 2. *Koeficijenti asimetrije i zaobljenosti nakon logaritamskih transformacija skorova*

Varijabla	Reflesija	S_k	K
Sprint iz visokog starta 20m / *High start sprint on 20m*	Da	-0.3	4.53
Bacanje med.1kg.forhend / *Throwing of a.1kg ball.forhend*	Da	-0.25	-0.42
Ležanje-sijed 30 sec. / *Lying-sitting in 30 sec.*	Ne	0.87	2.14
Koraci u stranu / *Side steps*	Ne	0.64	-1.11

S_k-Skewness; K- kurtosis

Utjecajmotoričkih prediktora na kriterijsku varijablu natjecateljska uspješnost – pozicija na rang lististolnotenisača

Tabela 3. *Deskriptori i pokazatelji multikolinearnosti za prediktorske varijable koje su uključene u regresijski model*

	M	σ	N	FIV**
Taping rukom / *Hand tapping*	44.54	5.87	48	1.07
Bacanje medicinke forhend 1kg / *Throwing of a.1kg ball.forhend*	13.91	2.01	48	1.07
Koraci u stranu / *Side steps*	7.55	.64	48	1.07
Dohvat u sijedu / *Reach in sitting position*	11.00	4.32	48	1.07
Skok u dalj s mjesta / *Distance jump*	232.91	21.19	48	1.07
Bacanje medicinke iz ležanja* / *Throwing of a ball from lying position**	7.59	1.02	48	1.07

***faktor inflacije varijance; M-aritmetička sredina; σ-standardna devijacija; N-broj ispitanika*

Na osnovu korelacione analize detektirano je šest (6) varijabli iz domena bazične motoričke sposobnosti koje statistički značajno koreliraju sa kriterijskom varijablom: *taping rukom (MBFTAP)* (.96), *bacanje medicinke forhend (MESFOR)* (-.93), *koraci u stranu (MAGKUS)* (.82), *dohvat u sijedu (MFLDSI)* (.74), *skok u dalj s mjesta (MFESDM)* (.73) i *bacanje medicinke iz ležanja na leđima (MFEBML)* (.47).

U koloni FIV date su vrijednosti indikatora multikolinearnosti. Budući da su sve vrijednosti faktora povećanja varijance relativno niske, može se konstatirati da nema povrede multikolinearnosti.

Tabela 4. *Koeficijent multiple korelacije i koeficijent determinacije za model procjene pozicije stolnotenisača na rang ljestvici*

Model	R	R^2	Korigovani / *Restated* R^2	Standardna greška / *Standard mistake*
1	.65	.41	.36	11.41

R-koeficijent multiple korelacije; R^2-koeficijent determinacije

S_k-Skewness; K- kurtosis

The influence of motor predictors on criterion variable competitive efficacy -table tennis players ranking position

Table 3. *Multilinear descriptor and characteristics for predictor variables which are included in regression model*

	M	σ	N	FIV**
Taping rukom / *Hand tapping*	44.54	5.87	48	1.07
Bacanje medicinke forhend 1kg / *Throwing of a.1kg ball.forhend*	13.91	2.01	48	1.07
Koraci u stranu / *Side steps*	7.55	.64	48	1.07
Dohvat u sijedu / *Reach in sitting position*	11.00	4.32	48	1.07
Skok u dalj s mjesta / *Distance jump*	232.91	21.19	48	1.07
Bacanje medicinke iz ležanja* / *Throwing of a ball from lying position**	7.59	1.02	48	1.07

***inflation variance factor M-arithmetic mean; σ-standard deviation; N-number of respondents*

Based on correlation analysis six variables was detected from the domain of basic motor skills which statistically have a significant correlation with the criterion variable: hand tapping *(MBFTAP)* (.96), throwing of a ball *forehand (MESFOR)* (-.93), side steps *(MAGKUS)* (.82), reach in sitting position *(MFLDSI)* (.74), distance jump *(MFESDM)* (.73) and throwing of a ball from back lying position *(MFEBML)* (.47).

In the column FIV there are values of multilinear indicators. Since all the values of variance increasing factors are relatively low, we can conclude that there is no multilinear disturbance.

Table 4. *Multiple correlation coefficient and determination of the coefficient for model assessing ranking position of a table tennis player*

Model	R	R^2	Korigovani / *Restated* R^2	Standardna greška / *Standard mistake*
1	.65	.41	.36	11.41

R-multiple correlation coefficient; R^2-coefficient of determination

Na osnovu podataka koji su uključeni u regresijski model izdvojena je jedna regresijska funkcija. Koeficijent multiple korelacije iznosi *R*=.65 što znači da je povezanost varijabli iz domena bazičnih motoričkih sposobnosti statistički značajna sa kriterijskom varijablom *pozicija igrača na rang ljestvici (BODRNG),* te se time može objasniti oko 41% varijance uspješnosti stolnotenisača (*Tabela 4*.).

Based on data included in regression model, one regression function is singled out. Coefficient of multiple corelation is *R*=.65 which means that by including variables from the domain of basic motor skills which are statistically significant with the criterion variable ranking position of a players *(BODRNG)* we can explain about 41% of efficacy variance of table tennis players (*Table 4*.).

Tabela 5. *Procjena značajnosti regresijskog modela u predikciji pozicije ispitanika na rang ljestvici*

Table 5. *Assesing significance of regression model in prediction of ranking position of the participants*

Model		Suma kvadrata / *The sum of squares*	df	Prosječni kvadrat / *Average square*	F	p.
1	Regression / *Regression*	3353.238	6	1676.619	12.878	.000
	Residual / *Residual*	5858.762	41	130.195		
	Ukupno / *Total*	9212.000	47			

F-regresijska funkcija; p-nivo značajnosti; df-prediktorske varijable

F-regression function; p-level of significance; df-predictor variables

Procjena značajnosti regresijskog modela izvršena je putem analize varijance. Dobivena regresijska funkcija je statistički značajna (F= 12.87) (p<0.01) (*Tabela 5*.).

Doprinosi pojedinih varijabli iz prostora bazičnih motoričkih sposobnosti ispitanika regresijskom modelu prikazani su u narednoj tabeli (*Tabela 6*.).

Assessing significance of regression model is done by analyzing the variance. Regression function that was given is statistically significant. (F= 12.87) (p<0.01) (*Table 5*.).

Contribution of individual variables from the area of participants` motor skills to regression model is shown in the following table (*Table 6*.).

Tabela 6. *Parcijalni doprinos varijabli regresijskom modelu*

Table 6. *Partial contribution of variables to the regression model*

Model		B	B_{se}	β	t	p.
1	konstanta / *constant*	78.92	12.58		6.27	.00
	Taping rukom / *Hand tapping*	.09	.04	.68	3.88	.00
	Bacanje medicinke forhend 1kg / *Throwing of a ball forhend 1kg*	.06	.04	.41	2.26	.02
	Koraci u stranu / *Side steps*	-.07	.03	-.39	- 2.11	.03
	Dohvat u sijedu / *Reach in sitting position*	.17	.11	.27	1.96	.06
	Skok u dalj s mjesta / *Distance jump*	.10	.02	.53	2.86	.00
	Bacanje medicinke iz ležanja / *Throwing of a ball from lying position*	-4.95	1.68	.36	-2.93	.00

β -parcijalni *doprinos prediktora; p – nivo značajnosti;*

β-partial contribution *of predictors; p - level of significance*

Na osnovu visine standarnih regresijskih koeficijenata te njihove značajnosti, može se konstatirati da pet (5) varijabli statistički značajno doprinose regresijskom modelu: *taping rukom (MBFTAP), bacanje medicinke forhend 1kg (MESFOR), koraci u stranu (MAGKUS), skok u dalj s mjesta (MFESDM)* i *bacanje medicinke iz ležanja na leđima (MFEBML).*

Based on the level of standard regression coefficient and their significance we can conclude that five variables statistically contribute to the regression model: hand tapping *(MBFTAP), throwing of a ball forehand 1kg (MESFOR), side steps (MAGKUS), distance jump (MFESD) and throwing of a ball from back lying position (MFEBML).*

Kada je riječ o parcijalnim doprinosima najbolji prediktori su: taping rukom (MBFTAP (β =.68), skok u dalj s mjesta (MFESDM) (β =-.53), bacanje medi-

Talking about partial contributions, the best predictors are: hand tapping (MBFTAP (β =.68), distance jump (MFESDM) (β =-.53), throwing of a ball forehand 1kg (MESFOR)

cinke forhend 1kg (MESFOR) (β =.41), koraci u stranu (MAGKUS) (β =.39) i bacanje medicinke iz ležanja na leđima (MFEBML) (β =.36).

Rezultati ovog istraživanja pokazuju da je statistički značajan utjecaj motoričkih prediktorskih varijabli brzine frekventnih pokreta rukom, eksplozivne snage gornjih i donjih ekstremiteta i agilnosti.

Brzina frekvencije pokreta gornjih ekstremiteta pokazala se kao ukupno gledano najvažnija varijabla u opisivanju natjecateljske uspješnosti stolnotenisača. Gotovo je sigurno da se ustvari radi o kombiniranom utjecaju brzine frekvencije pokreta i brzine jednostavnog pokreta. Naime, brzina frekvencije pokreta analizirana tapingom rukom uključuje u sebi niz ponavljanja kretnji koje odgovaraju brzom jednostavnom pokretu bekhenda i forhenda. Ova kombinacija zasigurno opisuje brzinu udaraca koje je stolnotenisač sposoban uputiti.

Međutim, ono što je za ovu priliku bitno važnije za primijetiti da je očit utjecaj eksplozivne snage donjih ekstremiteta, odnosno relativne eksplozivne snage. Ova sposobnost se prvenstveno očituje u skoku, međutim, ne treba zanemariti utjecaj ove sposobnosti na brze promjene pravca i smjera kretanja iz stabilnog stava, ali i sposobnost ponovljenih promjena pravca i smjera kretanja u određenim agilnim i kvaziagilnim kretnjama (skok u stranu, povratak na prvobitnu poziciju i sl.).

Ovo je jedno od rijetkih istraživanja koje je direktno provjeravalo povezanost motoričkih varijabli i natjecateljske uspješnosti kroz analizu povezanosti korelacijskog ili regresijskog tipa.

Konkretno, istraživanja koja su se bavila problemom motoričkih sposobnosti i natjecateljske uspješnosti postoje, ali se u pravilu radi o studijama koje su provjeravale razlike između igrača različitih kvalitativnih razina (Toriola i sur. 2004.; Munivrana, 2011.; Malagoli i sur. 2011.; Bankosz, 2012.).

Zaključak

Kao što se moglo očekivati motoričke varijable su značajan prediktor natjecateljske uspješnosti stolnotenisača.

Rezultati ovog istraživanja pokazuju da je statistički značajan utjecaj motoričkih prediktorskih varijabli brzine frekventnih pokreta rukom, eksplozivne snage gornjih i donjih ekstremiteta i agilnosti.

Test brzine frekvencije pokreta rukom značajni je prediktor natjecateljske uspješnosti, što ustvari govori o visokoj vrijednosti frekvencije pokreta kao mjere motoričkog statusa stolnotenisača. Za ovu činjenicu može se izdvojiti nekoliko razloga, ali u prvom redu razloga

(β =.41), side steps (MAGKUS) (β =.39) and throwing of a ball from back lying position (MFEBML) (β =.36).

The results of this research show statistically significant influence of motor predictor variables of speed frequency hand movements, explosive strength of upper and lower extremities and agility.

Speed of movement frequency of upper extremities is shown as generally the most important variable in description of competitive efficacy of table tennis players. It is almost certain that it is a combined influence of speed frequency movement and speed of simple movement. The speed of movement frequency analyzed by hand tapping includes the series of movement repetitions which corresponds to a fast simple movement of backhand i forehand. This combination surely describes speed of the hits which table tennis player can make.

What is important in this case is the evident influence of explosive strength of lower extremities that is of relative explosive strength. This ability is mainly evident in jumping but we should not forget the influence of this ability on fast direction change and movement direction from a firm position but also the ability of repeated direction changes and movement direction in certain agile and so called agile movements (side jump, returning to original position etc.).

Based on the results of multiple regression analysis which was conducted on 6 independent predictor variables from the area of basic motor skills and based on the ranking position of table tennis players (BODRNG), as a dependant variable of competitive efficacy with the use of enter method, one statistically significant function was given. It implies that there is a linear connection between the mentioned variables. The given coefficient of multiple correlation is statistically significant and is about 41% variance of results of participant position on a ranking list variable (BODRNG), can be explained with the help of included predictor variables.

Conclusion

As might be expected motor variables were significant predictors of the success of table tennis competition.

Results of this study indicate that a statistically significant predictor variable speed motor frequency of hand movements, explosive strength of upper and lower extremities and agility.

Test frequency of movement by hand is a significant predictor of competitive success, which actually talks about the high value of movement frequency as a measure of motor status table tennis players. For this fact can be extracted several reasons, but first and foremost

sadržan je u tome što varijabla tapinga rukom, mada prvenstveno varijabla za procjenu frekevencije pokreta, u sebi saturira jednu izuzetno važnu motoričku sposobnost u stolnom tenisu, a to je ustvari brzina jednostavnog pokreta.

Ono što je međutim zanimljivo za primijetiti je da varijabla taping rukom saturira dvije brzine jednostavnog pokreta i to: brzinu jednostavnog pokreta u kretnji koja je definirana angažmanom prsne muskulature i muskulature prednje strane ramena (forhend kretnja), ali i kretnji jednostavnog pokreta koja je definirana angažmanom leđne i stražnje ramene muskulature (bekhend kretnja).

Eksplozivna snaga gornjih ekstremiteta u stvari je sadržana u prethodno objašnjenom utjecaju udarca. Bolje rečeno radi se o ukupnom utjecaju eksplozivne snage i to kako one apsolutnog tako i one relativnog tipa na natjecateljsku uspješnost u stolnom tenisu.

Stolni tenis je sport brzine i agilnosti (Kondrič i sur. 2013.). Premda se moglo očekivati da će agilnost igrati značajniju ulogu u predikciji kako tehničko-taktičke tako i natjecateljske uspješnosti stolnotenisača, to se nije dogodilo. Konkretno, agilnost se pokazala značajan prediktor, ali ne u onolikoj mjeri i s onolikim faktorom doprinosa koliko je autor očekivao. Osnovni razlog za ovo je vjerojatno sadržan u činjenici da testiranje agilnosti nije provedeno testovima koji bi trebali opisati pravu stolnotenisku agilnost. Ovo se u prvom redu odnosi na činjenicu da se test *koraci u stranu*, ma koliko ustvari na prvi pogled opisivao kretnje u stolnom tenisu ne izvodi u stolnoteniskim uvjetima. Prvo, dimenzije testa nisu dimenzije koje odgovaraju realnoj stolnoteniskoj igri te bi se u tom smislu test u daljnjim istraživanjima vjerojatno trebao skratiti u prostornim parametrima i modificirati tako da bude test specifičan za stolni tenis. U posljednje vrijeme ovaj pristup je očit u sportskoj znanosti, te znanstvenici u svijetu sve češće primjenjuju originalno konstruirane sport-specifične testove (Uljević i sur. 2013.). Stoga bi u narednim istraživanjima bilo potrebno pratiti ovakav pristup i u stolnom tenisu.

reason is contained in that variable taping-hand, although primarily variable for estimating frequency energies movement inside it saturates a very important motor skills in table tennis and it is in fact speed of simple movements.

What is however interesting to note is that the variable hand tapping it saturates the two speeds of simple movements, namely: the speed of simple movements in motion that is defined pectoral muscle engagement and muscular front shoulder (forehand movement), but also a simple gesture movement that is defined engagement back and rear shoulder muscles (backhand movement).

Explosive power of the upper extremities in fact contained in the previously discussed the impact of the blow. Rather it is about the overall impact of explosive power and how those absolute and those relative to the type of competitive success in table tennis.

Table tennis is a sport of speed and agility (Kondrič et al. 2013.). Although it might be expected that the agility to play a more significant role in predicting both technical and tactical competition efficacy table tennis players that did not happen. In particular, agility proved a significant predictor, but not in so far is a factor to as many contributions as the author expected.

