

BODY MASS INDEX AND MOTOR STATUS OF PRESCHOOL CHILDREN

INDEKS TELESNE MASE I MOTORIČKI STATUS PREDŠKOLSKE DECE

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Abstract: The purpose of this study is to establish the existence of gender differences in motor skills in the preschool period as well as to check their nutritional status. The classification of their nutritional status has been performed based on their body mass index (BMI), based on the percentile values according to Centers for Disease Control and Prevention, (2000). Total sample consisted of 188 examinees with average values of body height (BH=124.59 cm±5.76) and body weight (BW=24.32 kg±3.11) with average age of 6.39±0.44 years, out which boys (N=107) and girls (N=81). Non-experimental research design, ex post facto correlation research plan, has been used. The battery with seven motor tests according to Bala and Popović (2007), has been used in this research. The study results show that the prevalence of malnourished children is 10.64%, well nourished 72.34%, tending to become obese 9.57% and obese children 7.44%, also with the existing gender difference in motor abilities in favour of better average values of boys in coordination, explosive and repetitive strength. The research results show that there is the satisfying percentage of normally nourished children and that the linearity of their nutritional status is in accordance with their motor status, growth and development. On the other hand, the perceived gender difference are present due to differentiation of motor abilities that occurs at this age. The authors point out that greater differences and variability regarding the level of nourishment and motor abilities of children can be expected only in prepuberty period, which will happen in the next phase.

Keywords: body mass index, motor skills, preschool age, differences.

Apstrakt: Cilj studije bio je utvrditi postojanje polnih razlika u predškolskom uzrastu u motoričkim sposobnostima i proveriti stanje njihove uhranjenosti. Klasifikacija hranjivog statusa izvršena je prema indeksu telesne mase (ITM), na osnovu percentilnih vrednosti prema Centers for Disease Control and Prevention, (2000). Ukupan uzorak sastojao se od 188 ispitanika sa prosečnim vrednostima telesne visine (TV=124,59 cm±5,76) i telesne težine (TM=24,32 kg±3,11), prosečne starosti 6,39±0,44 godine od kojih dečaka (N=107) i devojčica (N=81). Korišćen je neeksperimentalni istraživački dizajn, ex post facto korelacijski nacrt istraživanja. U istraživanju je korišćena baterija od sedam motornih testova prema Bala i Popović (2007). Rezultati studije pokazuju da je prevalenca neuhranjene dece 10,64%, normalno uhranjene 72,34%, rizično gojazne 9,57% i gojazne 7,44%, kao i da postoje polne razlike u motoričkim sposobnostima u korist boljih prosečnih vrednosti dečaka u koordinaciji, eksplozivnoj i repetitivnoj snazi. Rezultati istraživanja pokazuju da postoji zadovoljavajući procenat normalno uhranjene dece i da je linearnost njihovog nutritivnog statusa u skladu sa njihovim motoričkim statusom, rastom i razvojem. S druge strane, uočene polne razlike su prisutne zbog diferencijacije motoričkih sposobnosti koja nastaje u ovom periodu. Autori ističu da se veće razlike i varijabilnosti u pogledu stanja uhranjenosti i motoričkih sposobnosti dece mogu očekivati tek u prepubertetskom periodu.

Ključne reči: indeks telesne mase, motoričke veštine, predškolski uzrast, razlike.

INTRODUCTION

If physical activity is considered to be a phenomenon, even the basic type of physical activity, not programmed and planned cycle, is undoubtedly of great importance for the health of human population. Apart from prevention and a decrease of children's overweight and obesity, which a decade ago included about 22 million of children all over the world (WHO, 2008), physical activity is also connected in a positive way with cardiovascular status, muscular strength and endurance, decrease of depression and anxiety (Stron et al, 2005). Ever since then, a lot of attention has been paid to insufficient physical activity, so WHO (2000) classifies it as a risk factor and makes it as equal as risk which hypertension and obesity had back then (Pelemiš et al., 2015). The problem of physical (in)activity had been identified long time ago by National Association for Sport and Physical Education (NASPE, 2002), which published a guide for children, who need at least 60 minutes of planned physical activity on a daily basis.

On the other hand, the acquired motor skills and developed motor abilities are fundamental factor of children's motor competence, that is aptitude (Stamatović, Sekeljić, Martinović & Pelemiš, 2019) based on which it is possible to monitor the compliance and deviation of children's development. The level of development of children's motor abilities influence to a great degree on their regular further growth and development (Pelemiš, Branković & Banović, 2016). When it comes to preschool children, motor abilities have their distinctiveness. Throughout that period, motor abilities are characterized by significant variability, not fully built and inadequately defined motor structures which are still closely interconnected (Pelemiš et al., 2019a). The development of motor abilities moves in accordance with certain laws and is similar to ontogenetic body development (Pelemiš & Džinović-Kojić, 2018), and main features of that development are: heterochrony (intense development at different ages), synphasy (development of abilities matches), rhythm (occurrence in certain, relatively regular rhythm) and sensibility (sensitivity of organism to physical activity). Because of that, children who are overweight are prone to lower practice of physical activity and worse motor index (Planinsec & Matejek, 2004). Therefore, insufficient physical activity can be connected to the increase of obesity with children, as indicated in research of Mendonac & Anjos, (2004).

