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Morphological Characteristics as a Predictive Factor of Biotic Motor Knowledge

Morfološke karakteristike kao prediktivni faktor biotičkih motoričkih znanja

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Abstract: *On a sample of a total of 56 subjects, divided into two subsamples: 30 boys and 26 girls, measurements of 8 anthropometric measures and assessment of biotic motor knowledge were performed using the motor test "The Test of Gross Motor Development" (TGMD-2). The aim of the study was to determine gender differences in morphological characteristics between preschool children as well as the association of morphological characteristics with the motor test for the assessment of biotic motor skills for both sexes. The results of the research indicate the existence of statistically significant differences between boys and girls in morphological characteristics. These differences were manifested in the motor test, transverse dimensionality and subcutaneous fat in favor of boys, and in longitudinal dimensionality and volume and mass in favor of girls. It was further determined that the system of predictor variables in girls was significantly related to the variable for the assessment of biotic motor knowledge, while this cannot be stated for boys. This linearity of results indicates that the percentage of body fat in the body reduces the ability of girls to achieve better results in the motor test, which is largely under the control of the movement structuring system. It should also be noted that it would be good to use these types of motor tests with preschool children in which the child repeatedly confronts different situations on the one hand, and on the other hand improves the speed of alternative hand movements, explosive power, and a good part of the structuring mechanism. movements.*
Keywords: *analysis of variance, correlation, preschool age, morphological characteristics.*

Sažetak: *Na uzorku od ukupno 56 ispitanika, podeljenih u dva subuzorka: 30 dečaka i 26 devojčice, izvršeno je merenje 8 antropometrijskih mera i procena biotičkih motoričkih znanja putem motoričkog testa The Test of Gross Motor Development" (TGMD-2). Cilj istraživanja bio je utvrditi polne razlike u morfološkim karakteristikama između dece predškolskog uzrasta kao i povezanost morfoloških karakteristika sa motoričkim testom za procenu biotičkih motoričkih znanja za oba pola. Rezultati istraživanja ukazuju na postojanje statistički značajnih razlika između dečaka i devojčica u morfološkim karakteristikama. Te razlike ispoljene su u motoričkom testu, transverzalnoj dimenzionalnosti i potkožnoj masti u korist dečaka, te u longitudinalnoj dimezionalnosti i volumenu i masi u korist devojčica. Dalje je utvrđeno da je sistem prediktorskih varijabli kod devojčica bio značajno povezan sa varijablom za procenu biotičkih motoričkih znanja, dok se to ne može konstatovati za dečake. Ovakva linearnost rezultata ukazuje da procenat telesne masti u telu umanjuje sposobnost devojčica u ostvarivanju boljih rezultata u motoričkom testu, koji je većim delom pod kontrolom sistema za strukturiranje kretanja. Takođe treba napomenuti da bi bilo dobro sa decom predškolskog uzrasta koristiti ovakve vidove motoričkih testova u kojima se dete više puta konfrontira sa različitim situacijama sa jedne strane, a sa druge strane poboljšava se brzina alternativnih pokreta ruku, eksplozivnost, te dobar deo mehanizma za strukturiranje kretanja.*
Ključne reči: *morfološke karakteristike, biotička motorička znanja, povezanost, predškolski uzrast.*

Introduction

The processes of growth and development take place intensively in both preschool and younger school age, they

Uvod

Procesi rasta i razvoja se intenzivno odvijaju kako u predškolskom tako i u mlađem školskom uzra-

are interdependent and complementary. Physical growth and development of children, their motor, intellectual and emotional development, their behavior, socialization, physical and other activities need to be constantly measured and evaluated. This is especially important while children are in preschool age, when their body is very susceptible to various influences, and whose effects are manifested in the later period, and which cannot or are very difficult to repair at a later age (Popović, 2010). According to scientific research, a significant number of adolescents have one or more risk factors for the development of chronic cardiovascular diseases that manifest in adulthood (Mišigoj-Duraković, & Sorić, 2015), preliminary empirical data presented by the same authors show a worrying level of sedentary activity in 15-year-olds. That is why it is especially important to form healthy living habits from an early age, with kinesiological activity certainly being one of the most important ones.