The main reason for this is probably related to the fact that test agility is not conducted tests which should describe the real table tennis agility. This primarily refers to the fact that the test side steps, however in fact at first glance describing movement in table tennis is not running in Table tennis conditions. First, the dimensions of the test are not dimensions that correspond to real table tennis game and help in this regard the test further and probably should shorten the spatial parameters and modified to be specific test for table tennis. Recently, this approach is evident in the sports science and scientists in the world are increasingly applied originally designed sport-specific tests (Uljević et al. 2013.). Therefore, in future research was needed to follow this approach and table tennis.

Literatura / References

Bankosz, Z. (2012). The kinesthetic differentiation ability oft he table tennis players. *Human movement*, *13*(1), 16-22.

Bjeković, G., Trivun, M., Tanović, I., & Vuksanović, G. (2010). Analysis of the collision and flight balls in table tennis and tennis.U A. Biberović, *Collection of scientific papers*, *III International Symposium „* SPORT AND HEALTH *“,* (str.120-126.). Tuzla.University of Tuzla, Faculty of Physical Education and Sports.

Chiu, Y.-H.,& Tu, J.-H. (2006). The measuring method for the spin axis and the rate of the rotational ball. *Journal of Physical Education in Higher Education, 8*(3), 139-147.

Đokić, Z. (2007). Functional diagnostics of top table tennis players. U M. Kondrič, & G. Furjan Mandić (Eds.), *Proceedings book of The 10th Anniversary ITTF Sports Science Congress* (str. 168 - 174). Zagreb: University of Zagreb, Faculty of kinesiology; Croatian Table Tennis Association; International Table Tennis Federation.

Đokić, Z. (2007). Testing, perfection and monitoring of motor abilities of table tennis players. M. Kondrič, & G. Furjan Mandić (Eds.), *Proceedings book of The 10th Anniversary ITTF Sports Science Congress* (str. 175 - 182). Zagreb: University of Zagreb, Faculty of kinesiology; Croatian Table Tennis Association; International Table Tennis Federation.

Ivanek, V., Mikić, B., &Avdibašić-Vukadinović, N. (2010).Canonical correlation motor and situational-motor skills stolnotenisera cadet level. In D. Tomic, & M. Djukic, (Eds.), Proceedings of the VI International Conference “Sports Management”, (str.57-61). Belgrade. Faculty of Management in Sport “Alfa University”.

Kondrič, M., Hudetz, R., Koščak, J., Slatinšek, U., & Cerar, K. (2007). Research regarding possibilities of marking the ball in order to make spin visible. U M. Kondrič, & G. Furjan Mandić (Eds.), *Proceedings book of The 10th Anniversary ITTF Sports Science Congress* (str. 120 - 122). Zagreb: University of Zagreb, Faculty of kinesiology; Croatian Table Tennis Association; International Table Tennis Federation.

Kondrič, M., Zagatto, A. M., &Sekulić, D. (2013). The Physiological Demands of Table Tennis: A Review. *Journal of Sports Science and Medicine*, *12*(3), 362-370.

Krippendorff, K. (2004.). *Content Analysis: An Introduction to its Methodology*, Thousand Oaks, CA, Sage.

Malagoli, L.I., Rocco, M., & Franco, M. (2011). Reliability of selected table tennis performance indicators. *International Journal of Table Tennis Sciences*, *7*, 62-65.

Mikić, B. (2000). *Testiranje i mjerenje u sportu*. Tuzla: Fakultet za tjelesni odgoj i sport Univerziteta u Tuzli.

Munivrana, G. (2011).Structural analysis of the technical and tactical elements of the game of table tennis. Doctoral dissertation. Zagreb: University of Zagreb, Faculty of Kinesiology.

Toriola, A. L., Toriola, O.M., &Iqubokwe, N.U. (2004). Validity of specific motor skills in predicting Table Tennis performance in novice players. *Perceptual and Motor Skills*, *98*(2), 584-586.

Uljević, O., Spasić, M., & Sekulić, D. (2013). Sport-Specific Motor Fitness Tests in Water Polo: Reliability, Validity and Playing Position Differences. *Journal of Sports Science and Medicine*, *12*(4), 646-654.

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Short notice

Značaj fizičke aktivnosti u menadžmentu konflikata, zdravlju zaposlenih i poboljšanju kvaliteta zdravstvenih usluga

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Rezime: Cilj istraživanja je bio da se istraži značaj "pojačanja fizičke aktivnosti" u prevenciji konflikata u zdravstvenim ustanovama sa refleksijom na zdravlje zaposlenih i kvalitet zdravstvenih usluga koje pružaju. Podaci su prikupljeni putem ankete zaposlenih u JZU „Dom zdravlja" Živinice.
Rezultati istraživanja pokazuju da 4 (3,7 %) ispitanika smatra da ne treba fizičku aktivnost primjenjivati u mjerama prevencije, 104 (96,3 %) smatra da je to značajna mjera ("povremeno" i "da - uvijek") prevencije i upravljanja konflikata u zdravstvenim ustanovama.
Istaknuto mjesto u menadžmentu konflikta treba da bude fizička aktivnost uz primjenu adekvatnih strategija, planova, programa i procedura u prevenciji, zaštiti i unapređenju zdravlja zaposlenih. Tako bi se mentalno i fizičko zdravlje zaposlenih zaštitilo i unaprijedilo, postiglo zadovoljstvo na radnom mjestu, poboljšao kvalitet i sigurnost usluga koje pružaju, efektivnost, efikasnost i uspješno funkcionisanje ustanove. Interne i eksterne konflikte ne treba izbjegavati, nego ovladavati strategijama i tehnikama za njihovo uspješno preveniranje i upravljanje. Pored sticanja stručnih znanja i vještina, zaposleni se trebaju kontinuirano educirati iz menadžment konflikta, zaštite zdravlja u okviru antistresnih programa, organizacionih i menadžerskih edukacija.
Ključne riječi: zaposleni, fizička aktivnost, konflikti, prevencija, zdravlje, kvalitet usluga.

Uvod

Potrebe i značaj izučavanja i istraživanja internih i eksternih konflikata, konfliktnih situacija i mjera prevencije konflikata na svim nivoima, primarnom, sekundarnom i tercijarnom, u zdravstvenim ustanovama, su bitne za planiranje i provođenje interventnih, akcionih programa, a u cilju zaštite i unapređenja zdravlja zaposlenih, efektivnosti i efikasnosti zdravstvene ustanove i sprovođenja kvalitetne i sigurne zdravstvene zaštite.

The Importance of Physical Activity in Conflict Management, Employees' Health and Quality Improvement of Health Care Services

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Abstract: The main aim of this research was to explore the importance of "enhancement of physical activity" in conflict prevention in health facilities and the reflection on the employees' health and quality of services they provide. The survey was done by questionnaire and data were given by the employees at the Public Health Care Institution "Outpatient Clinic" Živinice. The results of the research show that 4 (3.7 %) respondents think that physical activity should not be applied in prevention measures, 104 (96.3 %) thinks that it is an important measure ("occasionally" and "yes-always") of prevention and conflict management in health facilities.
In conflicts management physical activity should be prominence by using adequate strategies, plans, programs and procedures in prevention, protection and improvement of employees' health. It is the way to protect and improve mental and physical health of employees, satisfaction in a workplace, to improve the quality and security of health care services, effectiveness, efficiency that leads to successfully functioning facility.
We are not supposed to avoid internal and external conflicts but to acquire strategies and techniques for successful prevention and management of conflicts.
Besides that, employees should be educated about conflict management, health protection within the anti-stress treatments, organizational and management skills training.
Key words: employees, physical activity, conflicts, prevention, health, quality of services.

Introduction

The significance and necessity of internal and external conflict research, research of conflict situations and measures of conflict prevention on primary, secondary and tertiary level in health facilities, are important for planning and implementation of emergency, action programs in order to protect and improve employees' health, effectiveness and efficiency of health facility and for im-

Za uspješno preveniranje i rješavanje internih i eksternih konflikata potrebno je njihovo ispravno razumijevanje. Konflikt predstavlja „postojanje suprotnosti interesa ili ciljeva između osoba ili organizacija koje valja razriješiti" (Srića, 1995). Konflikt je antagonistička interakcija u kojoj jedna strana pokušava blokirati namjere ili ciljeve druge (Robbins, 1992). „Sukobe motiva nazivamo konfliktima, a situacija u kojoj se čovjek nalazi usljed sukoba motiva naziva se konfliktnom situacijom" (Rot, 2000).

Interni i eksterni konflikti su dio svakodnevnog života ljudi, sa njima se stalno susrećemo i nešto su što većina želi izbjeći. Često nas dovode do frustracija, mentalne iscrpljenosti, stanja očaja, a vrlo često i do blažih oblika depresije. Najznačajniji uzroci poremećaja psihičkog odnosno mentalnog zdravlja proizilaze iz naše nespremnosti da se suočavamo i nosimo sa konfliktima. Njima nije posvećena dovoljna pažnja tokom školovanja i obrazovanja kadrova. Kriteriji modernog menadžmenta zahtijevaju kvalitetno preveniranje i rješavanje konfliktnih situacija, koje su gotovo svakodnevne i neizbježne. Uz profesionalne vještine koje posjeduju, zdravstveni radnici moraju uključiti i vještinu upravljanja konfliktima (Brestovački, Milutinović, Cigić, Grujić i Simin, 2011).

Značajna mjera prevencije i upravljanja konfliktima u zdravstvenim organizacijama, pored mnogih drugih, kao što su **učenje prihvatanja različitosti,** poboljšanje komunikacije, **učenje slušanja i razumijevanja drugih, traženje rješenja na obostranu korist,** promjene radnog mjesta, odlasci na bolovanja, napuštanje radne organizacije, educiranje iz menadžment konflikta, poboljšanje uslova rada, povećanje plata, je i pojačanje fizičke aktivnosti.

Upoznavanje sa strategijama i stilovima rješavanja konflikata pomoći će nam da na našem radnom mjestu uspostavimo i držimo dobre međuljudske odnose čime ćemo doprinijeti sveopštem uspjehu naše organizacije tj. institucije u kojoj smo zaposleni. Pored toga, novostečene vještine mogu nam koristiti i u svakoj drugoj situaciji van radnog mjesta u kojoj može doći do izbijanja sukoba između različitih strana (Šarenac i Begu, 2006).

Cilj rada je istražiti i utvrditi stav zaposlenih prema značaju, doprinosu i uticaju fizičke aktivnosti u prevenciji internih i eksternih konflikata u zdravstvenim ustanovama, odnosno, o efikasnosti jačanja fizičke aktivnosti kao mjere prevencije i upravljanja konfliktima i njen uticaj na zdravlje zaposlenih kao i na kvalitet i sigurnost zdravstvenih usluga koje pružaju.

Na osnovu dobijenih rezultata istraživanja uraditi analizu, zaključke i preporuke sa akcentom ukazivanja na značaj pojačanja fizičke aktivnosti u menadžmentu

plementation of safe and high-quality health care.

The correct understanding of internal and external conflicts is needed for their successful prevention and resolution. Conflict represents „the presence of conflicting interests or goals between persons or organisations that have to be solved"(Srića, 1995).

Conflict is an antagonistic interaction where one side attempts to block the intentions and aims of the opposite side (Robbins, 1992).

„Struggles between opposing motives are called conflicts, and the situation where the man is in the middle of this strugle is called conflict situation"(Rot, 2000).

Internal and external conflicts are part of people's everyday life, they confront them constantly and they are something that most people want to avoid. They often lead us to frustration, mental exhaustion, despair, and very often to milder forms of depression. The most important causes of mental health disorders arise out of ours unwillingness to confront and deal with conflicts. Conflicts don't get enough attention during education. Modern management criteria requires conflict prevention and resolution of conflict situations that are inevitable on a daily basis. Health care workers have to include conflict management skills to professional skills they possess (Brestovački, Milutinović, Cigić, Grujić & Simin, 2011).

The important measure of conflict prevention and conflict management in health care facilities is enhancement of physical activity, among many others like teaching to accept differences, communication improvement, learning to listen and understand others, finding solutions in everyone's favor, change of position, taking sick leave, abandonment of employment, conflict management education, improvement of working conditions, pay raise.

If we know the strategies and styles of conflict resolution, it will help us to establish and maintain good relationships in our workplace, that contributes to an overall success of our organization or institution. Besides that, we can use newly acquired skills in any other situation, outside the workplace, that can result conflicts between two different groups (Šarenac i Begu, 2006).

The aim of this paper is to explore and determine employees' attitude about importance, contribution and impact of physical activity in conflict prevention in health facilities, respectively, about enhancement od physical activity as a measure of conflict prevention and conflict management and its reflection on the employees' health and quality of services they provide.

The analysis, concusions and recommendations has to be done, with emphasis on importance of physical activity enhancement, especially on its impact on physical

konflikta, posebno uticaju na fizičko stanje i mentalno zdravlje zaposlenih, odnosno, kvalitet i sigurnost usluga koje pružaju.

Metodologija istraživanja

Uzorak čini 108, odnosno, 34,83 % zaposlenika JZU "Dom zdravlja" Živinice, stratificiran, u korelaciji sa populacijom, proporcionalno uzet po spolu, starosnoj dobi, stručnoj spremi, dužini radnog staža, različitih pozicija u ustanovi (raspoređenost na rukovodna i ostala radna mjesta) i ostalim parametrima.

Dobiveni rezultati su statistički obrađeni uz pomoć računarskog programa SPSS verzija 17,00 for Windows. Statističkom obradom podataka će se utvrditi statističke vrijednosti, dominantnost i zastupljenost uticaja fizičke aktivnosti u prevenciji i menadžmentu konflikata. Za posmatranu varijablu izračunati su osnovni deskriptivno - statistički parametri, apsolutne i relativne frekvencije.

Rezultati istraživanja

Tabela 1. *Struktura ispitanika prema spolu i starosnoj dobi, spolu i stručnoj spremi te spolu i radnom mjestu ispitanika, apsolutne i relativne frekvencije (f i %).*

and mental health of employees and the quality of services they provide, based on the obtained results.

Methodology

The research sample consisted of 108, respectively, 34.83 % employees at the Public Health Care Institution „Outpatient Clinic" Živinice, stratified, in population correlation, sorted by gender, age, education, lenght of service, position in organization (manager or other position) and other parameters.

Collected data is statistically processed in computer program SPSS version 17.00 for Windows. Statistical data processing will determine statistical values, dominance and representation of the influence of physical activity in conflict management. As observed variable were calculated basic descriptive and statistical parameters, absolute and relative frequencies.

Research results

Table 1. *Examinees' gender and age structure, gender and education structure and gender and workplace structure, absolute and relative frequencies (F and %).*

SPOL /*GENDER*	STAROSNA DOB / *EXAMINEE AGE*						STRUČNA SPREMA / *EDUCATION*						RADNO MJESTO / *WORKPLACE*				UKUPNO / *TOTAL*	
	Do 30 god. / *Up to 30 years*		Od 30 – 40 god. / *30-40 years*		Preko 40 god./ *Over 40 years*		SSS / *High School Diploma*		VŠS / *College degree*		VSS / *Bachelor degree*		Rukovodno / *Manager*		Ostalo / *Other*			
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
M/M	14	31.1	12	26.7	19	42.2	20	44.4	1	2.2	24	53.3	12	26.7	33	73.3	45	**41.67**
Ž/F	11	17.5	27	42.9	25	39.6	37	58.7	3	4.8	23	36.5	19	30.2	44	69.8	63	58.33
Σ	25	23.1	39	36.1	44	40.8	57	52.8	4	3.7	47	43.5	31	28.7	77	71.3	108	100.0
	χ^2=6.920; df = 3; p=0.074						χ^2=3.180; df = 2; p=0.204						χ^2=0.156;df=1;p=0.692					

Prema izračunatoj vrijednosti hi - kvadrat testa i p - vrijednosti koja je veća od 0,05 ne postoji statistički značajna povezanost između spola i starosne dobi ispitanika, između spola i stručne spreme ispitanika i između spola i vrste radnog mjesta.

According to calculated value of chi-square test and p-value that is higher than 0,05, there is no statistically significant difference between gender and age of examinees, between gender and education of examinees and between gender and workplace of examinees.