After discoveries on the results of previous researches, the flaw which has so far appeared in the the studies of similar character is the insufficient number of findings which point to facts on constant monitoring of motor abilities with preschool children, before enrolling school, at ex-

Uvod

Ako se fizička aktivnost smatra fenomenom, pa čak i osnovnim oblikom fizičke aktivnosti, a ne programiranim i planiranim ciklusom, njegova je važnost za zdravlje ljudske populacije nesumnjiva. Osim prevencije i smanjenja dečje prekomerne težine i gojaznosti, koja je pre deceniju uključivala oko 22 miliona dece širom sveta (WHO, 2008), fizička aktivnost je takođe pozitivno povezana s kardiovaskularnim statusom, mišićnom snagom i izdržljivošću, smanjenjem depresije i anksioznosti (Strong et al., 2005). Otada se mnogo pažnje posvećuje nedovoljnoj fizičkoj aktivnosti, te je WHO (2000) klasifikuje kao faktor rizika i izjednačava je sa rizikom koji su do tada imali hipertenzija i gojaznost (Pelemiš et al., 2015). Problem fizičke (ne)aktivnosti dugo je identifikovan od strane National Association for Sport and Physical Education (NASPE, 2002) koji je izdao vodič za decu za koje je potrebno najmanje 60 minuta planirane fizičke aktivnosti dnevno.

Sa druge strane, stečene motoričke veštine i razvijene motoričke sposobnosti su fundamentalni faktori dečje motoričke kompetencije, odnosno spremnosti (Stamatović, Šekeljić, Martinović i Pelemiš, 2019), na temelju kojih je moguće pratiti sklad i odstupanja dečjeg razvoja. Step en razvijenosti motoričkih sposobnosti dece uveliko zavisi o njihovom daljnjem pravilnom rastu i razvoju (Pelemiš, Branković i Banović, 2016). Kada su u pitanju predškolci, motoričke sposobnosti imaju svoje specifičnosti. Tokom tog perioda motoričke sposobnosti karakterišu značajna varijabilnost, nepotpuno izgrađene i neadekvatno definisane motoričke strukture koje su još uvek usko međusobno povezane (Pelemiš et al., 2019a). Razvoj motoričkih sposobnosti protiče u skladu sa određenim zakonitostima i sličan je ontogenetski razvoju organizma (Pelemiš i Džinović-Kojić, 2018), a glavne karakteristike razvoja su: heterohronost (intenzivan razvoj u različitim razdobljima), sinfaznost (razvoj sposobnosti se poklapa), ritmičnost (javljanje u određenom relativno pravilnom ritmu) i senzibilnost (osetljivost organizma na fizičku aktivnost). Zbog toga deca s preteranom telesnom težinom sklona su manjem upražnjavanju fizičkih aktivnosti i imaju lošiji motorički indeks (Planinsec i Matejek, 2004). Iz tih razloga nedovoljnu fizičku aktivnost možemo povezati s povećanjem gojaznosti kod dece, na što ukazuju istraživanja Mendonca i Anjos, (2004).

Nakon saznanja o nalazima dosadašnjih istraživanja, nedostatak koji je do sada proveden u studijama sličnog karaktera bi se ogledao u nedovoljnom broju nalaza koji ukazuju na činjenice o konstantnom praćenju motoričkih sposobnosti kod predškolske dece pre upisa

actly this age. Therefore, this study should give answers to questions if there are some significant gender differences, if they are in accordance with most findings got at a pre-school age, as well as to compare BMI values with the referent values for this age.

The purpose of this research was to establish the existence of gender differences with children of preschool age in motor abilities, and then establish their BMI values.

MATERIAL AND METHOD

The research was of transversal character. The plan of non-experimental research, to be more precise *ex post facto*, was used. According to character of scientific research, for the purpose of the applied methods, empirical method was used, while according to the knowledge connected to this problem, an affirmative method was used. According to the level of control, half-field method was used. Total sample consisted of 188 examinees, at the age of 6.39 ± 0.44 , out of which 107 boys (56,91%), at average age of 6.44 ± 0.50 years and the following values: $BH = 124.42 \pm 5.66$ cm; $BM = 24.77 \pm 2.82$ kg and $BMI = 16.03 \pm 1.72$ kg/m², and 81 girls (43.09%) from total sample, at the average age of 6.34 ± 0.35 years, $BM = 124.77 \pm 5.87$ cm; $BM = 23.88 \pm 3.35$ kg and $BMI = 15.35 \pm 1.93$ kg/m², who attended preschool institution Čukarica in Belgrade (The Republic of Serbia). Children's parents got a survey questionnaire before the research, where study deadline and the process itself were marked, so they approved the research on their children by giving their signature (Declaration of Helsinki, 2013).