Morphological characteristics as a factor of anthropological status should be understood as a biological and physiological foundation that generates the manifestation of anthropometric measures, such as body height and weight, trunk and limb circumference, length and thickness of long bones (limbs and corresponding joints), skin folds, etc. They define the growth and development of children, as their body structure, by determining the structure of morphological characteristics (Bala, 2004). The constant interaction between the hereditary basis and the environment shapes the growth and development of the child. Endogenous factors that affect the growth and development of children include biological inheritance, hormones; while exogenous factors are: diet, socioeconomic and psychological status, climate, seasons, secular trend (Malina, Bouchard, & Bar-Or, 2004). All these factors are important in body growth and development, with the length and width of the body being more influenced by hereditary factors, while body weight and the amount of subcutaneous adipose tissue are more affected by the external environment (Musalek, Coxtein, Papez, Scheffler, Mumm, Czernitzki, & Koziel, 2017). Body height increases even when body weight stagnates. The growth of the skeleton, especially the long bones of the extremities, is the basis for the increase in body height. As a rule, the dimensions of the extremities reach their maximum, first the distal, then the proximal parts. The growth of the extremities is accompanied by the growth of the trunk and chest, and the shoulders reach their adult size. This pattern results in a disproportion in appearance that disappears when the adolescent stops growing (Đorđević-Nikić, 1995). The first phase of slow growth starts from the 3rd year of life and

stu, međusobno su zavisni i dopunjuju se. Fizički rast i razvoj dece, njihov motorički, intelektualni i emotivni razvoj, njihovo ponašanje, socijalizacija, fizičke i druge aktivnosti potrebno je neprestano meriti i procenjivati. To je naročito važno dok su deca u predškolskom uzrastu, kada je njihov organizam veoma podložan raznim uticajima, a čiji efekti se manifestuju u kasnijem periodu, i koje nije moguće ili je veoma teško popraviti u kasnijem uzrastu (Popović, 2010). Značajan deo adolescenata prema naučnim istraživanjima ima jedan ili više faktora rizika za razvoj hroničnih kardiovaskularnih bolesti koji se manifestuju u odrasloj dobi (Mišigoj-Duraković, & Sorić, 2015), preliminarni empirijski podaci istih autora pokazuju zabrinjavajući nivo sedentarne aktivnosti petnaestogodišnjaka. Zbog toga je posebno važno od malena formirati zdrave životne navike, od kojih bi kineziološka aktivnost svakako trebala biti među prvima.

Morfološke karakteristike kao faktor antropološkog statusa treba shvatiti kao biološku i fiziološku osnovu koja generiše manifestaciju antropometrijskih mera, kao što su telesna visina i težina, obim trupa i ekstremiteta, dužina i debljina dugačkih kostiju (delovi udova i odgovarajući zglobovi), kožni nabori i dr. Njima se definiše rast i razvoj dece, kao njihova telesna građa i to tako što se utvrđuje struktura morfoloških karakteristika (Bala, 2004). Konstantna interakcija između nasledne osnove i okoline oblikuje rast i razvoj deteta. U endogene faktore koji utiču na rast i razvoj dece spadaju biološko nasleđe, hormoni; dok su egzogeni faktori: ishrana, socioekonomski i psihološki status, klima, godišnje doba, sekularni trend (Malina, Bouchard, & Bar-Or, 2004). Svi ovi faktori su bitni kod telesnog rasta i razvoja, s tim da na dužinu i širinu tela više utiče nasleđe, dok na telesnu masu i količinu potkožnog masnog tkiva više utiče spoljašnja sredina (Musalek, Kokstejn, Papez, Scheffler, Mumm, Czernitzki, & Koziel, 2017). Visina tela raste čak i onda kada telesna težina stagnira. Rast skeleta, posebno dugih kostiju ekstremiteta, osnova je povećanja telesne visine. Po pravilu, dimenzije ekstremiteta dostižu svoj maksimum i to prvo distalni, zatim proksimalni delovi. Rast ekstremiteta prati rast trupa i grudnog koša, a ramena dostižu svoju adultnu veličinu. Ovakav obrazac rezultira nesrazmerom u izgledu koja nestaje kada adolescent završi sa rastom (Đorđević-Nikić, 1995). Prva faza usporenog rasta počinje od 3. godine života i traje do početka puberteta, prosečni godišnji prirasti visine su 5 cm. Druga faza usporenog rasta se javlja kod devojčica od 16,5 godina, kada dostignu 98% od