Tabela 2. *Stavovi ispitanika o uticaju "fizičke aktivnosti", u prevenciji i menadžmentu internih i eksternih konflikata u zdravstvenim ustanovama, prema spolu, starosnoj dobi, stručnoj spremi i poziciji u ustanovi, apsolutne i relativne frekvencije (f/%).*

Table 2. *Examinees' view about „physical activity" impact in prevention and management of internal and external conflicts in health facilities by gender, age, education and workplace (position in institution), absolute and relative frequencies (F/%).*

	Ne / *No*	Povremeno / *Occasionally*	Da / *Yes*	Ne / *No*	Povremeno/ *Occasionally*	Da / *Yes*	Ne/ *No*	Povremeno/ *Occasionally*	Da / *Yes*	p
	f/%	f/%	f/%	f%	f/%	f/%	f/%	f/%	f/%	
Spol / *Gender*	Muški (45) / *Male (45)*			Ženski (63)/ *Female (63)*						
	1/ 2.22	20/ 44.44	24/ 53.33	3/ 4.76	30/ 47.62	30/ 47.62				0.000
		Σ 44/97.77		**Σ** 60/95.24						
Stručna sprema / *Education*	Srednja stručna sprema (57) / *High School Diploma*			Viša i visoka stručna sprema (51) / *College and Bachelor degree (51)*						
	3/ 5.26	25/ 43.86	29/ 50.88	1/ 1.96	25/ 49.02	25/ 49.02				0.045
		Σ 54/94.74			**Σ** 50/98.04					
Pozicija u ustanovi / *Workplace*	Rukovodno (31) / *Manager (31)*			Ostalo (77) / *Other (77)*						
	1/ 3.23	16/ 51.61	14/ 45.16	3/ 3.90	34/ 44.16	40/ 51.95				0.000
		Σ 30/96.77			**Σ** 74/96.11					
Starosna dob / *Age*	Do 30 godina (25) / *Up to 30 years (25)*			Do 40 godina (39) / *Up to 40 years (39)*			Preko 40 godina (44)/ *Over 40 years (44)*			
	1/ 4.0	14/ 56.0	10/ 40.0	0/ 0.0	14/ 35.9	25/ 64.1	3/ 3.9	22/ 50.0	19/ 43.2	0.292
		Σ 24/96.0			**Σ 39/100**			**Σ 41/93.2**		

Većina ispitanika (modaliteti "povremeno" i "da") smatra da je pojačanje fizičke aktivnosti značajna mjera prevencije i upravljanja konfliktima u zdravstvenim ustanovama, odnosno, da sa pojačanjem fizičke aktivnosti zaposleni uspješnije upravljaju konfliktima. Statistički značajna razlika u proporciji potvrdnih odgovora postoji kod svih grupa ispitanika ($p<0,05$) osim kod grupe "starosna dob" gdje je p 0,292, odnosno, $p>0,05$, tj. ne postoji statistički značajna razlika u procentu slaganja sa predloženom tvrdnjom između tri skupine ispitanika.

Analiza rezultata istraživanja

Preveniranje i upravljanje internih i eksternih konflikata ne treba učiniti da konflikti nestanu, cilj treba da bude naučiti kako da se njihovi negativni uticaji smanje, lakše prihvate i možda, čak, pretvore u pozitivno iskustvo.

Prihvatiti konflikt kao normalni dio života je važna odlika i vještina. Konflikti su svakodnevnica našeg života i treba ih shvatiti kao probleme kojima možemo pristupiti ili konstruktivno ili destruktivno (Milović, 2004). Kakve će efekte i/ili posljedice u zdravstvenim ustanovama imati, zavisi od načina njihovog shvatanja, njihove prevencije i upravljanja, vrste posla, kao i od intenziteta i kontrole konflikata.

Ličnost je značajan faktor u konfliktnoj situaciji sa unutrašnjim i spoljašnjim izvorima otpornosti. Ponašanje ličnosti u konfliktnoj situaciji je često presudno za tok i izhod konfliktne situacije. Ponašanja podrazumijevaju sve

Most of respondents (modalities „occasionally" and „yes") thinks that enhancement of physical activity is significant measure of prevention and conflict of management in health facilities, viz, with enhancement of physical activity employees manage conflicts better. Statistically significant difference in affirmative answers exists in all groups of examinees ($p<0,05$) except the group „age" where p is 0,292, $p>0,05$, i.e. there is no statistically significant diference in percentage agreement about one statement between three groups of examinees.

Analysis of the results

Prevention and management of internal and external conflicts should not make conflicts disappear, the aim is to learn how to reduce their negative impacts, to accept them easier and maybe, even turn them into positive experience.

It is an important quality and skill to accept conflicts as a normal part of life. Conflicts are our everyday life and they should be accepted as problems that can be approached constructively or destructively (Milović, 2004). Their influence and/or consequences in health facilities depend on their understanding, their prevention and management, type of job, intensity and conflict control.

Personality is an important factor in conflict situation with internal and external sources of resistance. Individual's behavior in conflict situation is usually crucial for its

načine (stilove, strategije) reagovanja odnosno ponašanja pri konfrontaciji sa internim i eksternim konfliktima u cilju prevladavanja konfliktne situacije. Riječ je o, manje ili više, (ne)efikasnim strategijama ponašanja pri konfrontaciji sa internim i eksternim konfliktima (Milić, 2009). Zato je potrebno raditi sa ličnostima i ukazivati im na značaj shvatanja svih situacija u vezi sa konfliktima kao i da na osnovu tog shvatanja reaguju i utiču na tok i ishod konfliktnog procesa.

Osobine ličnosti su pretpostavka za otpornost i/ili osjetljivost (vulnerabilnost), uopšte, a posebno u konfliktnim situacijama. Otporne ličnosti imaju viši prag tolerancije, ne doživljavaju brzi slom snaga, rjeđe se dekompenzuju, imaju ličnu kontrolu, vjeruju da mogu kontrolisati okolinu i da raspolažu sposobnostima i vještinama za efikasno reagovanje, angažuju se u određenim zadacima promišljeno izabranim, sa određenim smislom inteligentnije se ponašaju (Milić, 2009).

Zbog svega spomenutog kao i rezultata istraživanja, ukazuje se potreba i značaj podizanja fizičke i psihičke otpornosti zaposlenih u preventivnim mjerama konflikata. Mjere i aktivnosti za podizanje fizičke i psihičke otpornosti zaposlenih treba definisati godišnjim planovima i programima ustanove, u okviru planova i programa zaštite i unapređenja zdravlja zaposlenih, uz angažovanje menadžmenta ustanove, stručnih lica iz oblasti zaštite i unapređenja zdravlja zaposlenih i svih zaposlenih.

Fizička aktivnost kao značajna mjera prevencije i upravljanja internih i eksternih konflikata u zdravstvenim organizacijama, koju bi trebalo redovno sprovoditi i primjenjivati, uključuje hodanje, vožnju bicikla, ples, igru, sport, rad, aktivnosti u slobodnom vremenu i vježbanje. Fizičko vježbanje je sistematska fizička aktivnost veća od uobičajenih aktivnosti koja dovodi do hemodinamskih, morfoloških, metaboličkih, neurohormonalnih, vaskularnih i psiholoških promjena.

Psihološke promjene koje nastaju tokom fizičke aktivnosti su povećavanje emocionalne stabilnosti, samopouzdanja i motivisanosti za adaptacijama, smanjenje anksioznosti, agresije i depresije. Zato se fizička aktivnost uvijek preporučuje kada se želimo osloboditi psihičkih pritisaka. Nakon brze šetnje, plivanja, igre ili ostalih aktivnosti osjećamo se opuštenije. Fiziološke promjene se ogledaju u povećavanju maksimalne iskorištenosti kiseonika, smanjenju potrebe za kiseonikom za dati nivo opterećenja, povećavanju mišićne snage i izdržljivosti, fibrinolitičke aktivnosti plazme, a smanjenju agregacije trombocita i količine kateholamina. Anatomski se smanjuje progresija bolesti, a povećava regresija. Morbiditet i mortalitet se smanjuju, gledano sa epidemiološke strane. Sa ekonomske strane se povećava produktivnost, a smanjuje onesposobljenost za posao, brojne posjete ljekaru i potrošnja lijekova.

course and outcome. Behavior includes all ways (styles, strategies) of response to internal and external conflicts in order to overcome conflict situation. It's about, more or less, (in)effective behavioral strategies during internal and external conflict confrontation (Milić, 2009). Therefore, it is necessary to work with individuals and to show them the importance of understanding conflict situations. Based on that understanding they will react and affect on course and outcome of conflict process.

Personality traits are important for resistance and/or sensitivity (vulnerability), always, but especially in conflict situations. Resistant personalities have higher tolerance, they don't experience rapid breakdowns, they rarely decompensate, they have their own control, they believe that they can control others and they have abilities and skills for effective response, they do deliberately chosen tasks and behave more intelligent (Milić, 2009).

Due to research results, there is a necessity for physical and mental resistance enhancement of employees as a preventive measure of conflicts. It should be defined in annual plans and emergency, action programs in order to protect and improve employees' health by management of the facility, professionals and employees themselves.

Physical activity, as an important measure of conflict prevention and conflict management in health facilities that should be applies regularly, includes walking, cycling, dancing, playing games, sport, working, free time activities and exercising. Physical exercise is physical activity higher than usual activity that leads to hemodynamic, morphologic, metabolic, neurohormonal, vascular and psychological changes.

Psychological changes, that appear during physical activity, are improvement of emotional stability, confidence and motivation, anxiety relief, aggression and depression reduction. That is why physical activity is always recommended for phychological problems. After fast-walking, swimming, playing game or other activities we feel more relaxed. Physiological changes are increasement in the percentage utilization of oxygen, reduction of the amount of oxygen we need for that level of load, increment of muscle strenght and endurance, fibrinolytic activity in plasma, decrease platelet aggregation and amount of catecholamines. Anatomically, the disease progression reduces and the regression increases. Morbidity and mortality are decreasing, from an epidemiological point of view. From an economic point of view, productivity increases and doctor's visit and consumption of drugs reduces.

Physicaly strong, durable, trained persons, prone to physical and mental conditioning (exercising, running,

Fizički jake, izdržljive, utrenirane ličnosti, sklone tjelesnom i duševnom kondicioniranju (vježbanju, trčanju, rekreaciji, relaksaciji), bolje se osjećaju, psihički su otpornije, postoji im želja za radom i životom. Znaju da koriste i prihvataju psihosocijalnu podršku i pomoć u svojoj socijalnoj mreži, lakše će i efikasnije prihvatati i nositi se sa svim situacijama i izazovima pa i u svim konfliktnim situacijama.

Fizička aktivnost je važan način prevencije i rehabilitacije kardiovaskularnih bolesti i značajan faktor u očuvanju normalnog fizičkog i mentalnog zdravlja. Dokazano je da osobe sa dobrom fizičkom kondicijom imaju dva puta manji rizik od pojave kardiovaskularnih bolesti, čak i u prisustvu glavnih riziko faktora (arterijske hipertenzije, šećerne bolesti, pušenja, hiperlipoproteinemije, gojaznosti i dr.). Dozirana, kontrolisana i kontinuirana fizička aktivnost smanjuje mortalitet bolesnika poslije infarkta miokarda. Rizik nastanka komplikacija u toku fizičke aktivnosti je zanemarljiv, posebno ako se kao vid fizičke aktivnosti koristi hodanje.

Redovita tjelesna aktivnost može poboljšati zdravlje i smanjiti rizik prerane smrti na sljedeće načine: smanjenjem rizika razvoja koronarne bolesti srca (KBS) i rizika smrti od KBS; smanjenjem rizika moždanog udara; smanjenjem rizika drugog srčanog infarkta kod osoba koje su već imale jedan; sniženjem ukupnog kolesterola u krvi i triglicerida te povećanjem koncentracije „dobrog" lipoproteina visoke gustoće (HDL); smanjenjem rizika razvoja povišenog krvnog tlaka; pomaganjem u sniženju krvnog tlaka kod osoba kod kojih je već povišen; smanjenjem rizika razvoja dijabetesa neovisnog o inzulinu (NIDDM-tip 2); smanjenjem rizika razvoja karcinoma debelog crijeva; pomaganjem u postizanju i održanju zdrave tjelesne težine; smanjenjem osjećaja depresije i straha; unapređenjem psihološke stabilnosti i smanjenjem osjetljivosti na stres; pomaganjem u izgradnji i održanju zdravih kostiju, mišića i zglobova; pomaganjem starijim osobama da budu jače i da se lakše kreću bez padova i jakog umaranja (Heimer i Čajavec, 2006).

Započeti fizičku aktivnost nikada nije kasno. Važno je donijeti odluku, biti motiviran, koristiti sva pogodna životna i radna okruženja, voditi računa o tjelesnim sposobnostima, ne očekivati brze rezultate, biti ustrajan.

Redovna fizička aktivnost je najzdravija životna navika u svakoj životnoj dobi. Smatra se da će tjelesna aktivnost kod djece i mladih pogodovati pravilnijem rastu i razvoju, dok će kod starijih pomoći pri sprječavanju raznih bolesti, očuvanju funkcionalne sposobnosti starih i podržavanju njihove psihofizičke samostalnosti (Heimer i Čajavec, 2006).

Da bi mjere prevencije konflikata imale efekte, potrebno je sprovoditi intervencije kako na individualnom tako i na širem, organizacijskom nivou. Individualni nivo

recreation, relaxation), feel better, they are psychologically resistant and they have a desire for work and life. They know how to accept and use psychosocial support and help and they will accept and deal with every situation and conflict easier and on a more efficient way.

Physical activity is important way of prevention and cardiac rehabilitation and it is significant factor of normal physical and mental health. It is proved that people in good physical condition have lower risk of cardiovascular diseases, even with the presence of major risk factors (arterial hypertension, diabetes mellitus, smoking, hyperlipoproteinemia, obesity, etc.). Controlled and sustained physical activity reduces mortality in patients after recent myocardial infarction. Risk of complications during physical activity is negligible, especially if physical activity means walking.

Regular physical activity can improve our health and reduce the risk of premature death on certain ways: lowering the risk of developing coronary heart disease (CHD) and risk of death from CHD, reducing stroke risk, preventing a second heart attack, reducing total blood cholesterol and triglycerides and increasing high-density lipoprotein (HDL) cholesterol, reducing the risk of developing high blood pressure, lowering blood pressure, reducing the risk of developing non-insulin-dependent-diabetes mellitus (NIDDM-type 2 diabetes), lowering the risk for colon cancer, achieving and maintaining healthy body weight, reducing fear and depression, improving emotional health and reducing susceptibility to stress, helps building and maintaining healthy bones, muscles and joints, helps elderly to become stronger and to move easily without falling and fatigue (Heimer & Čajavec, 2006).

It is never too late to start exercising. It is important to make a decision, to stay motivated, to use every instrumentality, to take care about physical abilities and not to expect quick results, to be diligent.

Regular physical activity is the healthiest habit at any age. Physical activity is conductive to the proper growth and development of children and disease prevention, preservation of functional ability and psychophysical autonomy of older patients (Heimer & Čajavec, 2006).

It is necessary to carry out interventions on both, the individual and organizational level, if we want to prevent conflicts. Individual level means interventions in order to respond realistically to frustrations and to avoid negative consequences that lead to mental and physical disoders of employees, incresing the capacity and resistance of employees so conflicts won't affect

podrazumijeva intervencije u cilju realističkog reagiranja na frustracije i izbjegavanja negativnih posljedica frustracija, koje izazivaju poremećaje mentalnog i fizičkog zdravlja zaposlenih, povećavanja sposobnosti i otpornosti zaposlenih da konflikti imaju što manje uticaja na njih, odnosno stvaranje i izgrađivanje sposobnosti i mogućnosti da se mogu nositi sa njima a sve to utiče na efikasnost, efektivnost i funkcionisanje zdravstvene organizacije.