As a sample of the measuring instrument the following anthropometrical measures were chosen: I For estimation of skeleton longitude dimensionality 1) *Body height* (cm) – it was measured with the help of anthropometer by Martin; II For estimation of body mass and volume 2) *Body mass* (0.1 kg) – it was measured by decimal medical scales. Based on those two measured variables we calculated 3) *Body Mass Index* (kg/m²), in accordance with the classification regulated by National Institutes of Health (1998). The examinees were then grouped based on their reference values of BMI, and based on the percentile values regulated by Centers for Disease Control and Prevention (2000) to the following subsamples: 1) ≤ 5 percentiles-malnourished; 2) from 5-85 well nourished 3) from 85.01-95 tending to become obese and 4) 95.01 obese.

$$BMI = BM/(BM)^2$$

Legend: *BMI* – Body Mass Index; *BM* – Body Mass; *BH* – Body Height

u školu, upravo u ovom uzrasnom periodu. S toga bi ova studija trebala dati odgovore na pitanja da li postoje značajne polne razlike, te da li su u skladu sa većinom nalaza dobijenih na ovom predškolskom uzrastu, kao i uporediti vrednosti ITM sa referentnim vrednostima za ovaj uzrast.

Cilj istraživanje bio je utvrditi postojanje polnih razlika dece predškolskog uzrasta u motoričkim sposobnostima, te utvrditi njihove vrednosti ITM.

MATERIJAL I METOD

Istraživanje je bilo transverzalnog karaktera. Koristio se nacrt neeksperimentalnih istraživanja, tačnije *ex post facto* nacrt. Prema prirodi naučnih istraživanja, u svrhu primenjenih metoda korištena je empirijska metoda, dok se prema znanju problema koristila potvrdna metoda. Prema stepenu kontrole primenjena je polu-terenska metoda. Ukupak uzorak sačinjavalo je 188 ispitanika $6,39 \pm 0,44$ godina. Od toga 107 dečaka (56,91%) ukupnog uzorka, prosečnog uzrasta $6,44 \pm 0,50$ godina sa vrednostima $TV = 124,42 \pm 5,66$ cm; $TM = 24,77 \pm 2,82$ kg i $ITM = 16,03 \pm 1,72$ kg/m², te 81 devojčice (43,09%) ukupnog uzorka, prosečne starosti $6,34 \pm 0,35$ godina $TV = 124,77 \pm 5,87$ cm; $TM = 23,88 \pm 3,35$ kg i $ITM = 15,35 \pm 1,93$ kg/m², koji su bili polaznici predškolske ustanove PU Čukarica u Beogradu (Republika Srbija). Roditelji dece dobili su anketni upitnik pre ankete, u kome je bio naznačen plan i tok studije, te su svojim potpisima odobrili istraživanje na njihovoj deci (Declaration of Helsinki, 2013).

Kao uzorak mernih instrumenata izabrane su osnovne antropometrijske mere: I Za procenu longitudinalne dimenzionalnosti skeleta 1) *Telesna visina* (cm) – bila je izmerena uz pomoć antropometra po Martinu; II Za procenu volumena i mase tele 2) *Telesna masa* (0,1 kg) – bila je izmerena pomoću decimalne medicinske vage. Na osnovu te dve izmerene varijable izračunat je 3) *Indeks telesne mase* (kg/m²), sagledan prema klasifikaciji koju propisuje National Institutes of Health (1998). Ispitanici su dalje grupisani na osnovu referentnih vrednosti ITM, a prema percentilnim vrednostima koji su propisani od strane Centers for Disease Control and Prevention, (2000) na sledeće subuzorke: 1) ≤ 5 percentila-pothranjeni; 2) od 5-85 normalno uhranjeni 3) od 85,01-95 rizično gojazni i 4) 95,01 gojazni.

$$ITM = TM/(TV)^2$$

Legenda: *ITM* – Indeks telesne mase; *TM* – Telesna masa; *TV* – Telesna visina.

Body height was measured with anthropometer by Martin. Examinee was without shoes, standing on the flat surface, with heels pulled together, head in the position of „Frankfurt horizontal“. We measured the distance from the ground surface to the top of the head. The result is expressed in the values of 0.1 cm. Body Mass was measured by decimal medical scales. The examinee was standing on the device, wearing only underwear. The result is expressed in the values of 0.1 kg.