lasts until the beginning of puberty, and the average annual increments of height are 5 cm. The second phase of slow growth occurs in girls from their 16.5 years of age, when they reach 98% of their final height (Malina, & Katzmarzyk, 2006) and it lasts until the age of 18, while in boys it starts at 17.5 years of age and with individual differences, ends when they turn 20 years of age.

The factor approach was defined a long time ago and it can be claimed with considerable certainty that the latent morphological space is essentially four-dimensional, that is, we can talk about the model of the structure of morphological characteristics, which consists of the following four morphological factors (Bala, 1981): longitudinal dimensionality of the skeleton factor - responsible for the growth of bones in length; transverse dimensionality of the skeleton factor - responsible for bone growth in width; body mass and volume factor - responsible for the total mass and volume of the body, and subcutaneous adipose tissue factor - responsible for the total amount of fat in the body.

Changes and differences in the latent structure of morphological characteristics of children of younger school age (7-14 years of age) were analysed by Sturm, Strel and Ambrozic (1995). The differences identified in all age and gender categories indicate a great instability of the latent structure of morphological characteristics. Based on the analysis of the structure of morphological characteristics, it was determined that in boys the rate of change is somewhat faster during the entire observed period, that the development is more harmonious, in contrast to girls where larger structural changes occur in periods of 7-8 and 11-12 years of age.

This age period is very important, because in the early motor development stage, the formation of the so-called Fundamental motor patterns (FMO) occurs, which are extremely important because they allow children to interact with the environment. FMOs are organized series of related activities in certain spatio-temporal stages. Therefore, it is believed that FMOs are very closely related to physical development, and especially to the development and maturation of the brain and central nervous system (Brady, 2004), and directly to the development of the entire locomotor system.

Hence, the aim of the research would be to define, in addition to gender differences in morphological characteristics, the connection of morphological characteristics of children of both genders with the basic motor knowledge of children, which will refer to the assessment of biotic knowledge.

svoje konačne visine (Malina, & Katzmarzyk, 2006) traje do 18. godine, a kod dečaka sa 17,5 godina i uz individualne razlike, traje do 20. godine.

Još davno je definisan faktorski pristup te se sa znatnom sigurnošću može tvrditi da je latentni morfološki prostor u suštini četvorodimenzionalan, odnosno, može se govoriti o modelu strukture morfoloških karakteristika, koji se sastoji od sledeća četiri morfološka faktora (Bala, 1981): faktor longitudinalna dimenzionalnost skeleta – odgovorna za rast kostiju u dužinu; faktor transverzalna dimenzionalnost skeleta – odgovorna za rast kostiju u širinu; faktor mase i voluminoznosti tela – odgovorna za ukupnu masu i obim tela i faktor potkožno masno tkivo – odgovorno za ukupnu količinu masti u organizmu.

Promenama i razlikama u latentnoj strukturi morfoloških karakteristika dece mlađeg školskog uzrasta 7-14 godina bavili su se Šturm, Strel i Ambrožić (1995). Utvrđene razlike u svim uzrasnim i polnim kategorijama, ukazuju na veliku nestabilnost latentne strukture morfoloških karakteristika. Na osnovu analize strukture morfoloških karakteristika utvrđeno je da je kod dečaka nešto brži tempo promena tokom celog posmatranog perioda, da je razvoj harmoničniji, za razliku od devojčica gde se veće stukturalne promene javljaju u periodima od 7-8 i od 11-12 godine.