Pored sticanja znanja i vještina iz oblasti stručnog rada, zaposleni se trebaju kontinuirano obučavati i osposobljavati u okviru edukacija iz komunikacijskih vještina, edukacija iz menadžment konflikta, planovima i programima zaštite zdravlja zaposlenih u okviru antistresnih programa, programima jačanja fizičke otpornosti, organizacionih i menadžerskih edukacija. Značaj sticanja spomenutih znanja i vještina se ogleda u spoznaji da zaposleni koji su obučeni u svim oblastima rada se mogu nositi sa svim izazovima i radnim zadacima i mogu postizati dobre rezultate, čime postižu zadovoljstvo pacijenata, ustanove i svoje lično. Sve ove aktivnosti zaposleni trebaju sprovoditi pojedinačno ali i ustanova kao cjelina treba da stvara uslove i da motiviše zaposlene za sprovođenje tih aktivnosti.

Pored jačanja sprovođenja lične fizičke aktivnosti, zdravstveni radnici trebaju primjenjivati mjere promocije fizičke aktivnosti kod pacijenata kojima pružaju zdravstvene usluge, šireg kruga građanstva i lokalne zajednice.

Značaj u promociji fizičke aktivnosti doprinose i sertifikacijski i akreditacijski standardi za zdravstvene ustanove, posebno za timove porodične medicine: Tim porodične/obiteljske medicine prikuplja podatke o faktorima koje predstavljaju rizik za zdravlje pacijenta, uključujući značajne podatke iz lične, porodične i socijalne anamneze; fizičku aktivnost i invaliditet; ranije navike pušenja i trenutni status u pogledu konzumiranja duhana, droga i alkohola (AKAZ, 2014).

U kliničkoj reviziji hipertenzije, pored ostalih parametara kao što su laboratorijski status, pušački i BMI status, nefarmakološki i farmakološki tretmani, značajan parametar je fizička aktivnost pacijenata (redovna, povremena, nepoznata ili nema fizičke aktivnosti), kao i kod kliničke revizije zdravstvenih kartona pacijenata sa diabetes mellitusom u timovima porodične medicine, pored ostalih parametara je i registrovana edukacija vezana za diabetes (ishrana, fizička aktivnost, samokontrola glukoze u krvi, itd.). Značaj praćenja tih parametara je da se na osnovu kliničke revizije, odnosno, analize izrađuju akcioni planovi poboljšanja menadžmenta pacijenata sa pomenutim bolestima, odnosno, akcenat savjetovanja pacijenata na primjenu fizičke aktivnosti u skladu sa kliničkim vodiljama. Savjetovanje o primjeni fizičke aktivnosti primjereno zdravstvenom stanju

them, viz employees can handle it without consequences on the efficiency, effectiveness and functioning of health care organization.

Besides professional knowledge and skills improvement, employees should be educated about many other fields like: communication skills, conflict management, health protection within the anti-stress treatments, strenght-training programs, organizational and management skills training. This is important because trained employees can handle every challenge and task and they can achieve good results thus they achieve patient satisfaction, their own satisfaction and satisfaction of the organization they work. Employees have to carry out these activities individually but institution has to create conditions to motivate employees so they implement these activities.

Besides enhancement of personal physical activity, health care workers should apply measures to promote physical activity to patients they provide health care services, to global citizenship and a local community.

To importance of promoting physical activity contribute the healthcare facilities certification and accreditation programs, especially for family medicine (FM) teams: FM team collects informations about risk factors that may represent a health hazard, including personal, family and social history data, physical activity and disability, earlier smoking habits and the current consumption of tobacco, drugs and alcohol (AKAZ, 2014).

In clinical audit of the quality of care of hypertension, besides other parameters like laboratory status, smoking status and BMI, non-pharmacological and pharmacological treatments, physical activity of patients is the important parameter (regular, occasional, unknown or no physical activity). Also, in clinical audit of diabetes mellitus in family health teams, besides other parameters there is education about diabetes (nutrition, physical activity, self-monitoring of blood glucose, etc.). Based on these audits or analysis, action plans are prepared to improve management of patients with these illnesses. The emphasis in counseling patients is on increasing physical activity according to clinical guidelines. Counseling is supposed to be applied regularly and it is supposed to be one of the major moments of health promotion and disease prevention by health care professionals.

Programs for promoting and implementation of physical activity could be carried out by high quality interdisciplinary and multi-sectoral approach through schools, health care institutions, media, government and non-governmental sector, labor organizations. All of

svih pacijenata treba da se redovno sprovodi i da bude jedan od glavnih momenata promocije zdravlja i prevencije bolesti kod svih zdravstvenih profesionalaca.

Širi program promocije i primjene fizičke aktivnosti bi se mogao sprovoditi kvalitetnim interdisciplinarnim i multisektorskim pristupom (uključivanje svih društvenih subjekata) preko škola, zdravstvenih institucija, medija, vladinog i nevladinog sektora, radnih organizacija, koji bi svi u okviru svojih mogućnosti i nadležnosti radili na edukaciji, promovisanju i stvaranju uslova sprovođenja fizičke aktivnosti.

Kampanje putem masovnih medija imaju veliku mogućnost uticaja na pozitivne norme zajednice povezane sa zdravim ponašanjem i mogu na relativno jeftini način obuhvatiti veliki dio stanovništva u podizanju svijesti o značaju i primjeni fizičke aktivnosti.

Zdravstveni profesionalci imaju vodeću ulogu u koordiniranju višesektorske akcije s profesionalcima iz drugih sektora lokalne zajednice kao što su urbanisti, arhitekti, inženjeri i planeri prijevoza i prometa, poslodavci, dobrovoljne i nevladine organizacije. Cilj je stvaranje okoline koja potiče fizički aktivan život unapređenjem pješačenja i vožnje bicikla, privlačnih zelenih površina i objekata na kojima je provođenje fizičke aktivnosti lakše i sigurnije.

Zdravstvene ustanove bi trebale vršiti promociju fizičke aktivnosti među zaposlenima, motivišući ih da dolaze na posao pješice ili biciklom, da budu aktivni tokom pauza, da im obezbijede sportske rekreacije i takmičenja.

Učestvovanje u sportskim aktivnostima ima pozitivan efekat na zdravlje i zato je važno područje promocije zdravlja. Višesektorska politika treba da promovira javno finansiranje sportskih organizacija, službi i izgradnju sportskih objekata.

Zdravstveni, obrazovni, sportski, rekreacijski sektori i radne organizacije bi trebali provoditi kampanje i organizovati događaje u cilju podizanja svijesti, promjene politike na radnim mjestima i školama. Trebali bi razvijati programe i intervencije koji koriste fizičku aktivnost i sport, kao što su uređenje pješačkih i biciklističkih staza, uređenje parkova i mjesta za igru, sportskih klubova za mlade, informacije za građanstvo o raspoloživosti igrališta i objekata, intervencije primarne zdravstvene zaštite za promociju fizičke aktivnosti, uključujući npr. savjete o smanjenju gledanja televizije, jačanje fizičkog odgoja i fizičkih aktivnosti vezanih uz školu i rad, obuka o fizičkoj aktivnosti, smanjenje sjedilačkih aktivnosti (TV, video igre, računar) i o potencijalnim posljedicama neaktivnosti, omogućavanje korištenja školskih, sportskih, radnih objekata za unapređenje fizičke aktivnosti izvan nastavnih i radnih sati i programa.

them within their means and competences would work on education, promotion and creation of conditions for physical activity implementation.

Mass media campaigns have ability to influence on positive community norms connected to health behavior and they can on a relatively cheap way cover large part of population and raise awareness about significance of physical activity.

Health professionals have a leading role in coordinating multi-sectoral actions together with professionals from other sectors of the local community such as urban planners, architects, engineers and planners of transport and traffic, employers, voluntary organizations and NGOs. The goal is to create environment that encourages physically active lives by improving walking and cycling strategy, enable attractive green spaces and facilities where the implementation of physical activity is easier and safer.

Health facilities should promote physical activity among employees, motivate them to come to work on foot or by bicycle, to be active during breaks, to provide them sport recreations and competitions.

Participation in sport activities has a positive effect on health and it is therefore an important area of health promotion. Multi-sectoral policies should promote public funding of sports organizations, services and sports facilities construction.

Health, education, sport, recreation sectors and labor organizations should implement campaigns and organize events to raise awareness and policy changes in the workplace and schools. They should develop programs and interventions that use physical activity and sport, such as arranging footpaths and biking trails, landscaping parks and places for playing games, sport clubs for young people, information for the public about the availability of playing fields and facilities, to promote physical activities in primary care, including for example, advice on reducing TV time, enhancement of physical education and physical activity related to school and work, training about physical activity, reducing sedentary behavior (television, video games, computer) and training about the potential consequences of inaction. They should also allow access to school, sports, working facilities for the promotion of physical activity outside of work hours and programs.

Internal and external conflicts should not be avoided, but to dominate the strategies and techniques for their successful prevention and management, that is one of the conditions of effectiveness, efficiency and successful functioning of healthcare organization. A prominent

Interne i eksterne konflikte ne treba izbjegavati, nego ovladavati strategijama i tehnikama za njihovo uspješno preveniranje i upravljanje, što je jedan od uslova efektivnosti, efikasnosti i uspješnog funkcionisanja zdravstvene organizacije. Istaknuto mjesto u menadžmentu konflikta treba da bude zaštita i unapređenje zdravlja zaposlenih primjenom adekvatnih strategija, planova, programa i procedura iz oblasti zaštite i unapređenja zdravlja zaposlenih. Tako bi se mentalno i fizičko zdravlje zaposlenih zaštitilo i unaprijedilo i postiglo zadovoljstvo na radnom mjestu a time i kvalitet i sigurnost usluga koje pružaju doveo do maksimalnog stepena izvodljivosti. Time će se stvoriti zadovoljstvo kod pacijenata kao korisnika zdravstvenih usluga, zaposlenih kao davaoca zdravstvenih usluga, lokalne zajednice, nadležnih ministarstava, zavoda zdravstvenih osiguranja, itd., kao nadležnih finansijera i kontrolora u zdravstvenom sistemu.

Zaključak

Potrebe i značaj izučavanja i istraživanja konflikata, konfliktnih situacija i mjera prevencije i upravljanja konfliktima na svim nivoima, u zdravstvenim ustanovama su bitne za:

- planiranje i provođenje interventnih, akcionih programa,
- zaštite i unapređenja zdravlja zaposlenih,
- efektivnosti, efikasnosti i uspješnog funkcionisanja zdravstvene ustanove, i
- sprovođenja kvalitetne i sigurne zdravstvene zaštite.

Značajna mjera prevencije i upravljanja konfliktima je jačanje fizičke otpornosti zaposlenih.

Mjere i aktivnosti za podizanje i fizičke i psihičke otpornosti zaposlenih treba definisati godišnjim planovima i programima ustanove, u okviru planova i programa zaštite i unapređenja zdravlja zaposlenih, uz angažovanje menadžmenta ustanove, stručnih lica iz oblasti zaštite i unapređenja zdravlja zaposlenih i svih zaposlenih.

Zaposleni se trebaju redovno educirati iz:

- vještina iz oblasti stručnog rada,
- komunikacijskih vještina,
- menadžment konflikta,
- zaštite zdravlja u okviru antistresnih programa, programa jačanja fizičke otpornosti,
- organizacionih i menadžerskih edukacija.

Fizička aktivnost je značajan faktor u očuvanju normalnog fizičkog i mentalnog zdravlja i važan način prevencije i rehabilitacije kardiovaskularnih bolesti.

Pored jačanja sprovođenja lične fizičke aktivnosti, zdravstveni radnici trebaju primjenjivati mjere njene promocije kod pacijenata, građanstva i lokalne zajednice. Zdravstveni sektor treba osigurati da promocija fizičke aktivnosti postane sastavni dio zdravstvene zaštite.

place in the management of conflicts should be protection and improvement of employees' health by applying appropriate strategies, plans, programs and procedures in this field. It is the way to protect and improve mental and physical health of employees and to achieve satisfaction in the workplace and the quality and safety of services provided. This will create satisfaction of patients as users of health services, employees as health care providers, local community, relevant ministries, institutes of health insurance, etc., as relevant funders and controllers in the health system.

Conclusion

The significance and necessity of internal and external conflict research, research of conflict situations and conflict prevention measures on all levels in health facilities, are important for :

- planning and implementation of emergency, action programs,
- protection and improvement of employees' health,
- effectiveness, efficiency and successful functioning of health facility, and
- implementation of safe and high-quality health care.

The important measure of conflict prevention and conflict management in health care facilities is enhancement of employees' physical resistance. Measures for physical and mental resistance should be defined in annual plans and emergency, action programs in order to protect and improve employees' health by management of the facility, professionals and employees. Employees should be regularly trained in:

- professional skills,
- communication skills
- conflict management,
- health protection within the anti-stress treatments,
- enhancement of physical resistance,
- organizational and managerial skills.

Physical activity is an important factor of maintaining normal physical and mental health and an important way of prevention and rehabilitation of cardiovascular diseases. Besides enhancement of personal physical activity, health care workers should apply measures to promote physical activity to patients they provide health care services, to global citizenship and a local community. The health sector should ensure that the promotion of physical activity becomes an integral part of health care.

Physical activity implementation program could be carried out by high quality interdisciplinary and multisectoral approach of all social entites, schools, health care

Širi program primjene fizičke aktivnosti sprovoditi kvalitetnim interdisciplinarnim i multisektorskim pristupom, uključivanjem svih društvenih subjekata, škola, zdravstvenih institucija, medija, vladinog i nevladinog sektora, radnih organizacija, koji bi u okviru svojih mogućnosti i nadležnosti radili na promovisanju i stvaranju uslova primjene fizičke aktivnosti.

Obrazovni, zdravstveni, prijevozni i urbanistički sektori trebali bi omogućiti građanstvu sprovođenje fizičke aktivnosti i staviti u prioritete promociju fizičke aktivnosti, izgradnju i održavanje objekata za fizičku aktivnost.

Preporučuje se ustrajavati na preveniranju i rješavanju konflikata i pretvarati ih u prilike a ne u problem.

Kvalitetno upravljanje konfliktima omogućava bolju saradnju na radnom mjestu a izbjegavanje rješavanja i upravljanja dovodi do poremećenih odnosa.

institutions, media, government and non-governmental sector, labor organizations. All of them within their means and competences would work on education, promotion and creation of conditions for physical activity implementation.

Education, health, transport and urban planning sectors should enable citizens implementation of physical activities and put priority on promotion of physical activity, the construction and maintenance of facilities for physical activity.

It is recommended to insist on preventing and resolving conflicts and convert them into opportunities rather than problems.

Quality management of conflicts means better cooperation in the workplace but avoidance of conflict resolution and conflict management leads to disturbed relations.

Literatura / References

Brestovački, B., Milutinović, D., Cigić, T., Grujić, V., & Simin, D. (2011). Conflict styles observed in doctors and nurses in health care organization. *Medicinski pregled*, *64*(5-6), 262-266.

Heimer, S., & Čajavec, R. (2006). *Medicina sporta.* Zagreb: Kineziološki fakultet Sveučilišta u Zagrebu.

Milović, Lj. (2004). *Organizacija zdravstvene nege sa menadžmentom*. Beograd: Naučna KMD.

Milić, A. (2009). Čovjek i njegov socijalni svijet. Banja Luka: Psimedica.

Robbins, S. P. (1992). *Bitni elementi organizacijskog ponašanja*. Zagreb: Mate.

Rot, N. (2000). *Opšta psihologija*. Beograd: Zavod za udžbenike i nastavna sredstva.

Standardi za timove porodične /obiteljske medicine, AKAZ, oktobar, 2014.

Srića, V. (1995). *Inventivni menadžer*. Zagreb: MEP Consult, Zagreb.

Šarenac, R., & Begu, B. (2006). *Rješavanje konfliktnih situacija*. Podgorica.

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Short notice

Analiza snage pojedinih mišićnih grupa kod dece narušenog posturalnog statusa

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Apstrakt: Cilj ovoga rada je analiza nivoa snage pojednih mišićnih grupa, odnosno utvrđivanje razlika u varijablama : repititivna snaga trupa, eksplozivna snag a nogu i statička snaga ruku i ramenog pojasa kod dece narušene posture. Istraživanjem je bilo obuhvaćeno ukupno 67 ispitanika sa područja opštine Subotica, od čega je merenjima bilo podvrgnuto 22 ispitanika sa kifotičnim narušenim držanjem tela, 18 ispitanika sa lordotičnim lošim držanjem tela , dok je ispitanika sa ravnim stopalima bilo 27. Za merenje odnosno procenu nivoa snage pojedinih mišićnih grupa je primenjena baterija standardizovanih testova: izdržaj u zgibu, skok u dalj iz mesta i podizanje trupa za 60 sekundi. Rezultati do kojih se došlo ukazuju da postoje statistički značajne razlike u manifestaciji snage u sve tri varijable: kifotično loše držanje tela, lordotično loše držanje tela i ravna stopala.
Ključne reči: Posturalni status, snaga, loše držanje tela, mišići.