As a sample of measuring instruments for estimation of motor abilities with children of preschool age, standardized motor tests with good metric performances (validity, reliability, representiveness and homogeneity) have been used, based on the reduced theoretical model of Kurelić, Momirović, Stojanović, Šturm, Radojević & Viskić-Štalec, (1975) and Gredelj, Metikos, Hosek & Momirović, (1975) applied in the research of (Bala & Popović, 2007) checked on a big sample of the examinees, applying the following test battery: I For estimation of movement structuring factor: 1) *Backwards polygon* (0.1s); II For estimation of factor of excitement intensity of motor units: 2) *Long jump* (cm), 3) *Running 20 m from a high start* (0.1 s); III) For estimation of factor of functional synergy and muscular tonus: 4) *Hand tapping* (frec.), 5) *Bending with spread legs in a seating position* (cm); IV For estimation of duration factor with excitement of motor units; 6) *Sit-ups in 30 s* (frec.), 7) *Endurance in pull-ups* (0.1 s).

Out of all measuring instruments which are used for testing motor abilities, the following have been used in this research: stopwatch Polar C 112, frequency tapping board, whistle, colourful sticky bands, carpet with marked centimeters, springboard, metal measure tape, plastic table, sponge and chalk.

For statistical processing of data, statistical program SPSS Statistics for Windows, version 20, has been used. For all acquired data, calculation of basic parameters of descriptive statistics was performed: from measures of central tendency (M)–arithmetic mean; from measures of variability (S)–standard deviation. Testing normality of distribution has been performed applying Kolmogorov-Smirnov (KS) test. Then, based on percentile values, the examinees have been classified into four categories as follows: malnourished; well nourished; tending to become obese and obese. For establishing gender differences in the overall motor space, multi-variable variance analysis (Manova) has been used, and for establishing individual differences, One-Way Anova.

Telesna visina merena je antropometrom po Martinu. Ispitanik je bio bez cipela. Stajao je na ravnoj površini, pete skupljene, glava u položaju „frankfurtske horizontale“. Merila se udaljenost od podloge do teme na glave. Rezultat je izražen u vrednostima od 0,1cm. Telesna masa je izmerena pomoću decimalne medicinske vage. Ispitanik je stajao na uređaju odeven samo u donjem vešu. Rezultat je izražen u vrednostima od 0,1kg.

Kao uzorak mernih instrumenata za procenu motoričkih sposobnosti kod dece predškolskog uzrasta korišteni su standardizirani motorički testovi s dobrim metrijskim karakteristikama (valjanost, pouzdanost, reprezentativnost i homogenost), po redukovanom teoretskom modelu Kurelića, Momirovića, Stojanovića, Šturma, Radojevića, i Viskić-Štalecove, (1975) i Gredelja, Metikoš, Hošek i Momirović, (1975) primenjenom u istraživanju (Bala i Popović, 2007) proverenom na velikom uzorku ispitanika, te se primenjivala sledeća baterija testova: I Za procenu faktora strukturiranja kretanja: 1) *Poligon natraške* (0,1 s); II Za procenu faktora intenziteta ekscitacije motoričkih jedinica: 2) *Skok udalj iz mesta* (cm), 3) *Trčanje 20 m iz visokog starta* (0,1 s); III Za procenu faktora funkcionalne sinergije i regulacije tonusa: 4) *Taping rukom* (frec.), 5) *Preklon u sedu raznožno* (cm); IV Za procenu faktora trajanja ekscitacije motoričkih jedinica: 6) *Podizanje trupa za 30 s* (frec.), 7) *Izdržaj u zgibu podhvata* (0,1 s).

Od mernih instrumenata koji se koriste za ispitivanje motoričkih sposobnosti bili su korišćeni: štoperica Polar C 112, frekvenciona ploča za taping, pištaljka, obojene lepljive trake, tepih sa izvučenim centimetrima, odskočna daska, metalna merna traka, plastični stočić, sunder za brisanje i kreda.

Za statističku obradu podataka koristio se statistički program SPSS Statistics for Windows, version 20. Za sve dobijene podatke urađeno je izračunavanje osnovnih parametara deskriptivne statistike: od mera centralne tendencije (M) -aritmetička sredina; od mera varijabilnosti (S)-standardno odstupanje. Ispitivanje normalnosti distribucije provedeno je primenom testa Kolmogorov-Smirnov (KS). Dalje su ispitanici na temelju percentilnih vrednosti podeljeni u četiri kategorije i to: pothranjeni; normalno uhranjeni; rizične gojazni i gojazni. Za utvrđivanje polnih razlika u celokupnom motoričkom prostoru korištena je multivarijantna analiza varijance (Manova), a za određivanje pojedinačnih razlika One-Way Anova.