Ovaj uzrasni period je jako bitan, jer upravo u ranom motoričkom razvoju, dolazi do formiranja tzv. Fundamentalnih motoričkih obrazaca (*eng. fundamental motor patterns, FMO*), čiji je značaj veliki, jer omogućava interakciju dece sa okolinom. FMO predstavljaju organizovane serije povezanih aktivnosti u određenim prostorno-vremenskim etapama. Stoga, važi mišljenje da FMO su veoma blisko povezane sa telesnim razvojem, a posebno sa razvojem i sazrevanjem mozga i centralnog nervnog sistema (Brady, 2004), a neposredno i sa razvojem celokupnog lokomotornog sistema.

Otuda bi cilj istraživanja bio definisati pored polnih razlika u morfološkim karakteristikama i povezanost morfoloških karakteristika dece oba pola sa temeljnim motoričkim znanjima dece koji će se odnosi se na procenu biotičkih znanja.

Material and Method

The research was of a transversal character, which means that one measurement was conducted in a sample of preschool children from Belgrade. The sample of participants was taken from the population of children by a non-random sampling method, a quota sample from Belgrade. The sample included 56 children, 30 of which were boys and 26 were girls who attended the preschool institution "Čukarica", aged 6 and 7, who were attending two school-preparation preschool groups at the time of measurement.

The measurement was conducted in May 2019, and the parents of the children who were planned to be part of the sample were given a survey questionnaire before the measurement. Testing their children could be performed only after their parents granted the approval, which is in line with the Declaration of Helsinki (World Medical Association Declaration of Helsinki, 2013).

The following basic anthropometric measures were chosen to assess the morphological characteristics: I - To assess the longitudinal dimensionality of the skeleton: 1) *Body height (cm),* 2) *Arm span (cm)* and 3) *Arm length (cm);* II - To assess the transverse dimensionality of the skeleton: 4) *Shoulder width (cm),* 5) *Pelvic width (cm)* and 6) *Wrist diameter (cm);* III - To assess the volume and weight of the body: 7) *Body weight (kg*), 8) *Average circumference of the outstretched upper arm (cm*) and 9) *Average circumference of the outstretched forearm (cm);* IV - To assess subcutaneous adipose tissue: 10) *Abdominal skinfold (cm),* 11) *Back skinfold (cm*) and 12) *Triceps skinfold (cm).*

The motor test called "The Test of Gross Motor Development – Second Edition (TGMD-2)" (Ulrich, 2000a) was used to assess biotic motor knowledge: V - Biotic motor knowledge: 13) TGMD-2 (sec).

When measuring morphological characteristics, there are certain standards that must be met (according to IBP standards): The participant's posture was standard standing (the participant was barefoot in underwear, head in the Frankfurt horizontal position). Measurement of anthropometric characteristics was performed during the morning hours (from 7 to 13 o'clock). The instruments were standard ones and were calibrated daily before the start and during the measurement after 10 measured participants. The participants were measured in the gyms and classrooms where physical education classes are organized. The gym was spacious and bright enough, and the air temperature was such that the participants felt comfortable (from 17 ºC to 22 ºC). It was necessary to set up two positions where measurements in the gym would take place before the start of the measurement. The distance between those places had to be at least 5 meters.

Materijal i metod

istraživanje je bilo transverzalnog karaktera, što znači da je bilo sprovedeno jedno merenje na uzorku dece predškolskog uzrasta iz Beograda. Uzorak ispitanika bio je izveden iz populacije dece neverovatnosnom metodom uzorkovanja, kvotnim uzorkom iz Beograda. Ukupan broj uzorka činilo je 56 dece, od toga 30 dečaka i 26 devojčice polaznika Predškolske ustanove "Čukarica", starosti 6 i 7 godina, koji su u trenutku merenja pohađali dve pripremne predškolske grupe.

Merenje je bilo izvršeno u maju mesecu 2018/2019. školske godine, a roditeljima dece koji su planirani uzorkom je pre merenja podeljen anketni upitnik. Testiranje na njihovoj deci je usledilo tek nakon odobrenja njihovih roditelja, što je u skladu sa Helsinskom deklaracijom (World Medical Association Declaration of Helsinki, 2013).