Uvod

Posturalni poremećaji su učestaliji u dečijem i adolescentnom uzrastu. U predškolskom i ranom školskom uzrastu najčešće se javljaju funkcionalni poremećaji posture, dok je za adolescentni uzrast karakteristična pojava strukturalnih deformiteta kičmenog stuba (Adar, 2004; Demeši, 2007). Tokom perioda školovanja, postura deteta se suprotstavlja mnogim spoljašnjim uticajima, koji dovode do neadekvatnih posturalnih navika. Postura se najviše menja između 7. i 12. godine života pod uticajem telesnih promena i psihosocijalnih faktora, sve u cilju postizanja ravnoteže u skladu sa novim proporcijama tela (McEvoy & Grimmer, 2005; Penha et all, 2005). Kako navode McEvoy& Grimmer (2005) posturalna kontrola razvija se segmentarno u cefalo-kaudalnom smeru, počevši od uspostavljanja kontrole glave, potom trupa

Analysis of strength of particular muscle groups in children with postural disorders

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Abstract: The objective of this paper was to analyse the level of strenght of particular muscle groups in children aged 10-11 who have postural disorder. The research was conducted in Subotica, on a sample of 67 children from which 22 had kyphotic postural disorder, 18 with lordotic potural disorder and a total of 27 children with a disturbed longitudinal instep ie flat foot. A battery of standard motor tests was used for measuring the level of strength of particular muscle groups: static strength of the arms and shoulders, standing broad jump (cm) and Sit-ups in 60 s (freq). The results indicate that there are significant statistical differences in the manifestation of strenght within all three variables: kyphotic postural disorder, lordotic postural disorder and disturbed longitudinal instep ie flat foot.
Key words: postural status, strength, bad posture, muscles.

Introduction

Postural disorders are more common in children and adolescents. In the preschool and early school age functional posture disorders are the most frequent, while the adolescence is characterized by the appearance of structural deformities of the spinal column (Adar 2004, Demes, 2007). During the period of schooling, the child's posture is opposed to many external influences that lead to inadequate postural habits. Posture varies the most between 7 and 12 years of age under the influence of body changes and psychosocial factors, in order to achieve balance in accordance with the new proportions of the body (McEvoy & Grimmer, 2005; Penha et al, 2005). As stated by McEvoy & Grimmer (2005) postural control is developing in segments following the cephalocaudal trend, beginning with the establishment of control of the head, then the torso and eventually by achieving postural stability when standing.

i na kraju postizanje posturalne stabilnosti pri stajanju. Motorički i senzorni sistem koji je odgovoran za posturalnu stabilnost prolazi kroz tranziciju u uzrastu od 4-6 godina, a postiže zrelost odrasle osobe u uzrastu od 7-10 godina. Evolucija posture u sagitalnoj ravni između 4. i 12. godine smatra se posledicom normalnog muskuloskeletnog sazrevanja ili rezultatom procesa adaptacije u smislu održavanja ravnoteže u sagitalnoj ravni (Lafond et all, 2007).). Slabost antigravitacione muskulature je pojava koja je više zastupljena u ranom školskom uzrastu u odnosu na adolescentni. Postura je usko vezana za dužinu i balans mišića koji se pripajaju na kičmenom stubu i karlici. Istraživanja su potvrdila da je poremećaj statike i dinamike kičmenog stuba, uz promene na statici i dinamici stopala, najzastupljeniji poremećaj kod školske populacije (Milenković, Bogdanović 2008).

Cilj istraživanja je analiza nivoa snage pojednih mišićnih grupa, odnosno utvrđivanje razlika u varijablama : repititivna snaga trupa, eksplozivna snaga nogu i statička snaga ruku i ramenog pojasa kod dece narušene posture.

Metod rada

Transferzalno istraživanje je sprovedeno na uzorku od šezdeset i sedmoro dece sa već postojećom dijagnozom (kifotično loše držanje, lordotično loše držanje i ravna stopala). Ispitanici su bili učenici osnovne škole „Ivan Goran Kovačić“ i osnovne škole „Jovan Jovanović Zmaj“ uzrasta deset i jedanaest godina (±6 meseci), odnosno učenici četvrtih razreda iz Subotice. Za procenu motoričkih sposobnosti kod ispitanika sa kifotičnim, lordotičnim lošim držanjem i ravnim stopalima, mlađeg školskog uzrasta bili su korišćeni standardizovani motorički testovi prema standardizovanom modelu Bala, Stojanović (2007: izdržaj u zgibu (s); za procenu statičke snage ruku i ramenog pojasa; podizanje trupa za 60 s za procenu repetitivne snage mišića trupa (frek.); skok u dalj iz mesta (cm) za procenu eksplozivne snage nogu.

Za obradu podataka koristili su se statistički postupci: deskriptivna statistika, potom je bilo izvršeno testiranje postojanja statistički značajnih razlika između grupa ispitanika za sve analizirane varijable pomoću univarijatne (ANOVA) analize varijanse i LSD Post Hok testa (serije nezavisnih t- testova).

Rezultati

Istraživanjem je bilo obuhvaćeno ukupno 67 ispitanika sa područja opštine Subotice, od čega je merenjima bilo podvrgnuto 22 ispitanika. Grupna struktura uzorka prikazana je na grafikonu 1.

The motor and sensory systems, which are responsible for postural stability, go through a transition at the age of 4-6 years, reaching maturity of adult person between the ages of 7-10. Sagittal plane postural evolution between 4 and 12 years of age is considered a normal consequence of musculo-skeletal maturation or the result of the adaptation process in terms of maintaining balance in the sagittal plane (Lafond et al, 2007). The weakness of the antigravity muscles is a phenomenon that is more common in the early school age than in adolescents. Posture is closely related to the length and balance of muscles that connect to the spine and pelvis. Also, studies have confirmed that the disorders of statics and dynamics of the spinal column, together with the changes in statics and dynamics of feet are the most common disorder in school population (Milenković, Bogdanović 2008).

The aim of the research is to analyze the strength levels of certain muscle groups, and to determine differences in the variables: repetitive strength of torso, explosive leg strength and static strength of arms and shoulders in children with postural disorders.

Method of work

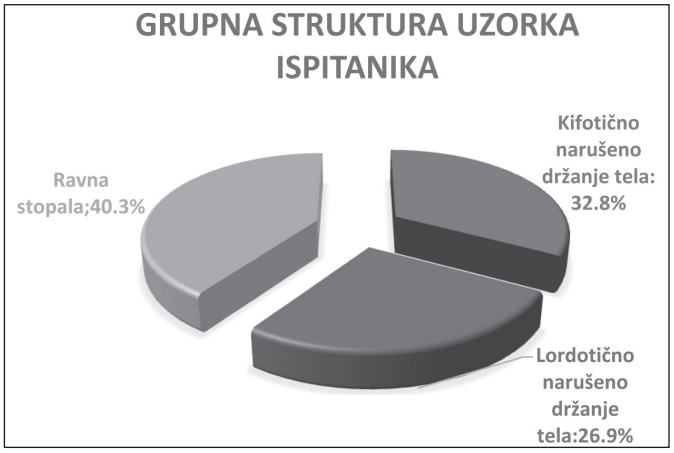
A transversal study was conducted on a sample of sixty-seven children with pre-existing diagnosis (postural kyphosis, postural lordosis and flat feet). The respondents were students of primary schools “Ivan Goran Kovačić” and “Jovan Jovanović Zmaj” of ages of ten and eleven (±6 months), i.e. fourth-grade students from Subotica. Standardized motor tests according to a standardized model by Bala, Stojanović (2007) were used for assessment of motor abilities in respondents of early school-age with kyphotic and lordotic postural disorder and flat feet. For assessment of excitation duration factors: *bent arm hang* (s), for assessment of static strength of arms and shoulders; *sit-ups in 60 s*, for assessment of repetitive strength of torso muscles (freq.) and for assessment of factors of regulation of excitation intensity; and *standing broad jump* (cm), for assessment of explosive strength of legs.

Statistical procedures used for processing of the obtained data were: descriptive statistics, then testing for the existence of statistically significant differences between groups of respondents for all variables analyzed using the univariate (ANOVA) variance analysis and LSD Post hoc test (series of independent t-tests).

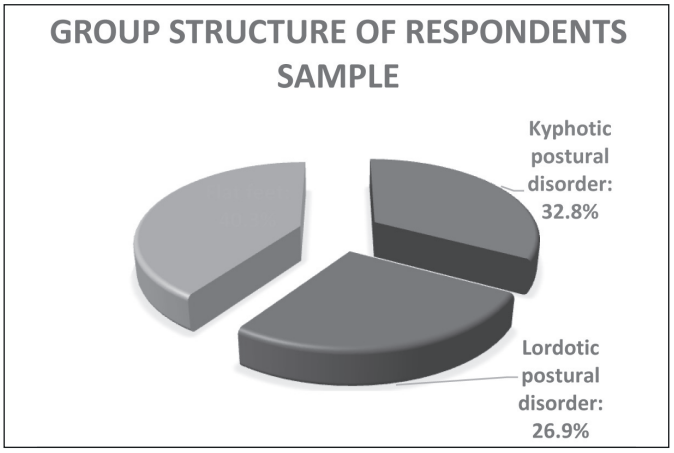
Results

The study involved a total of 67 respondents from the municipality of Subotica, of which 22 respondents were subjected to measurements. Group structure of the sample is shown in Graph 1.

Grafikon 1. *Grupna struktura ispitanika*



Graph 1 *Group structure of respondents*



Na osnovu deskriptivnih statistika u tabeli 1. može se zaključiti da su ispitanici na različitom nivou statičke snage ruku i ramenog pojasa, repetitivne snage trupa i eksplozivne snage nogu, posmatranih u okviru svojih grupa. Izuzetan varijabilitet rezultata, posledica je neujednačenosti razvoja navedenih vidova snage kod datog uzorka ispitanika i slabosti pojedinih mišićnih regija u neravnomernom odnosu kod svih ispitanika. Vrednosti minimalnih rezultata u varijabli za procenu hipotetskog motoričkog faktora trajanja ekscitacije *Izdržaj u zgibu* ukazuju na činjenicu da postoji velika neproporcionalnost između telesne mase i stanja generisanja mišićnih sila kod dece osnovnoškolskog uzrasta sa narušenim lošim držanjem. Dok pojedinci ostvaruju izuzetne rezultate (78,85 s zabeleženi kod grupe dece sa ravnim stopalima) drugi nisu u stanju da izvedu test (minimalni zabeležen rezultata u sve tri grupe je bio 0 s). Kao što se u tabeli 1. vidi, veliki su rasponi rezultata i u druge dve analizirane varijable, što je prouzrokovalo i povećan varijabilitet rezultata.

Based on descriptive statistics in Table 1 it can be concluded that the respondents are at different levels of static strength of arms and shoulders, repetitive strength of torso and explosive strength of legs, observed within their groups. Exceptional variability of the results is a consequence of imbalances in development of the above mentioned forms of strength within a given sample of respondents and weaknesses of individual muscle regions with uneven distribution in all respondents. The values of minimum results regarding variable for assessing the hypothetical motor factor of excitation duration *Bent arm hang* indicate that there is a great disproportion between body weight and the ability to generate muscular strength in children of primary school age with postural disorder. While individuals achieve outstanding results (78.85 s recorded in group of children with flat feet), others are not able to perform the test at all (minimum score recorded in all three groups was 0 s). As seen in Table 1, there are large ranges of results also in other two analyzed variables, causing the increased variability.

Tabela 1. *Rezultati deskriptivnih statistika motoričkih varijabli za ispitanike različitih grupa*

Table 1. *Results of descriptive statistics of motor variables for different groups of respondents*

Varijabla / *Variable*	Grupa / *Group*	AS / *Mean*	S / *SD*	MIN	MAX
Izdržaj u zgibu (s) / *Bent arm hang (s)*	K	14.70	10.20	0	32.10
	L	12.58	7.20	0	23.30
	RS	23.81	21.41	0	78.85
Podizanje trupa za 60 s (frek.) / *Sit-ups in 60 s (freq.)*	K	33.77	9.78	17	54
	L	19.67	5.30	8	31
	RS	35.70	10.97	15	58
Skok udalj iz mesta (cm) / *Standing broad jump (cm)*	K	167.32	19.49	108	200
	L	153.44	21.35	121	188
	RS	158.56	19.41	122	195

Legenda: *AS – aritmetička sredina; S – standardna devijacija; MIN – minimalni zabeleženi rezultat merenja; MAX – maksimalni zabeleženi rezultat merenja*

Legend: *SD – standard deviation; MIN – minimum recorded measurement result; MAX – maximum recorded measurement result*

Dobijene vrednosti F odnosa ukazuju na to da postoje statistički značajne razlike između ispitanika različitih subuzoraka u varijablama za procenu statičke snage ruku i ramenog pojasa *Izdržaj u zgibu* (p=0,03) i varijabli za procenu repetitivne snage trupa *Podizanje trupa za 60 s* (p=0,00). U varijabli za procenu eksplozivne snage nogu, *Skok u dalj iz mesta,* statistički značajne razlike nisu konstatovane (p=0,09).

The obtained values for F relationships suggest that there are statistically significant differences between respondents from different subsamples regarding variables for assessment of static strength of arms and shoulders *Bent arm hang* (p=0.03) and variable for assessment of repetitive strength of torso *Sit-ups in 60 s* (p=0.00). When it comes to variable for assessment of explosive strength of legs, *Standing broad jump*, statistically significant differences were not found (p=0.09).

Tabela 2. *Razlike između grupa ispitanika*

Table 2. *Differences between groups of respondents*

Varijabla / *Variable*	F	sig
Izdržaj u zgibu (0.1 s) / *Bent arm hang (0.1 s)*	3.58	**0.03**
Podizanje trupa za 60 s (frek.) / *Sit-ups in 60 s (freq.)*	17.51	**0.00**
Skok u dalj iz mesta (cm) / *Standing broad jump (cm)*	2.52	0.09

Legenda: F – F test; sig – nivo statističke značajnosti za F test

Legend: F – F test; sig – level of statistical significance for the F test

Da bi se dobio uvid između kojih grupa postoje statistički značajne razlike pribeglo se korišćenju t – testa za dve nezavisne grupe. U Tabeli 3. su predstavljene su vrednosti razlika aritmetičkih sredina pomoću nezavisnog t– testa primenom LSD Post Hock testa.

Dobijeni rezultati (tabela 4) ukazuju na to da se statistički značajna razlika manifestovala:

1. u varijabli *Izdržaj u zgibu*:
   a. između ispitanika sa kifotičnim lošim držanjem i ravnim stopalima (p=0,04) u korist ispitanika sa ravnim stopalima,
   b. između ispitanika sa lordotičnim lošim držanjem i ispitanika sa ravnim stopalima (p=0,02) u korist ispitanika sa ravnim stopalima;
2. u varijabli *Podizanje trupa za 60 s:*
   a. između ispitanika sa kifotičnim i lordotičnim lošim držanjem (p=0,00) u korist ispitanika sa kifotičnim lošim držanjem,
   b. između ispitanika sa lordotičnim lošim držanjem i ispitanika sa ravnim stopalima (p=0,00) u korist ispitanika sa ravnim stopalima;
3. u varijabli *Skok u dalj iz mesta:*
   a. između ispitanika sa kifotičnim i lordotičnim lošim držanjem (p=0,03) u korist ispitanika sa kifotičnim lošim držanjem.

In order to find out between which groups exactly statistically significant differences exist we used t – test for two independent groups. Table 3 presents the differences between the values of arithmetic means using independent t-test using the Post Hoc LSD test.