RESULTS

Based on the coefficient values of *Body Mass Index* (BMI) table 1 shows the performed classification of subsamples which are further grouped according to percentile values into the following subsamples: 1) ≤ 5 percentiles-malnourished; 2) from 5-85 percentiles, the examinees of normal level of nourishment; 3) from 85,01–95 percentiles, tending to become obese 4) over 95,01 percentiles, obese.

Research results show that prevalence of malnourished children in total sample is 10,64%; well nourished 72,34%; tending to become obese 9,57% and obese 7,44%. After classification of total sample according to gender, it can be said there was 9,35% of malnourished boys, 71,03% of

REZULTATI

Na osnovu vrednosti koeficijena *Indeksa telesne mase* (ITM) u tabeli 1, prikazano je i izvršeno razvrstavanje subuzoraka koji su dalje grupisani po percentilnim vrednostima u sledeće poduzorake: 1) ≤ 5 percentila-pothranjeni; 2) od 5-85 percentila ispitanici s normalnim stanjem uhranjenosti; 3) od 85,01–95 percentila s rizikom od gojaznosti 4) više od 95,01 percentila gojazni.

Rezultati istraživanja pokazuju da je prevalenca pothranjene dece u ukupnom uzorku 10,64%; normalno uhranjene 72,34%; rizično gojazne 9,57% i gojazne 7,44%. Nakon podele celog uzorka prema polu, može se reći da je pothranjenih dečaka bilo 9,35%, normalno

Table 1. Nourishment status within the sample / Tabela 1. Stanje uhranjenosti u uzorku

Nourishment Status Stanje uhranjenosti	Percentile BMI values Percentilne vrednosti ITM	Boys (kg/m ²) Dečaci (kg/m ²)	Girls (kg/m ²) Devojčice (kg/m ²)
Malnourished / Pothranjeni	<5	<13.78 (N=10 – 9.35%)	<13.50 (N=10 -12.35%)
Well Nourished / Normalno uhranjani	5-85	od 13.79 do 17.20 (N=76 – 71.03%)	od 13.51 do 17.40 (N=60 – 74.07%)
Tending to become obese / Rizično gojazni	85.01-95	Od 17.21 do 18.80 (N=13 – 12.15%)	Od 17.41 do 19.40 (N=5 – 6.17%)
Obese / Gojazni	<95.01	>18.81 (N=8 – 7.47%)	>19.41 (N=6 – 7.41%)

Table 2. Descriptive statistics and gender differences / Tabela 2. Deskriptivni statistici i polne razlike

Variable / Varijabla	Gender / Pol	AS	S	KSp	f	p
Backwards polygon (0.1s) / Poligon natraške (0.1 s)	Boys / Dečaci	197.42	45.47	0.01	4.09	0.04
	Girls / Devojčice	211.85	52.14	0.20		
Long jump (cm) / Skok udalj iz mesta (cm)	Boys / Dečaci	118.45	15.26	0.07	5.04	0.03
	Girls / Devojčice	113.33	15.80	0.01		
Running 20 m from a high start (0.1s) / Trčanje 20 m iz visokog starta (0.1 s)	Boys / Dečaci	51.31	4.40	0.01	3.68	0.06
	Girls / Devojčice	52.30	3.79	0.00		
Hand tapping (frec.) / Taping rukom (frek.)	Boys / Dečaci	18.57	3.48	0.00	0.02	0.90
	Girls / Devojčice	18.58	3.54	0.01		
Bending with spread legs in a sitting position(cm) / Pretklon u sedu raznožno (cm)	Boys / Dečaci	42.50	3.85	0.00	7.10	0.01
	Girls / Devojčice	44.46	4.52	0.05		
Sit-ups 30s (frec.) / Podizanje trupa 30s (frek.)	Boys / Dečaci	18.98	6.62	0.12	0.24	0.62
	Girls / Devojčice	18.47	6.73	0.01		
Endurance in pull-ups (0.1s) / Izdržaj u zgibu pothvatom (0.1 s)	Boys / Dečaci	145.67	101.29	0.00	1.10	0.30
	Girls / Devojčice	131.22	92.82	0.00		

$F=2.61$; $P=0.01$

Legend: AS – arithmetic mean, S – standard deviation, KSp – level of statistical significance of Kolmogorov Smirnov coefficient f – univariant f test; p – level of statistical significance of f test; F – multivariant Wilks F test; P – statistical significance of multivariant F test.

Legenda: AS - aritmetička sredina, S - standardna devijacija, KSp - nivo statističke značajnosti Kolmogorov Smirnovljevog koeficijenta f – univarijantni f test; p – nivo statističke značajnosti f testa; F – multivarijantni Wilksov F test; P – statistička značajnost multivarijantnog F testa.

well nourished, 12,15% of the ones tending to become obese, and only 7,47% of obese boys. When it comes to girls, the percentage of malnourished girls is somewhat higher than the one with boys, which is 12,35%, well nourished are also slightly higher, which is 74,07%, girls tending to become obese are less when compared to boys, which is 6,17% and the percentage of obese is exactly the same, 7,41%.