Za procenu morfoloških karakteristika bile su izabrane sledeće osnovne antropometrijske mere: I Za procenu longitudinalne dimenzionalnosti skeleta: 1) *Telesna visina (cm),* 2) *Raspon ruku (cm)* i 3) *Dužina ruke (cm);* II Za procenu tranverzalne dimenzionalnosti skeleta: 4) Širina ramena *(cm),* 5) Širina karlice *(cm)* i 6) *Dijametar ručnog zgloba (cm);* III Za procenu volumena i mase tela: 7) *Telesna težina (kg),* 8) *Srednji obim opružene nadlaktice (cm)* i 9) *Srednji obim opružene podlaktice (cm);* IV Za procenu potkožnog masnog tkiva: 10) *Kožni nabor trbuha (cm),* 11) *Kožni nabor leđa (cm)* i 12) *Kožni nabor nadlaktice (cm).*

Za procenu biotičkih motoričkih znanja izabran je motorički test „The Test of Gross Motor Development– Second Edition" (TGMD-2)" (Ulrich, 2000a): V Biotička motorička znanja: 13) *TGMD-2 (sek.)*

Prilikom merenja morfoloških karakteristika postoje određeni standardi koji se moraju ispoštovati (prema standardima IBP-a): Stav ispitanika bio je standardni stojeći (ispitanik bos u donjem vešu, glava u položaju franfurtske horizontale). Merenje antropometrijskih mera obavljalo se u toku prepodneva (od 7 do 13 časova). Instrumenti su bili standardne izrade i baždareni su svakodnevno pre početka i u toku merenja nakon 10 izmerenih ispitanika. Ispitanici su se merili u salama i kabinetima gde ispitanici obavljaju nastavu fizičkog vaspitanja. Sala je bila dovoljno prostrana i osvetljena, a temperatura vazduha takva da su se svučeni ispitanici osećali prijatno (od 17 °C do 22 °C). U sali pre početka merenja neophodno je bilo pripremiti dva radna mesta za merenja. Razmak između tih mesta je morao da bude najmanje 5 metara. Sva merenja obavljalo je četiri merioca, s tim što je svaki od njih izvršavao uvek ista mere-

All measurements were done by four people, with each of them always performing the same measurements. One of them measured body height and body weight, the other measured limb length, the third measured limb circumference and chest circumference, and the fourth recorded the measurement results. Participants who were measured had to be minimally dressed, barefoot, and wore only sports shorts. The measurement results were read while the instrument was on the measured parameter of the examinee, and the person who records the data, loudly repeated the results before entering it in the examinee's card for verification purposes. Medical measuring scales, a centimeter tape measure, a Martin anthropometer, a sliding caliper and a John Bull caliper were used as measuring instruments. The measurement was performed by a standard procedure following the IBP standard (International Biological Standards for each anthropometric measure).

„The Test of Gross Motor Development–Second Edition" (TGMD-2)" (Ulrich, 2000b).

It is a battery of tests that are used to assess the basic motor skills of children aged 3-10. It consists of 12 tests divided into two groups. The first group of tests refers to the assessment of locomotor knowledge (running, galloping, skipping, vault, long jump and sideways movement) while the second group of tests refers to the assessment of manipulative knowledge (baseball kick, running the ball, catching the ball, kicking the ball, throwing the ball, rolling the ball). The task is evaluated as motor knowledge in the shortest possible time, through correctly performed all subtests in the entire test. The total result is time in seconds. Based on groups of tests, biotic motor knowledge expressed over the shortest possible period of time is calculated.