The obtained results (Table 4) indicate that a statistically significant difference was manifested:

1. in variable *Bent arm hang:*
   a. between respondents with postural kyphosis and flat feet (p=0.04) in favor of those with flat feet,
   b. between respondents with postural lordosis and respondents with flat feet (p=0.02) in favor of those with flat feet;
2. in variable *Sit-ups in 60 s:*
   a. between respondents with postural kyphosis and postural lordosis (p=0.00) in favor of those with postural kyphosis,
   b. between respondents with postural lordosis and respondents with flat feet (p=0.00) in favor of those with flat feet;
3. in variable *Standing broad jump:*
   a. between respondents with postural kyphosis and postural lordosis (p=0.03) in favor of those with postural kyphosis.

Tabela 3. *Serija t-testova (LSD) i razlike AS*

Table 3. *Series of t-tests (LSD) and differences in AMs*

Varijabla / *Variable*	**(I) Grupa / *(I) Group***	**(J) Grupa / *(J) Group***	**Razlika AS (I-J) / *Difference in AM (I-J)***	**sig**
Izdržaj u zgibu (s) / *Bent arm hang (s)*	K	L	2.12	0.67
		RS	-9.11	**0.04**
	L	K	-2.12	0.67
		RS	-11.22	**0.02**
	RS	K	9.11	**0.04**
		L	11.22	**0.02**
Podizanje trupa za 60s (frek.) / *Sit-ups in 60 s (freq.)*	K	L	14.11	**0.00**
		RS	-1.93	0.48
	L	K	-14.11	**0.00**
		RS	-16.04	**0.00**
	RS	K	1.93	0.48
		L	16.04	**0.00**
Skok u dalj iz mesta (cm) / *Standing broad jump (cm)*	K	L	13.87	**0.03**
		RS	8.76	0.13
	L	K	-13.87	**0.03**
		RS	-5.11	0.40
	RS	K	-8.76	0.13
		L	5.11	0.40

Legenda*:* *sig – nivo statističke značajnosti t testa*

Legend*:* *sig – level of statistical significance of t test*

Diskusija

Istraživanjem je utvrđeno postojanje statistički značajnih razlika u pogledu snage pojedinih mišićnih grupa ispitanika sa narušenim telesnim držanjima segmenata kičmenog stuba i stopala, što je potvrdilo i ranija istraživanja autora (Krsmanović, 1988; Ulić, 1997). Skraćenost grudne muskulature i izduženost mišića sa zadnje strane tela (mišića gornje trećine leđa) doprineli su lošijim rezultatima u varijabli *Izdržaj u zgibu* kod ispitanika sa kifiotičnim držanjem u odnosu na ispitanike sa ravnim stopalima, kao i između ispitanika sa lordotičnim lošim držanjem i ispitanika sa ravnim stopalima u korist ispitanika sa ravnim stopalima. Kod kifotičnog lošeg držanja u manjoj meri su zahvaćeni duboki mišići grudnog koša: spoljni i unutrašnji međurebarni mišići(*mm. intercostales externi et interni*); zatim poprečni grudni mišić (*m. transversus thoracis*) što je moglo da stvori razliku u korist ispitanika sa ravnim stopalima. Telesne promene na posturi takođe doprinose razlici u ispoljavanju snage, što potvrđuju istraživanja (McEvoy & Grimmer, 2005; Penha et all, 2005). Slaba muskulatura mišića leđa, pogotovo mišića gornje trećine leđa (površinskih i dubokih mišića), odgovorna je za slabe rezultate ove grupe ispitanika u varijabli za procenu statičke snage ruku i ramenog pojasa. Svi mišići u većoj ili manjoj meri mogu da budu oslabljeni kod dece sa kifotičnim lošim držanjem, i na

Discussion

The study found statistically significant differences regarding certain muscle groups of respondents with postural disorders of segments of the spinal column and feet, which also confirmed findings from previous research (Krsmanović 1988, Ulić 1997). Brevity of pectoral muscles and the elongation of the muscle on the back side of the body (muscles of the upper third of the back) have contributed to poor results regarding the variable *Bent arm hang* by kyphotic respondents compared to respondents with flat feet, as well as between respondents with postural lordosis and respondents with flat feet in favor of respondents with flat feet. In postural kyphosis deep muscles of the chest are affected to a lesser extent: external and internal intercostal muscles (*mm. intercostales externi et interni*); then transverse pectoral muscle (*m. transversus thoracis*) which might have created a difference in favor of those with flat feet. Physical changes in posture also contribute to the difference in the manifestation of strength, as evidenced by studies (McEvoy & Grimmer, 2005; Penha et al, 2005). Weak back muscles, especially the muscles of the upper third of the back (superficial and deep muscles), is responsible for the poor results of this group of respondents in variables for evaluation of static strength of arms and shoulders. All muscles to a greater or lesser extent can be weakened in children with postural kyphosis, and they

njih direktno treba uticati vežbama sa ciljem jačanja, dok se muskulatura grudnog koša mora permanentno istezati. Slabije stanje mišića leđa kod ispitanika sa lordotičnim lošem držanjem u odnosu na ispitanike sa ravnim stopalima je nastalo zbog protruzije trbušnog zida što potvrđuju i istraživanja Ishida & Kuwajima (2001) i Penha et all. (2005). Očito pored slabe muskulature trbuha, ovi ispitanici poseduju slabu i nerazvijenu muskulaturu leđa koja može da doprinese nastajanju kifo – skolioza koje su veoma česte, i nastaju kao posledica kompenzacije na kičmenom stubu kod dece sa lumbalnim lordozama. Evidentne statistički značajne razlike u varijabli za procenu repetitivne snage trupa *Podizanje trupa za 60 s* između analiziranih subuzoraka je posledica pre svega slabog stanja muskulature, pogotovo kod ispitanika sa lordotičnim narušenim držanjem, jer se pre svega misli na lumbalnu lordozu koju karakteriše mlitav i ispupčen trbuh, kao i slaba istegnutost mišića *m. iliopsoasa.* Slaba i istegnuta muskulatura prednjeg trbušnog zida je glavni problem kod ispitanika sa narušenim držanjem tela koji se odnosi na promene na kičmenom stubu. Slaba muskulatura, pre svega navedenih mišića ispitanika sa lordotičnim lošim držanjem je doprinela boljim i većim prosečnim rezultatima kod ispitanika sa kifotičnim lošim držanjem u varijabli za procenu eksplozivne snage nogu *Skok u dalj iz mesta.* Stanje mišića trbušnog zida moglo bi se uzeti kao izuzetno bitno za manifestaciju ove sposobnosti. Rezultati ovog dela rada potvrđuju dosadašnja istraživanja stranih autora koji ukazuju na slabost pojedinih mišićnih grupa kod ispitanika sa narušenim lošim držanjem, kao što su istraživanja Viole i Andrassy – a (1995) i Kratenove i sar. (2007).

Zaključak

Na osnovu postavljenog cilja i iznetih rezultata može se zaključiti da postoje statistički značajne razlike u manifestaciji snage kod ispitanika narušenog posturalnog statusa. Mišićna slabost, stepen skraćenosti elongiranosti određenih mišićnih grupa je osnovni razlog zbog kog su se te razlike i manifestovale. Upravo zbog navedenih činjenica se mora pristupiti izradi dugoročnog plana na polju telesnog vaspitanja i sporta koji uzima u obzir specifičnosti oslabljene muskulature kod određenih deformiteta. Istraživanje treba da bude smernica u daljem praćenju i istraživanju motoričkog prostora dece sa narušenim lošim držanjem. Zabrinjavajući podaci grupne strukture ispitanika ukazuju na to da se po pitanju prevencije narušene telesne posture i dalje jako malo deluje. Prisutnost posturalnih deformiteta kod dece je sve učestalija i definitivno tiho i sigurno uzima svoj danak ostav-

should be directly affected by exercise in order to strengthen, while the pectoral muscles have to be stretched constantly. The weaker back muscles in respondents with posture lordosis compared to those with flat feet result from the protrusion of the abdominal wall which is confirmed by research of Ishida & Kuwajima (2001), and Penha et al. (2005). Obviously, in addition to weak abdominal muscles, these respondents have poor and underdeveloped back muscles, which can contribute to emerging kyphoscoliosis, which is very common, and occur as a result of compensation at the spinal column in children with lumbar lordosis. Evident statistically significant differences in variable for assessing repetitive strength of torso *Sit-ups in 60 s* between the analyzed subsamples is a consequence of the poor condition of the muscles, especially in respondents with postural lordosis, primarily the lumbar lordosis characterized by flabby and bulging belly, and poorly stretched muscles *m. iliopsoas*. Weak and stretched muscles of the anterior abdominal wall are major problems in respondents with postural disorder relating to changes in the spinal column. Weak muscles of the body, especially above mentioned muscles of the respondents with the postural lordosis, have contributed to a better and higher average results in respondents with postural kyphosis regarding variable for the assessment of explosive strength of legs *Standing broad jump*. Condition of the abdominal muscles could be considered as extremely important for the manifestation of this ability. The results from this part of the research confirm previous studies by foreign authors that indicate the weakness of certain muscle groups in respondents with postural disorder, such as research by Viola & Andrassy – a (1995) and Kratenova et al. (2007).

Conclusion

On the basis of the set objective and presented results it can be concluded that there are statistically significant differences in the manifestation of strength in respondents with postural disorders. Muscle weakness and the degree of brevity of certain muscle groups is the main reason why these differences were manifested. Precisely because of these facts a long-term plan must be created in the field of physical education and sport that takes into account the specificities of the weakened muscles in certain deformities. The research should be a guideline in further monitoring and research of motoric space of the children with postural disorder. Disturbing data from the group structure of the respondents indicate that there are still only few works regarding the prevention of postural disorders. The presence of postural deformities in children is becoming more common and definitely quietly

ljajući " ožiljke" koji se kasnije jako teško mogu zaceliti. Porodica, zdravstvene institucije, sportski klubovi i škole moraju se više pozabaviti ovim problemom.

but surely take their toll leaving "scars" that are later very difficult to heal. Families, sports clubs and schools must be more engaged in addressing of this problem.

Literatura / References

Adar, B.Z. (2004). Risk Factors of Prolonged Sitting and Lack of Physical Activity in Relate to Postural Deformities, Muscles Tension and Backache Among Israeli Children. A clinical cross sectional research. *Doctoral Thesis*, Semmelweis University Budapest.

Bala, G. (2006). *Physical activity in girls and boys of preschool age (p. 67) (monography)*. Novi Sad: Faculty of Physical Education.

Bala, G., Stojanović, M. V., Stojanović, M. (2007). *Measuring and defining motor abilities in children.* Novi Sad: Faculty of Sport and Physical Education.

Bogdanović, Z. (2005). Influence of programmed training of corrective gymnastics on postural status of primary school students. *Doctoral thesis*. Niš

Demeši, Č. (2007). Anti-gravity muscles in postural status of children aged 7 and 13. *Master's thesis*. Novi Sad: Faculty of Medicine, Novi Sad.

Ishida, A. & Kuwajima, S.S. (2001). Desenvolvimento Postural Dos Membros inferiores na crianca. Exame fisico em Ortopedia. *Editora Sarvier*. 301-2088.

Krsmanović, B. (1982). The corelation between antropometric and motoric variables in pupils of elementary Novi Sad: Faculty of Physical Education

Kratenova, J., Žejlicova, K., Maly, M. & Filipova, V. (2007). Prevalence and Risk Factors of Poor Posture in School Children in the Czech Republic. *Journal of School Health*, 77(3):131-137.

Milenković, S. (2000). Determining differences in the postural antropometric and motoric dimension in third graders at the beginning and the end of the year. *Physical Education and Sport*, 1(7), 39-48.

Lafond, D., Descarreaux, M., Normand, M.C. & Harrison, D.E. (2007). Postural development in school children: a cross-sectional study. *Chiropra Osteopat*, 4:15-21.

McEvoy, M.P. & Grimmer, K. (2005). Reliability of upright posture measurements in primary school children. *BMC Musculoscelet Disord*, 29:6-35.

Nićin, Đ. (2008). *Antropomotorika.* Belgrade: Faculty of Sport Management.

Palastanga, N., Field, D. & Soames, R. (2000). *Anatomia e Movimento Humano: Estrutura e Funcao. 3 ed.* Sao Paolo: Editora Manole.

Penha, P.J., Joao, S.M., Casarotto, R.A., Amino, C.J. & Penteado, D.C. (2005). Postural assessment of girls between 7 and 10 years of age. *Clinics*, 60 (1).

Perić, D. (2011*). Introduction to sports anthropomotorics.* Belgrade: DTA Belgrade

Sabo,E. (2008). *The shape of legs and feet posture in preschool children from Novi Sad.* Novi Sad: Pedagogical reality.

Ulić, D. (1997). *Osnove kineziterapije* (str. 89). Novi Sad: Faculty of Physical Education.

Viola, S., Andrassy, I. (1995). Spinal mobility and posture: changes during growth with postural defects, structural scoliosis and spinal osteochondrosis.*European Spine Journal, 4 (1)*, 29-33.

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Short notice

Rezultatska uspješnost ronjenja na dah (apnea) u zavisnosti od uslova sredine

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Sažetak: Istraživanje je provedeno na uzorku od 21. ispitanika - studenta Fakulteta fizičkog vaspitanja i sporta Univerziteta u Istočnom Sarajevu, upisanih u III godinu studija školske 2010/2011, muškog pola, starosti 23 godine ± 6 mjeseci. Slučajnim izborom podijeljeni u dvije grupe za vrijeme izvođenja nastave aktivnosti u prirodi u studentskom kampu na Tjentištu. Osnovni cilj istraživanja je da se utvrdi rezultatska uspješnost ronjenja apneom (u dužinu) u zavisnosti od prirodnih uslova sredine (temperatura vode i vazduha).
Uzorak varijabli predstavljali su: dužina ronjenja na dah (apneom) izražena u metrima, temperatura vode izražena u stepenima (º C) i temperatura vazduha izražena u stepenima (º C).
Testiranje svih ispitanika izvršeno je u dva vremenska termina, pri različitim temperaturama vode u bazenu koja je varirala od 17 do 22º C i vazduha koja je varirala od 22 do 26º C.
Za utvrđivanje rezultatske uspješnostu u ronjenju apneom u dužinu u zavisnosti od temperature vode u bazenu i temperature vazduha, izvršena je komparacija rezultata osnovnih centralnih i disperzionih parametara i analize rezultata t-testa.
Analizom dobijenih rezultata, može se zaključiti da temperatura vode u bazenu i temperatura vazduha imaju značajan uticaj na dužinu ronjenja apneom i to tako što je povećanje temperature vode u bazenu za 3 do 5ºC i temperature vazduha za 2 do 4º C doprinijelo postizanju boljih rezultata u ronjenju apneom (u dužinu).
Ključne riječi: ronjenje, apnea, ispitanici,temperatura, t-test.

Uvod

Ronjenje na dah (apnea) u dužinu je ronilačka disciplina kojom se ljudi bave od davnina. Izvodi se sa privremenim zaustavljanjem spoljašnjeg disanja (apnea), kojoj prethodi duboki udah vazduha. U ovoj disciplini ronilac pokušava sa jednim udahom preplivati što veću udaljenost u horizontalnom položaju ispod površine

Resultative Success of Breath-Hold Diving (Apnea) Depending From Environment Conditions

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Summary: The research was conducted on the specimen of 21 examinees - students Physical education and sport Faculty Istocno Sarajevo University, enrolled in the IIIrd year of school year 2010/2011, males, age of 23=6 months. By random choice they were divided into two groups during lessons in nature within student camp Tjentiste based. The basic aim of the research is to establish the resultative success of diving by apnea(long distance) depending of natural conditions of the environment(air and water temperature). The specimen of variables represented: length of breath –hold diving (apnea) expressed in metres, water temperature expressed in degress(°C) and air temperature expressed in degrees(°C).
Testing of all examinees were carried out at two time intervals, and at different temperatures of water in pool varying from 17 to 22°C and air temperature varying from 22 to 26°C.
For establishing the resultative success in diving by apnea in length depending from temperature of pool water and air temperature, the comparisson was made of results of basic central and dispersion parameters and analyses of t-test results.
Through analyses of the obtained results, it can be concluded that pool water temperature and air temperature have significant impact on the apnea diving in length in such a way that the increase of pool water temperature for 3 to 5 °C and air temperature for 2 to 4°C contributed achieving better results in apnea diving in length.
Key words: diving, apnea, examinees,temperature, t-test.