Taking into account the values of multi-variant Wilks' F test and its significance presented in Table 2, it can be concluded that there is statistically significant difference between the samples of different genders, regarding their motor abilities, considering the overall system of the applied variables. These differences, from case to case, have been identified in variables for estimation of coordination, explosive strength of legs, in favour of boys and in variables for estimation of flexibility, in favour of girls.

DISCUSSION

Observing study findings, directed at the establishment of gender differences among children of preschool period in their motor abilities and their BMI values, some significant differences can be noticed.

It needs to be pointed out that the study had 10.64% of malnourished children in total, and those data could not be fully connected with shortage of food in the previous period of life, but this fact could be connected to some seasonal variations and changes, and the way of eating. The opposite findings with one year younger sample of preschool children are set forth by Pelemiš, Branković & Banović (2016), pointing out to extremely high level of malnourished children, even 31.76% of total sample. Namely, children nowadays, and their way of eating in this part of Europe, do not deviate from the findings acquired in other developed countries, where it must be taken into account some age characteristics of children and periods of growth and development. Recent survey on the territory of Serbia, which analyzed the period of ten years, indicated the trend of increase in body height and decrease of BMI parameters (Pavlica, Rakić & Šironjić, 2017), which can be a consequence of migrations in this region, but also of the way of eating and partly of practicing some physical activity. The countries with the highest prevalence of obesity are Micronesia and Polynesia, where more than 38% of men and over 50% of women are obese (Radić, 2016). There is a growing obesity trend around the world, and in developed countries like the USA and Great Britain, the number of overweight people is higher than the number of people of normal body weight (NCD Risk factor collaboration, 2016.), which complies with the findings of this research. To be more specific, recent findings of the research in Serbia also show that the boys who are 7 years old are not much different than the

uhranjenih 71,03%, rizično gojaznih 12,15%, a gojaznih samo 7,47%. Kada se sagledaju devojčice, napominje se da je postotak pothranjenih devojčica nešto viši od dečaka i iznosio je 12,35%, normalno uhranjenih takođe neznatno više i iznosio je 74,07%, rizično gojaznih znatno manje kada se upoređi sa dečacima 6,17% i gojaznih gotovo isto 7,41%.

Uzimajući u obzir vrednosti multivarijantnog Wilksovog F testa i njegovu značajnost prikazanu u tabeli 2, zaključuje se da postoji statistički značajna razlika između uzoraka različitog pola u pogledu njihovih motoričkih sposobnosti, uzimajući u obzir celokupni sistem primenjenih varijabli. Ove razlike, od slučaja do slučaja, identifikovane su u varijablama za procenu koordinacije, eksplozivne snage nogu u korist dečaka i u varijabli za procenu fleksibilnosti u korist devojčica.

DISKUSIJA

Gledajući nalaze studije usmerene na utvrđivanje polnih razlika dece predškolskog uzrasta u motoričkim sposobnostima i njihove vrednosti ITM, može se primetiti da se opažaju neke značajne razlike.

Treba naglasiti da je studija imala ukupno 10,64% pothranjene dece, a ti podaci se nisu u potpunosti mogli povezati s nedostatkom u ishrani u prethodnom periodu života, ali ova činjenica može biti povezana s nekim sezonskim varijacijama i promenama i načinu ishrane. Suprotne nalaze na godinu dana mlađem uzorku predškolske dece iznose Pelemiš, Branković & Banović (2016), te ukazuju na izrazito visok nivo pothranjene dece čak 31,76% ukupnog uzorka. Naime, današnja deca i njihov način ishrane u ovom delu Europe ne odstupaju od nalaza dobivenih u drugim razvijenim zemljama, pri čemu se moraju uzeti u obzir uzrasne karakteristike dece i periodi rasta i razvoja. Nedavno istraživanje na području Srbije, koje je analiziralo period od deset godina, ukazalo je na trend povećanja telesne visine i smanjenja parametara ITM (Pavlica, Rakić & Šironjić, 2017), što može biti posledica migracija u ovoj regiji, ali i načina ishrane i jednim delom upražnjavanja fizičke aktivnosti. Zemlje sa najvećom prevalencom gojaznosti su Mikronezija i Polinezija, u kojima je više od 38% muškaraca i preko 50% žena gojazno (Radić, 2016). U svetu raste trend gojaznosti, a u razvijenim zemljama poput Sjedinjenih Američkih Država i Velike Britanije broj ljudi s prekomernom telesnom težinom veći je od broja ljudi s optimalnom telesnom težinom (NCD Risk factor collaboration, 2016.), što se ne podudara s nalazima iz ovog istraživanja. Konkretno, nedavni nalazi istraživanja u Srbiji takođe pokazuju da se dečaci stari 7 godina ne razlikuju značajno od