Statistical analysis of data by using kinesiological statistics took place in several stages: Basic descriptive statistical parameters were determined for all variables. Starting with the measures of central tendency: arithmetic mean (AM); variability measures: standard deviation (S), minimum (MIN) and maximum measurement results (MAX); Measures of Shape of Distribution: skewness - measure of symmetry of distribution (SKEW) and kurtosis - measure of homogeneity of distribution (KURT). The normality of distribution on the initial and final measurements for all variables was tested using the Kolmogorov – Smirnov test, for both genders. Multivariate analysis of variance (MANOVA) and univariate analysis of variance (ANOVA) were used to determine statistically significant differences between boys and girls. Correlation and regression analysis were used to identify the relationship between morphological characteristics and biotic motor knowledge.

nja. Jedan od merilaca merio je telesnu visinu i telesnu masu, drugi je merio dužine ekstremiteta, treći obime ekstremiteta i obim grudnog koša, četvrti je zapisivao rezultate merenja. Ispitanici koji su bili mereni morali su biti minimalno obučeni, mereni su bosi, a na sebi su imali samo sportske gaćice. Rezultati merenja čitali su se dok je instrument bio na merenom parametru ispitanika, a osoba koja evidentira podatke radi kontrole, glasno je ponavljala rezultate pre upisa u karton ispitanika. Od mernih instrumentarija bili su korišteni medicinska decimalna vaga, centimetarska traka, antropometar po Martinu, klizni šestar i kaliper tipa Jon Bull. Merenje je realizovano standardnim postupkom pridržavajući se IBP (Internacionalnih bioloških standarda za svaku antropometrijsku meru).

„The Test of Gross Motor Development–Second Edition" (TGMD-2)" (Ulrich, 2000b).

To je baterija testova pomoću koje se procenjuju temeljna motorička znanja dece od 3-10 godina života. Sastoji se od 12 testova podeljenih u dve grupe. Prva grupa testova odnosi se na procenu lokomotornih znanja (trčanje, galop, poskoci, preskok, skok u dalj i bočno kretanje) dok se druga grupa testova odnosi na procenu manipulativnih znanja (bejzbol udarac, vođenje lopte, hvatanje lopte, udarac lopte nogom, bacanje loptice, kotrljanje loptice). Zadatak se vrednuje kao motoričko znanje u što kraćem vremenskom periodu, kroz pravilno izvedene sve podtestove u celokupnom testu. Ukupan rezultat iznosi vreme u sekundama. Na temelju grupa testova, izračunavaju se biotičko motoričko znanje izraženo kroz što kraći dati vremenski period.

Statistička obrada podataka kineziološkom statistikom odvijala se u nekoliko etapa:

Za sve varijable utvrđeni su osnovni deskriptivni statistici. Od mera centralne tendencije: aritmetička sredina (AS); od mera varijabilnosti: standardna devijacija (S), minimalni (MIN) i maksimalni rezultati merenja (MAX); od mera oblika distribucije: skjunis -mera simetričnosti distribucije (SKEW) i kurtosis - mera homogenosti distribucije (KURT). Testirana je normalnost disribucije na inicijalnom i finalnom merenju za sve varijable primenom Kolmogorov–Smirnov testa, za oba pola. Za utvrđivanje statistički značajnih razlika između dečaka i devojčica koristila se multivarijatna analiza varijanse (Manova) i univarijatna analiza varijanse (Anova). Za utvrđivanje povezanosti između morfoloških karakteristika i biotičkih motoričkih znanja korišćena je korelaciona i regresiona analiza.

Results

based on the results shown in Table 1, and on the basis of arithmetic mean and standard deviation values of the tested anthropometric variables, it can be said that good discriminant validity was observed, except for the variable *Abdominal skinfold*. Moreover, based on the minimum and maximum measurement results for the abovementioned variable, it can be seen that the range is slightly larger than usual. Measures of Shape of Distribution do not exceed the predicted coefficients, but the Kurtosis values for the variable *Back skinfold* are at the limit allowed. The skewness values for the variables intended to assess skin folds do not exceed the allowed coefficients. Such slight deviations could be expected when it comes to skin folds.