Introduction

Breath – hold diving (apnea) in length is diving discipline people are dealing with since long ago. It is performed with temporary holding of external breathing(apnea), being preceeded by deep inhale of air. In this discipline diver attempts to swim with one breath the longest distance possible in horisontal position below

vode. Takmičenja se održavaju u bazenima, koji ne smiju biti manji od 25m. U realizaciji ove discipline najvažniju ulogu ima tehnika i fizička pripremljenost ronioca, jer se takmičar ne smije koristiti nikakvim pomagalima. Mogu se koristiti odijelo i tegovi koji se ne smiju odbacivati za vrijeme izvođenja discipline.

Zbog bezbjedenosti takmičara postoji fizičko obezbjeđenje ronilac-asistent, koji prati takmičara i ako primijeti bilo kakve poremećaje kod ronioca, odmah ga vadi iz vode.

Dakle, apnea u sportu podrazumijeva zadržavanje daha (nedisanje) i ronjenje u inspiratornoj apneji, čija dužina i dubina zavise od mnogo faktora: doba, pola, vitalnog kapaciteta, treninga, zamora, motivisanosti, straha, ambijentalnog pritiska i temperature okoline.

U početnim fazama razvoja ove discipline, ljudi koji su se bavili ovom aktivnosti smatrani su prirodnim fenomenima. Međutim, u posljednje vrijeme ova disciplina se snažno razvija, tako da su počela i ozbiljnija naučna istraživanja koja objašnjavaju sposobnosti ljudi da se pod vodom zadrže po nekoliko minuta i zaranjaju na dubine i do 200 metara.

Ronjenje na dah u dužinu sastoji se iz četiri faze, faza hiperventilacije, faza starta, faza podvodnog plivanja i faza finiša.

Faza hiperventilacije se provodi neposredno pred početak i ispred startne linije na sljedeći način: ronilac se sasvim opusti, olabavi sve mišiće tijela i napravi pet do deset dubokih udaha i izdaha. Broj udaha i izdaha zavisi od individualnih osobina i fizičke pripremljenosti svakog pojedinca. Ronilac mora da prestane s hipreventilacijom čim osjeti laganu vrtoglavicu, jer bi u suprotnom nastupila hipokapnija (pad u nesvjesno stanje zbog naglog pada parcijalnog pritiska CO2 u arterijskoj krvi).

Po završetku hiperventilacije, ronilac rukom daje znak sudijama da je spreman za start i odmah startuje (s mjesta ili iz pokreta). Kod starta u pokretu ronilac po završenoj hiperventilaciji zaroni pet do sedam metara ispred linije starta i to na sledeći način: napravi zadnji duboki udah, lijevu ruku ispruža naprijed po površini vode, glavu naglo pokreće na dole, tijelo se povija u pojasu i ronilac zaronjava. U fazi vraćanja desne ruke u ispruženi položaj, tijelo je već u vodi tako da odmah tpočinje s radom peraja i to stilom «delfin» što će ronioca odmah dovesti na potrebnu dubinu. Po zaronjavanju, ronilac prelazi na rad nogama tehnikom «kraul», trudeći se da ne gubi vrijeme i potisak kod prelaza s jednog stila na drugi. Startovanjem na ovakav način ronilac će kroz startnu liniju preći punom brzinom.

Brzina podvodnog plivanja zavisi od položaja tijela,

water surface. Competitons are held in swimming pools, that mustn't be smaller than 25m. In realisation of this discipline the most importan role has technique along with physical fitness of diver, because the competitior may not use any tools. A suit and weights can be used and they mustn't be disposed during the performance of the discipline. For the sake of competitor's safety there is physical security diver-assistant who monitors a competitior and in case of noticing any disturbances with a diver, he imediately pulls him out of water.

So, apnea in sport implies holding breath (non breathing) and diving in inspiratory apnea, the length of which and depth depend of many factors: age, gender, vital capacity, training, exhaustion, motivation, fear, ambiental pressure and environment temperature.

In initial developing phases of the discipline, people doing this activity were considered as natural phenomena. However, recently this discipline has strongly been developing, so that some serious scientific researches have started, explaining the capacity of people to hold under water for several minutes, diving on depths up to 200 metres.

Apnea diving on length consists of four phases, phase of hyperventilation, start phase, underwater swimming phase and finish phase.

Hyperventilation phase is conducted just before the beginning and in front of start line in the following way: a diver relaxes totally, relaxing all muscles and makes five to tendeep inhales and exhales. The number of inhales and exhales depends from individual features and physical fitness of each individual. The diver has to stop with hyperventilation as soon as he feels light dizziness, for in contrary, hypocapnia would occur (falling into uncosciencious state due to uprupt fall of partial pressure CO_2 in arterial blood). Upon completion of hyperventilation, a diver gives sign by hand to judges that he is ready for start and starts imediately. (from standing or moving). At starting from moving the diver dives five to seven times upon finished hyperventilation in front of starting line in the following way: making the last deep inhale, streching left arm on water surface, with head ubruptly pushed downwards, body bent in waist and diver dives. In returning of right arm into streched position, body is already in water, therefore he instantly begins with fins working with „dolphin" style which will bring the diver to necessary depth. After diving in, the diver starts with legs work „crawl" technique trying not to lose time and push at transfering from one style to another. By starting on such a way, the diver shall cross the start line with full speed. The speed of underwater swimming depends of body position, amplitude

amplitude i frekvencije rada nogu, forme i elastičnosti peraja, a u bazenima i od dubine na kojoj se pliva. Najbolji rezultati se postižu kada se pliva na dubini 1 do 1, 5 m. Ako je ronilac na manjoj dubini postoji opasnost da perajama ili dijelom tijela izroni na površinu i pokvari rezultat. Drugi nedostatak plitkog plivanja je što se javlja površinski kontra tok vode koji usporava kretanje ronioca. Povratno strujanje vode formira se i pri dnu bazena, pa će kontra strujanje vode usporavati njegovo kretanje.

Finiš treba da bude na dva do tri metra pred linijom cilja, kada ronilac pravi jak zaveslaj jednom rukom povlačeći je do kuka, dok druga ruka ostaje ispružena u očekivanju udara u liniju cilja ili ivicu bazena. Efekat finiša može se umanjiti ako ronilac podigne glavu da bi osmotrio liniju cilja.

Za vrijeme podvodnog plivanja, od starta do prolaska kroz cilj, ronilac treba da drži glavu između ispruženih ruku s pogledom okrenutim prema dnu bazena.

Istraživanja koja se bave proučavanjem problematike ronjenja na našim prostorima nema ili bar autorima takva istraživanja nisu poznata, te su i parcijalna istraživanja problematike ronjenja značajna za dobijanje validnih informacija o ronjenju.

Metod istraživanja

Uzorak ispitanika

Populacija iz koje je ekstrahovan uzorak ispitanika predstavlja 21 student Fakulteta fizičkog vaspitanja i sporta Univerziteta u Istočnom Sarajevu, muškog pola, starosti 23 godine ± 6 mjeseci.

Uzorak varijabli

Uzorak varijabli odabran je tako da reprezentativno pokrije istraživano područje i pruži informaciju o uticaju uslova prirodne sredine na varijable ronjenja apneom u dužinu.

1. Dužina ronjenja na dah (apneom).....ADAJ
2. Temperatura vode .....TVOD
3. Temperatura vazduha.....TVAZ

Procedure mjerenja

Testiranje je izvršeno na bazenu studentskog kampa "Tjentište" na Tjentištu. Pored bazena je razvučena metalna pantljika sa koje se očitava dužina preronjene dionice sa tačnošću očit avanja od 0,1 m. Ispitanik stoji na ivici bazena i na znak mjerioca vremena (ispitivača) sunožnim odrazom ulazi u vodu i započinje ronjenje uz pomoć rada ruku i nogu. Mjerena je dužina preronjene dionice izražena u metrima.

and frequency of legs' work, form and elasticity of fins, and in swimming pools from depth on which swimming is done. The best results are being achieved when swimming on 1 to 1,5 m. depth. If the diver is on smaller depth, there is a risk to dive out on the surface with fins or a body part spoiling the result doing so. Another disadvantage of shallow swimming is appearance of surface counter water flow which slows down the diver's movement. Returning water flow has been formed at the pool's bottom, leading to slowing down of his movement by counter water flow. Finish should be two to three meters before starting line, when the diver makes strong stroke hand pulling it to hip, while the other hand remains streched expecting hit in start line or pool's edge. The effect of finish may be reduced if the diver raises his head in order to observe the start line. During underwater swimming, from a start to passing trhough finish line, the diver should keep his head between stretched arms with view turned to the pool's bottom.

There are no the researches dealing with research of diving issues in our area or at least they are not known to authors, therefore, partial researches of the diving issue are significant for obtaining valid information on diving.

Research method

The specimen of examinees

Population out of which the specimen of examinees was extracted is represented by 21 student Physical education and sport Faculty of Istocno Sarajevo University, males, age 23=6months.

The specimen of variables

The specimen of variables was selected so to representatively cover the researched field and provides information on the impact of environment conditions to variables of apnea diving in length.

1. The length of apnea diving.....ADAJ
2. Water temperature .....TVOD
3. Air temperature.....TVAZ

Measuring procedures

Testing was carried out on the pool of student camp „Tjentiste" in Tjentiste. By the pool the metal ribbon was spread which reads the length of dived line with punctuality of reading of 0,1 m. The examinee stands on the edge of pool and on sign of time measurer (examiner) with pedal reflection enters water starting diving by help of arm and leg working. The length of dived line was measured expressed in meters.

Prvo testiranje ispitanika prve grupe izvedeno je pri temperaturi vode od 17º C i temperaturi vazduha od 20º C, a drugo testiranje je izvedeno pri temperaturi vode od 18º C i temperaturi vazduha od 22º C.

Prvo testiranje ispitanika druge grupe izvedeno je kada je temperatura vode bila 20º C i temperatura vazduha 22º C, a drugo testiranje je izvedeno kada je temperatura vode iznosila 22º C, a temperatura vazduha 26º C.

Statistička obrada podataka

Za sve primijenjene varijable izračunati su osnovni centralni i disperzioni parametri:

- Aritmetička sredina.....(Mean),
- Minimalni rezultat mjerenja.....(Min),
- Maksimalni rezultat mjerenja.....(Max),
- Standardna devijacija.....(Std. Dev).

Za utvrđivanje statističke značajnosti razlika prvog u odnosu na drugo mjerenje na malim zavisnim uzorcima primijenjena je analiza rezultata t – testa.

Rezultati istraživanja i diskusija

Rezultati istraživanja obrađeni su na način da se dobiju informacije o centralnim i disperzionim parametrima za sve manifestne varijable i to: srednja vrijednost, minimalni i maksimalni (numerički) rezultat, standardna devijacija.

Tabela 1. Osnovni centralni i disperzioni parametri primijenjenih varijabli na prvom i drugom mjerenju kod prve grupe ispitanika - studenata

The first testing of the first group was done at water temperature of 17°C and air temperature of 20°C, and second testing was made at water temperature of 18°C and air temperatureof 22°C.

The first testing of the second group examinees was performed when water temperature was 20°C and air temperature 22°C, and the second testing was done at water temperature of 20°C and air temperature 26°C.

Statistical data processing

For all applied variables the basic central and dispersion parameters were calculated. For all applied variables the basic central and dispersion parameters were calculated:

- Arithmetic mean.....(Mean),
- Minmal result of measuring.....(Min),
- Maximum measuring result.....(Max),
- Standard deviation.....(Std. Dev).

For establishing of statistical significance of differences between first and second measuring on small dependable specimen analyses of results of t-test was applied.

Results of research and discussion

Results of research were processed in a way to get information on the central dispersion parameters for all manifesting variables, that is: middle value, minimum and maximum (numeric) result, standard deviation.

Table 1. Basic central and dispersion parameters of the applied variables at first and second measuring with the first group of examinees- students

	Valid N	Mean	Min	Max	Std. Dev
ADAJI	16	12.03	9.00	37.50	6.92
ADAJF	16	14.16	9.80	39.50	7.25
TVODI	16	17.00	17.00	17.00	0.00
TVODF	16	18.00	18.00	18.00	0.00
TVAZI	16	20.00	20.00	20.00	0.00
TVAZF	16	22.00	22.00	22.00	0.00

U tabeli 1 prikazani su osnovni centralni i disperzioni parametri primijenjenih varijabli na prvom i drugom mjerenju kod prve grupe ispitanika – studenata. Analizom rezultata prikazanih u tabeli 1 može se vidjeti sljedeće:

Na prvom mjerenju pri temperaturi vode od 17 º C i vazduha 20º C vrijednosti parametara su sledeći: srednja vrijednost (Mean=12.03), najslabiji rezultat (Min=9.00), a najbolji (Max=37,50), standardnu devijaciju (Std. Dev = 6.92).

In table 1 the basic central and dispersion parameters of applied variables at the first and second measuring with the first group of examinees - students are shown. Through analyses of results presented within table 1 the following can be seen:

On the first measuring at water temperature of 17°C air of 20°C parameters' values were the following: middle value (Mean=12.03), the weakest result (Min=9.00), and the best (Max=37,50), standard deviation(Std. Dev = 6.92).

Na drugom mjerenju iste grupe ispitanika pri temperaturi vode od 18º C i temperaturi vazduha od 22º C dobijene su sljedeće vrijednosti parametara: srednja vrijednost (Mean=14.16), najslabiji rezultat (Min=9.80), a najbolji (Max=39,50), standardna devijacija (Std. Dev = 7.25).

Komparacijom vrijednosti aritmetičkih sredina dobijenih u prvom i drugom mjerenju može se uočiti da su ispitanici prve grupe postigli bolje prosječne rezultate u drugom mjerenju kada su temperature vode i vazduha bile nešto veće (temperatura vode bila je veća za 1º C, a temperatura vazduha bila je veća za 2º C). Takođe, komparacijom vrijednosti minimalnih i maksimalnih rezultata postignutih u prvom i drugom mjerenju, može se uočiti da su njihove vrijednosti u drugom mjerenju veće u odnosu na prvo mjerenje, što ukazuje na činjenicu da su ispitanici postizali bolje rezultate pri većim vrijednostima temperature vode i vazduha. Vrijednosti standardne devijacije, kao mjere koja pokazuje realnu mjeru odstupanja pojedinih vrijednosti serije od aritmetičke sredine su veće u drugom mjerenju, što ukazuje na činjenicu da je prva grupa ispitanika postala heterogenija u drugom mjerenju, pa se može pretpostaviti da je temperatura vode i temperatura vazduha značajno uticali na dužinu ronjenja apneom.

On the seond measuring of the same group of examinees at water temperature of 18°C and air temperature of 22°C the following parameters values have been obtained: middle value (Mean=14.16), the weakest result (Min=9.80), and the best (Max=39,50), standard deviation (Std. Dev = 7.25).

Through comparisson of arithmetic means obtained in the first and second measuring it may be noticed that the examinees of the first group achieved better average results in the second measuring when temperature of water and air were higher (water temperature was higher for 1°C, while air temperature was higher for 2°C.) Likewise,through comparisson of minima and maximum results achieved in the first and second measuring, it is obvious that their values in the second measuring are higher as compared to the first measuring, which implies that the examinees achieved better results at higher values of water and air temperature. The value of standard deviation, as the measure showing the real measure of deviation of individual values of series from arithmetic mean are higher in the second measuring, which indicates to the fact that the first group of examinees became more heterogeneous in the second measuring, which leads to presumption that water and air temperature had significant influence on the length of apnea diving.