girls of the same age regarding BMI and body fat (Madić, Trajković, Popović, Radanović & Sporiš, 2017), which was not really the case in this research. In other parts of the world, Japan for example, with children of the same age (6 and 7), there is a lower percentage of fat tissue found with girls of preschool period, which is explained by the beginning phase of the early development. Namely, the cells are filled with fat before the phase of intense growth, later dominated by longitudinal dimensionality of skeleton, that is, the growth of bones in length. That is the signal for faster entrance into puberty phase with girls. Comparing these findings with the research of Pelemiš et al., (2019b) of some older sample of children from Serbia (7.27 ± 0.43 years of age), a higher percentage of malnourished children (3.87%) can be noticed, which points out the increase of percentage of malnourished children at preschool age, but also a usual phase of growth and development for this age, where the number of malnourished children decreases in years, as the ratio of fat and muscle tissue significantly changes.

The existence of significant differences in motor behaviour of children of different gender, which is confirmed in this research, is in accordance with the previous researches of Pavlović & Marinković (2013). The authors point to a significantly higher level of coordination and strength with boys. Better coordination with boys of preschool age on the same tests, in the same developing period is confirmed by Bala, Jakšić & Popović (2009). Furthermore, recent researches performed by Ujsasi, Bulatović & Kerić, (2014) show the domination of boys in coordination and strength. It is very interesting to notice the opposite findings, which do not support the results of this research, named by Aćimović (2013), and which point to a better coordination and flexibility with girls, and strength and preciseness with boys. Justification of the existing differences acquired in this study is connected with more versatile movement of boys and greater activity during this growing up. Better motor control of movement with boys can be result of more versatile moves. Therefore, it is, first and foremost, about the biotic motor knowledge, which speeds up work of central nervous system (CNS), coordination of moves, and achieve better inner and intermuscular coordination, which is expressed in better coordination of moves and higher explosive strength than the opposite sex examinees. Better performances of boys in the explosive strength can be explained with greater body activity, including greater presence and diversity of moves, especially „rough physical games“ (rough-and-tumble play) (Lindsey & Mize, 2001). Based on this, it can be concluded that motor functioning of children, especially boys, is still and in a great degree influenced by the mechanism for movement structuring, and that coordination, together with strength can be singled out and

devojkica iste dobi u smislu ITM i telesne masti (Madić, Trajković, Popović, Radanović & Sporiš, 2017), što u ovom istraživanju i nije bio slučaj. U drugim delovima sveta, na primer, u Japanu, kod dece u istoj uzrasnoj dobi (6 i 7 godina) manji je postotak masnog tkiva pronađen kod devojkica predškolskog uzrasta, što se objašnjava početkom faze ranog sazrevanja. Naime, ćelije se napune masnoćom pre faze intenzivnog rasta, kojom kasnije dominira longitudinalna dimenzionalnost kostura, tj. rast kostiju u dužinu. To je signal za brži ulazak u pubertet-sku fazu kod devojkica. Uspoređujući ove nalaze s istraživanjem Pelemiša i sar., (2019b) nešto starijeg uzorka dece iz Srbije (7.27 ± 0.43 godine), može se primetiti veći postotak pothranjene dece (3,87%), što ukazuje na porast postotka pothranjene dece u predškolskoj dobi, ali i uobičajenu fazu rasta i razvoja za ovaj uzrast, gde se broj pothranjene dece smanjuje sa godinama kako se omer masnog i mišićnog tkiva značajno menja.

Postojanje značajnih razlika u motoričkom ponašanju dece različitog pola, što je i potvrđeno u ovom istraživanju, u skladu je s dosadašnjim istraživanjima Pavlovića i Marinkovića (2013). Autori ukazuju na znatno viši nivo koordinacije i snage izražene kod dečaka. Bolja koordinacija dečaka predškolskog uzrasta na istim testovima u istom razvojnom periodu potvrđuju Bala, Jakšić i Popović (2009). Takođe, nedavna istraživanja koja su sprovedili (Ujsasi, Bulatović i Kerić, 2014) pokazuju dominaciju dečaka u koordinaciji i snazi. Vrlo je zanimljivo primetiti suprotne nalaze, koji ne podržavaju rezultate ovog istraživanja, koje je naveo Aćimović (2013), a koji ukazuju na bolju koordinaciju i fleksibilnost kod devojkica te snagu i preciznost kod dečaka. Opravdanje postojanja razlika dobijenih u ovoj studiji, povezano je s bogatijim kretanjem dečaka i većom aktivnošću tokom ovog odrastanja. Bolja motorička kontrola kretanja dečaka može proizlaziti iz raznolikih pokreta. Dakle, pre svega se radi o biotičkim motoričkim znanjima, koje ubrzavaju rad centralnog nervnog sistema (CNS), koordiniraju izvođenje pokreta, postižu bolju unutrašnju i intermuskularnu koordinaciju, što se ispoljava boljom koordinacijom pokreta i većom eksplozivnom snagom od ispitanika suprotnog pola. Bolje performanse dečaka u eksplozivnoj snazi mogu se objasniti većom telesnom aktivnošću, uključujući veću zastupljenost i raznolikost pokreta, posebno „grubih fizičkih igara“ (rough-and-tumble play) (Lindsey & Mize, 2001). Iz ovoga se zaključuje da na motoričko funkcionisanje dece, posebno dečaka, još uvek i u velikoj meri utiče mehanizam za strukturiranje kretanja, te da se koordinacija, zajedno sa snagom, može izdvojiti i prepoznati kao dominantna. Postoje različita istraživanja sa sličnim