Table 1. *Basic descriptive statistics of anthropometric variables for boys*

Rezultati

Na osnovu vrednosti rezultata koji su prikazani u tabeli 1, a na osnovu aritmetičkih sredina i standardnih devijacija testiranih antropometrijskih varijabli može se konstatovati dobra diskriminativnost merenja, sem u varijabli *Kožni nabor trbuha*. Takođe se na osnovu minimalnog i maksimalnog rezultata merenja u pomenutoj varijabli vidi da je raspon nešto veći od uobičajenog. Mere oblika distribucije ne prelaze predviđene koeficijente, ali su kurtične vrednosti u varijabli *Kožni nabor leđa* na granici dozvoljenih. Skjunične vrednosti kod varijabli za procenu kožnih nabore ne prelaze dozvoljene koeficijente. Ovakva blaga odstupanja su se mogla i očekivati kada su kožni nabori u pitanju.

Tabela 1. *Osnovni deskriptivni statistici antropometrijskih varijabli za dečake*

Variable / Varijabla	*AM*	*S*	*MIN*	*MAX*	*Sk*	*Kurt*
Body height (cm) / Telesna visina *(cm)*	1237.41	43.24	1140.00	1298.00	-.646	-.266
Arm span (cm) / Raspon ruku *(cm)*	1224.05	44.31	1111.00	1288.00	-.941	.538
Arm length (cm) / Dužina ruke *(cm)*	488.50	20.10	447.00	521.00	-.265	-.576
Shoulder width (cm) / Širina ramena *(cm)*	365.41	22.69	322.00	406.00	-.181	-.899
Pelvic width (cm) / Širina karlice *(cm)*	212.95	10.80	198.00	235.00	.346	-.793
Wrist diameter (cm) / D. ručnog zgloba *(cm)*	35.36	2.44	31.00	41.00	.333	.039
Body weight (kg) / Telesna težina *(kg)*	254.36	31.166	208.00	329.00	.811	.742
Circumf. of upper arm (cm) / Obim nadlaktice *(cm)*	195.73	21.80	159.00	218.00	.835	.861
Circumf. of forearm (cm) / Obim podlaktice *(cm)*	182.09	12.86	161.00	218.00	1.012	1.813
Abdominal skinfold (cm) / K. nabor trbuha *(cm)*	85.86	45.13	34.00	210.00	1.252	1.414
Back skinfold (cm) / K. nabor leđa *(cm)*	62.36	23.18	40.00	140.00	1.534	2.934
Triceps skinfold (cm) / K. nabor nadlaktice *(cm)*	96.73	36.94	49.00	192.00	1.156	.876
TGMD-2 (sec) / TGMD-2 (sek)	26.73	12.24	20.94	44.00	1.156	.876

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

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

The results of basic descriptive statistical analysis of anthropometric variables for girls indicate good discriminant validity in all tested anthropometric variables, and even in the variables that assessed skin folds of girls. Girls are almost the same height as boys, but on average they are slightly lighter than boys. This could indicate that they are entering into the second phase of more intensive growth, which usually happens earlier in girls than in boys. Measures of Shape of Distribution indicate

Rezultati osnovnih deskriptivnih statistika antropometrijskih varijabli za devojčice ukazuju na dobru diskriminativnost u svim testiranim antropometrijskim varijablama, pa čak i u varijablama za procenu kožnih nabora devojčica. Devojčice su skoro istog rasta kao i dečaci, ali su u proseku nešto lakše od dečaka. To bi moglo da ukaže na ulazak u drugu fazu intenzivnijeg rasta, što se kod devojčica obično i dešava ranije nego kod dečaka. Mere oblika distribucije ukazuju na dobru homogenost u svim

good homogeneity in all variables, even the kurtosis values for skin folds do not exceed the coefficients +/- 1.50, which is considered to be a highly homogeneous sample.

varijablama, čak kurtične vrednosti kod kožnih nabora ne prelaze koeficijente +/- 1,50 što se smatra izrazito homogenim uzorkom.