Tabela 2. Osnovni centralni i disperzioni parametri primijenjenih varijabli na prvom i drugom mjerenju druge grupe ispitanika - studenata

Table 2. The basic central and dispersion parameters of applied variables on the first and second measuring of the second group of examinees- students

	Valid N	Mean	Min	Max	Std. Dev
ADAJI	5	11.90	9.10	17.30	3.42
ADAJF	5	15.82	9.70	25.20	5.63
TVODI	5	20.00	20.00	20.00	0.00
TVODF	5	22.00	22.00	22.00	0.00
TVAZI	5	22.00	22.00	22.00	0.00
TVAZF	5	26.00	26.00	26.00	0.00

U tabeli 2 prikazani su osnovni centralni i disperzioni parametri primijenjenih varijabli na prvom i drugom mjerenju kod ispitanika druge grupe. Uvidom u tabelu 2, u kojoj su prikazani centralni i disperzioni parametri ronjenja apneom kod druge grupe ispitanika - studenata na prvom mjerenju pri temperaturi vode od 20º C i temperaturi vazduha od 22º C vrijednosti parametara su sljedeći: srednja vrijednost: (Mean=11.90), najslabiji rezultat (Min=9.10), a najbolji (Max=17,30), standardnu devijaciju (Std. Dev=3.42). Na drugom mjerenju druge grupe ispitanika pri temperaturi vode od 22º C i temperaturi vazduha od 26º C dobijene su sljedeće vrijednosti

In table 2 the basic central and dispersion parameters of the applied variables on the first and second measuring with second group examinees. Through the insight in table which shows the central and dispersion parameters of apnea diving with the second group of examinees – students on the first measuring at water temperature of 20°C and air temperature of 22°C the parameter values are the following: middle value: (Mean=11.90), the weakest result (Min=9.10), and the best (Max=17,30), standard deviation (Std. Dev=3.42). On the second measuring of the second group of examinees at water temperature of 22°C and air temperature of 26°C the following

parametara: srednja vrijednost: (Mean=15.82), najslabiji rezultat (Min=9.70), a najbolji (Max=25.20), standardnu devijaciju (Std. Dev=5.63).

Komparacijom rezultata dobijenih u prvom i drugom mjerenju može se uočiti da su ispitanici druge grupe postigli znatno bolje rezultate ronjenjem apneom na dužinu u drugom mjerenju kada je temperatura vode bila veća za dva stepena C, a temperatura vazduha za četiri stepena C, što se vidi iz vrijednosti aritmetičkih sredina prvog i drugog mjerenja. Ovakvi rezultati doprinijeli su i heterogenizaciji ispitanika druge grupe u drugom mjerenju, jer je vrijednost standardne devijacije u drugom mjerenju veća u odnosu na njenu vrijednost u prvom mjerenju.

Tabela 3. *Analiza rezultati t-testa ronjenja na apneu u dužinu kod prve grupe ispitanika - studenata*

	Mean	Std.Dv	N	Diff.	Std. Dv	t	df	p
ADAI	12.03	6.92						
ADAF	14.16	7.25	16	-2.13	1.87	-4.5	15	0.00

Analizom tabele 3 u kojoj su prikazani rezultati t-testa kojim se porede statističke serije i to na malim zavisnim uzorcima može se vidjeti da su rezultati aritmetičkih sredina (Mean) u drugom mjerenju bolji od rezultata u prvom mjerenju, kod ronjenja apneom kod prve grupe ispitanika – studenata. Na osnovu prikazanih rezultata aritmetičkih sredina (Mean) na prvom i na drugom mjerenju kao i na osnovu značajnosti promjena (p) testiranih (T-testom) može se uočiti da je povećanje temperature vode u bazenu za jedan stepen i temperature vazduha za dva stepena proizvelo parcijalne promjene kod varijable ronjenje na dah u daljinu, a vrijednosti t-testa bile su značajne na nivou p = 0,00.

Može se konstatovati da se rezultati prvog i drugog mjerenja kod prve grupe ispitanika statistički značajno razlikuju, a da je razlika nastala kao posljedica uticaja povećanih vrijednosti temperatura prirodne sredine.

Tabela 4. *Analiza rezultata t-testa ronjenja na apneu u dužinu kod druge druge ispitanika - studenata*

	Mean	Std.Dv	N	Diff.	Std. Dv	t	df	p
ADAI	11.90	3.42						
ADAF	15.82	5.68	5	-3.92	3.14	-2.78	15	0.04

Analizom tabele 4 u kojoj su prikazani rezultati t-testa kojim se porede statističke serije i to na malim zavisnim uzorcima može se vidjeti da su rezultati aritmetič-

parameter values have been obtained: (Mean=15.82), the weakest result (Min=9.70), and the best (Max=25.20), standard deviation (Std. Dev=5.63).

Through comparisson of the results obtained in the first and second measuring it may be obvious that the examinees of the second group achieved quite better results in apnea diving in length in the second measuring when the water temperature was higher for two degrees C, and air temperature for four degrees C higher, which can be seen from values of arithmetic means of the first and second measuring. Such results contributed heterogenization of the second group examinees in the second measuring, since the values of standard deviation in the second measuring is higher compared to its value in the first one.

Table 3. *Analysis of t-test results of apnea diving in length ronjenja at the first group of examinees -students*

By analysis of table 3 where t-test results are shown comparing static series on small dependable specimen it is obvious that results of arithmetic means (Mean) in the second measuring are better than the first measuring results, at apnea diving of the first examined group – students. On the base of the presented results of arithmetic means (Mean) on the first and second measuring and on the bas of significant changes (p) of tested (with T-test) it can be noticed that the water temperature increase for one degree and air temperature for two degrees resulted in partial changes at variable of breath-hold diving in length , and t-test values were important at level p=0,00.

It may be said that the results of the first and second measuring at the first examined group quite differ statistically, and the differene derives as a consequence of influences of increased natural environment temperature values.

Table 4. *The analysis of t-test results in apnea diving in length with the second group of examinees - students*

Through analysis of table 4 where t-test results are shown comparing statistical series on small dependable specimen it can be noticed that the results of arithmetic

kih sredina (Mean) u drugom mjerenju bolji od rezultata u prvom mjerenju, kod ronjenja apneom i kod druge grupe ispitanika – studenata. Na osnovu prikazanih rezultata aritmetičkih sredina (Mean) na prvom i na drugom mjerenju kao i na osnovu značajnosti promjena (p) testiranih (T-testom) može se uočiti da je povećanje temperature vode u bazenu za dva stepena i temperature vazduha za četiri stepena proizvelo parcijalne promjene kod varijable ronjenje na dah u daljinu, a vrijednosti t-testa bile su značajne na nivou p = 0,04.

Može se konstatovati da se rezultati prvog i drugog mjerenja statistički značajno razlikuju i kod druge grupe ispitanika, a da je razlika nastala kao posljedica različitih temperatura vode u bazenu i temperature vazduha (veće temperature) u kojima je izvedeno prvo, odnosno drugo mjerenje.

Na osnovu dobijenih rezultata može se zaključiti da temperatura vode u bazenu i temperatura vazduha imaju značajan uticaj na dužinu ronjenja apneom i to tako što je povećanje temperature vode u bazenu za 3 do 5ºC i temperature vazduha za 2 do 4º C doprinijelo postizanju boljih rezultata u ronjenju apneom na dalj.

Zaključak

Istraživanje je izvedeno na uzorku od 21 ispitanika - studenta Fakulteta fizičkog vaspitanja i sporta Univerziteta u Istočnom Sarajevu, upisanih u III godinu studija školske 2010/2011, muškog pola, starosti 23 godine ± 6 mjeseci, koji su slučajnim izborom podijeljeni u dvije grupe za vrijemme izvođenja nastave aktivnosti u prirodi u studentskom kampu „ Tjentište“ na Tjentištu. Uzorak varijabli predstavljali su: dužina ronjenja na dah izražena u metrima (apneom), temperatura vode izražena u stepenima (º C) i temperatura vazduha izražena u stepenima (º C).

Testiranje ispitanika obe grupe izvedeno je u dva vremenska termina, kada se temperature vode u bazenu kretala od 17 do 22º C, a temperatura vazduha od 22 do 26º C.

Prvo testiranje ispitanika prve grupe izvedeno je pri temperaturi vode u bazenu od 17º C i temperaturi vazduha od 20º C, a drugo testiranje je izvedeno pri temperaturi vode u bazenu od 18º C i temperaturi vazduha od 22º C.

Prvo testiranje ispitanika druge grupe izvedeno je kada je temperatura vode u bazenu bila 20º C, a temperatura vazduha 22º C, a drugo testiranje je izvedeno kada je temperatura vode u bazenu iznosila 22º C, a temperatura vazduha 26º C.

Osnovni cilj istraživanja bio je da se utvrdi rezultatska uspješnost u ronjenju na dah apneom u dužinu u

means (Mean) in the second measuring are better than those in the first one, with apnea diving and with the second examined group -students. On the base of the presented results of the arithmetic means (Mean) on the first and second measuring along with the significance of changes (p) of tested (by T-test) it can be noticed the increase of water temperature in pool for two degrees and air temperature for four degrees resulted in partial changes at variable of breath – hold diving in length, while t-test values were important on the level p=0,04.

It may be said that the results of the first and second measuring quite differ statistically with the second examined group too, and the difference derives as a consequence of different temperatures of pool water and air temperature (higher temperatures) at which the first and then the second measuring was done.

On the base of the obtained results it can be concluded that the pool water temperature and air temperature had significant influence on the length of apnea diving in such a way that the increase of pool water for 3 to 5°C and air temperature for 2 to 4°C contributed better results achievement in apnea diving in length.

Conclusion

The research was carried out on the specimen of 21 examinees – students of Faculty of physical education and sport, Istocno Sarajevo University, enrolled in IIIrd year of studies of school year 2010/2011, males, age 23 =6 months, who by random choice were divided into two groups during the lessons in nature within the student camp „Tjentiste“ in Tjentiste.

The specimen of variables was represented by: the length of breath-hold diving expressed in metres (by apnea), water temperature expressed in degrees (°C) and air temperature expressed in degrees (°C). Testing of both groups of examinees was done in two time intervals, when the pool water temperature was from 17 to 22°C and air temperature was from 22 to 26°C. The first testing of the first examined group was performed at pool water temperature of 17°and air temperature of 20°C, and the second testing was done at pool water temperature of 18°C and air temperature of 22°C

The first testing of the second group of examinees was conducted when pool water temperature was 20°C and air temperature 22°C, and the second testing was done when pool water temperature was 22°C and air temperature 26°C. The basic aim of the research was to establish the resultative success in breath-hold diving by apnea in length depending of water temperature and air temperature (natural conditions of environment).

zavisnosti od temperature vode i temperature vazduha (prirodnih uslova sredine).

Izvršena je komparacija rezultata osnovnih centralnih i disperzionih parametara i analize rezultata t-testa. Analizom rezultata osnovnih centralnih i disperzionih parametara i rezultata t-testa, može se zaključiti da temperatura vode u bazenu i temperatura vazduha imaju značajan uticaj na dužinu ronjenja apneom i to tako što je povećanje temperature vode u bazenu za 3 do 5ºC i temperature vazduha za 2 do 4º C doprinijelo postizanju boljih rezultata u ronjenju apneom na dalj.

The comparisson of results have been made between basic central and dispersion parameters and analysis of t-test results.

Through analysis of the basic central and dispersion parameters results and t-test results it can be concluded that the pool water temperature and t-test results have significant influence on the length of apnea diving in such a way that the pool water temperature increase for 3 to 5°C and air temperaturefor 2 to 4°C has contributed better achievement of results in apnea diving in length.

Literatura / References

Bala, G. (2002). Some problems and suggestions in measuring motor behavior of preschool children. *Kinesiologika Slovenica*, 5, 1-2:5-10.

Bala, G., A. Hošek., & Momirović, K. (2002). Aberantno ponašanje i motoričke sposobnosti predškolske djece. (Aberrant behaviour and motor abilities of preschool children) (Topics) Teme, 2002, 3:371-382.

Geiß, H. C., Parhofer, K. G., & Schwandt, P. (2001). Parameters of childhood obesity and ther relationship to cardiovascular risik factors in heathy prepubescent children. *International Journal of Obesity*, 25, 830-7.

Counsilman, J. E. (1978). *Nauka o plivanju*,(Science on swimming) Sportska knjiga, Beograd, page 9.

Hsu, T. G., & Hsu, K. M. (1997). The effect of shoulder isokinetic strenght on speed and propulsive forces in front crawl swimming. *Medicine and Science in Sport and Exercise,* 29 (5).

Issurin, V., & Vrijens, J. (1996). *Altitude training in alite sport*, Flamish Journal for Sports Medicine and Sport Science, 7, 66, 24-41.

Kazazović, B. (1998). *Plivanje kao sport i sredstvo zdravstvenog i tjelesnog odgoja*.(Swimming as sport and means of health and physical education) FEDERACIJA BOSNE I HERCEGOVINE Ministarstvo obrazovanja, nauke, kulture i sporta. IP SVETLOST d.d. Zavod za udžbenike i nastavna sredstva. Sarajevo, page 35-48.

Koprivica, D. (2000). Savremeno ronjenje. (Contemporary swimming) "BODEX". Beograd. pages 297:299.

Kazazović, B. (2008). *Plivanje, biomehanika, metodika, strenažni proces, primjenjeno plivanje*, /3 izmjenjeno i dopunjeno izdanje/; (Swimming,biomechanics, methodology, straining process, applied swimming, / 3 revised and amended edition/|"*Grafičar promet*" d.o.o Sarajevo, page 59-74.

McLeod. I. A. (2010). *Swimming Anatomy*. Plivanje Anatomija. *Datastatus*. Beograd 2 – 3.

Leko, G. (2001). *Definiranje odnosa motoričkih sposobnosti i antropometrijskih karakteristika plivača*. (Defining of relation between motor abilities and anthropometric features of swimming) (PhD thesis) (Doktorska disertacija). Zagreb: Fakultet za fizičku kulturu.

Lokken, B. (1998). Swimming fitness testing. *Exercise Physiology*.

Malacko, J. (2000*). Osnove sportskog treninga. Antropološki status sportista*, Sportska akademija Beograd, page 47(Basics of sport training. Anthropological status of sportsmen)

Maver, H., Rudan, P., & Tarbuk, D. (1975). *Antropometrija*, tiskara "Varteks" Varaždin, Zagreb, page 10-47.(Anthropometry)

Perić, D. (1996). *OPERACIONALIZACIJA (OPERATIONALIZATION)2*.FINE graf, Beograd, page 140-163 i 227-247.

Perić, D. (2001). *Statistika, statističke aplikacije u istraživanjima sporta i fizičkog vaspitanja*, (Statistics, statistical applications in researching sport and physical education) IDEAPRINT, Beograd, page 177- 205 and 273-311.

Persyn U., De Maeyer J., & Vervaeke H. (1975) Investigation of hydrodynamic determinants of competitive swimming strokes. International Series on Sport Sciences 2, 214-222

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NASLOV RADA (U NAJVIŠE DVA REDA)

Ime Prezime[1], Ime Prezime[2]

[1]Naziv organizacije, [2]Naziv organizacije

Apstrakt: *Svaki rad mora da sadrži apstrakt. U apstraktu treba ukratko izložiti osnovnu ideju i postignute rezultate. Rad napisati po ugledu na tekst iz ovog uputstva. Apstrakt može da sadrži do 150 riječi.*

Ključne riječi: *Navesti do pet ključnih riječi odvojene zarezima.*

Rad treba da ima jasno dat uvod, postavku problema, način njegovog rješavanja, rezultate, zaključak i korištenu literaturu, na ne više od 8 strana B5 formata (16,8 x 24,0 cm) uključujući slike, tabele, reference. Na stranicama rada margine moraju biti: gornja i donja 2,5cm, unutrašnja 2,5cm i vanjska 2cm. Stranice nije potrebno numerisati.

Naslov rada (Times New Roman, veličina 12pt, *bold*) treba da se nalazi na sredini prve stranice pomjeren dva proreda veličine 10pt ispod gornje margine. Nakon naslova ostaviti jednu praznu liniju veličine 10pt. Rad se elektronskom poštom dostavlja Naučnom odboru skupa u PDF i DOC formatu na e-mail adresu siz@siz-au.com.

Iznad tabele treba da stoji natpis, npr. „Tabela 1. Matrica interkorelacija“. Ispod slike treba da stoji broj slike i legenda, npr. „Slika 3. Rad sa predškolcima“.

LITERATURA

Obavezno je navođenje svih bibliografskih izvora koji su korišteni za pripremu i pisanje rada. Preporučuje se *APA* standard indeksiranja literature, APA Harvard reference system.

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