identified as dominant. There are different researches with similar findings which point to the fact that coordination at this preschool age can be isolated as a general motor factor as well. Research points out to findings of general motor factor and motor behaviour of small children (Bala & Nicin, 1997; Pelemiš 2016), whereas there are different findings on differentiation of motor abilities in motor behaviour of children (Rajtmajer & Proje, 1990; Planinsec, 1995), and also by Russian authors (Popeska, Georgiev & Mitevski, 2009) and Ivanović in Serbia (2007).

Practical value of this paper is reflected in the initial evaluation of motor abilities and the nourishment status of children of preschool age, whereby we got a starting base for monitoring of their anthropological features. Therefore, such condition, achieved by transversal section of research, will considerably change in the following year, since those children will enter the phase of intensive growth, that girls' BMI values already show, and which is slightly lower compared to boys'. That is also confirmed by slightly higher values of body height in comparison to boys. Moreover, it needs to be pointed out that the acquired findings indicate to the fact that with girls, some additional treatment of physical activities, based on the development of coordination and in a great degree improvement of biotic motor skills, could be conducted.

Based on all above mentioned and the acquired research results, it can be concluded that there are significant differences in motor space of boys and girls in favour of better average values of boy in coordination, explosive and repetitive strength. Study results show that there is a satisfying percentage of well nourished children of both genders and that there is a linearity between their nourishment statuses, which is in accordance with their motor status, growth and development. The authors recommend some additional work with girls in the field of improvement of biotic motor skills and such programmes of kinesiology activities based on the development of coordination.

Announcemet

We announce that the authors have equally contributed to this paper.

Conflict of interests

There is no conflict of interests among the authors themselves.

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nalazima koji ukazuju na to da se koordinacija u ovom predškolskom uzrastu može izolovati i kao generalni motorički faktor. O nalazima generalnog motoričkog faktora i motoričkog ponašanja male dece ukazuju istraživanja (Bala i Nićin, 1997; Pelemiš, 2016), dok postoje različiti nalazi o diferencijaciji motoričkih sposobnosti u motoričkom ponašanju dece (Rajtmajer i Proje, 1990; Planinsec, 1995), zatim (Popeska, Georgiev i Mitevski, 2009) i u Srbiji Ivanović (2007).

Praktična vrednost rada ogleda se u inicijalnoj evaluaciji motoričkih sposobnosti i stanju uhranjenosti dece predškolskog uzrasta čime se dobila polazna osnova za praćenje njihovih antropoloških obeležja. Dakle ovo stanje dobiveno transversalnim presekom istraživanja će se znatno promeniti u narednoj godini jer će deca ući u fazu intenzivnog rasta na što već ukazuju vrednosti ITM kod devojčica, koji je nešto niži u odnosu na dečake. To takođe potvrđuju i neznatno veće vrednostima telesne visine devojčica u odnosu na dečake. Takođe treba istaći da dobijeni nalazi ukazuju na činjenicu da bi se sa devojčicama mogao sprovesti dodatni tretman fizičkih aktivnosti koji bi bio koncipiran na razvoju koordinacije i dobrim delom usavršavanjem biotičkih motoričkih znanja.

Na temelju svega navedenog i dobijenih rezultata istraživanja, može se zaključiti da postoje značajne razlike u motoričkom prostoru dečaka i devojčica u korist boljih prosečnih vrednosti dečaka u koordinaciji, eksplozivnoj i repetitivnoj snazi. Rezultati studije pokazuju da je zadovoljavajući postotak normalno uhranjene dece oba pola i da postoji linearnost između njihovog stanja uhranjenosti, koji je u skladu sa njihovim motoričkim statusom, te rastom i razvojem. Autori preporučuju dodatni rad sa devojčicama na polju unapređenja biotičkih motoričkih znanja i takve programe kinezioloških aktivnosti koji bi se temeljili na razvoju koordinacije.

Izjava

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Konflikt interesa

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