Table 2. *Basic descriptive statistics of anthropometric variables for girls*

Tabela 2. *Osnovnih deskriptivnih statistika antropometrijskih varijabli za devojčice*

Variable / **Varijabla**	***AM***	***S***	***MIN***	***MAX***	***Sk***	***Kurt***
Body height / Telesna visina	1235.50	36.15	1164.00	1298.00	-.165	-.772
Arm span / Raspon ruku	1230.46	32.56	1160.00	1285.00	-.254	-.637
Arm length / Dužina ruke	514.58	39.66	452.00	564.00	-.319	-1.55
Shoulder width / Širina ramena	357.73	21.07	319.00	412.00	.384	.678
Pelvic width / Širina karlice	211.27	8.46	195.00	231.00	.395	-.059
Wrist diameter / D. ručnog zgloba	33.27	2.76	28.00	38.00	-.106	-.787
Body weight / Telesna težina	242.04	20.52	210.00	271.00	-.333	-.872
Circumf. of upper arm / Obim nadlaktice	195.69	23.08	162.00	248.00	.817	-.082
Circumf. of forearm / Obim podlaktice	186.31	15.21	163.00	217.00	.624	-.217
Abdominal skinfold / K. nabor trbuha	69.38	27.16	28.00	123.00	.336	-.968
Back skinfold / K. nabor leđa	58.50	17.47	38.00	99.00	1.032	.211
Triceps skinfold / K. nabor nadlaktice	78.42	15.41	50.00	112.00	.227	-.073
TGMD-2	29.42	5.41	22.00	46.00	.227	-.073

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

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

As for the morphological characteristics, there are tables with data on the normality of deviation of distribution from theoretical (normal) distribution for anthropometric variables are presented, all at the level of statistical significance p <0.01.

U prostoru morfoloških karakteristika prikazane su tabele normalnosti odstupanja distribucije od teorijske (normalne) distibucije u antropometrijskim varijablama, a sve na nivou zaključivanja statističke značajnosti p<0,01.

Table 3. *Distribution normality verified with the Kolmogorov - Smirnov test of anthropometric variables for boys*

Tabela 3. *Normalnost distribucije testirana Kolmogorov – Smirnov testom antropometrijskih varijabli za dečake*

Variable	***KS***	***p***	***MEA***
Body height / Telesna visina	.711	.694	.151
Arm span / Raspon ruku	.853	.460	.182
Arm length / Dužina ruke	.555	.918	.118
Shoulder width / Širina ramena	.555	.918	.118
Pelvic width / Širina karlice	.764	.604	.163
Wrist diameter / Dijametar ručnog zgloba	.567	.905	.121
Body weight / Telesna težina	.592	.875	.126
Circumf. of upper arm / Obim nadlaktice	.788	.564	.168

Circumf. of forearm / Obim podlaktice	.662	.772	.141
Abdominal skinfold / Kožni nabor trbuha	.955	.321	.204
Back skinfold / Kožni nabor leđa	1.011	.259	.216
Triceps skinfold / Kožni nabor nadlakta	.800	.544	.171
TGMD-2	.542	.112	.571

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

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

By looking at Table 3, which shows the normality of the distribution of anthropometric variables tested by the Kolmogorov-Smirnov test, it can be concluded that there is no statistically significant deviation of the tested distribution from the normal (theoretical) one. No value of the maximum extreme deviation exceeds the values of the K-S test and is not statistically significant. This justifies the application of parametric statistical methods of data analysis in the remainder of the research.

Iz tabela 3 u kojoj su prikazane normalnosti distribucije antropometrijskih varijabli, testirane Kolmogorov–Smirnov testom može se konstatovati da ne postoji statistički značajno odstupanje testirane distribucije od normalne (teorijske). Nijedna vrednost maksimalnog ekstremnog odstupanja ne prelazi vrednosti K-S testa i nije statistički značajna. To opravdava primenu parametrijskih statističkih metoda obrade podataka u nastavku istraživanja.

Table 4. *Distribution normality verified with the Kolmogorov - Smirnov test of anthropometric variables for girls*

Tabela 4. *Normalnost distribucije testirana Kolmogorov – Smirnov testom antropometrijskih varijabli za devojčice*

***Variable* / Varijabla**	***KS***	***p***	***MEA***
Body height / Telesna visina	.377	.999	.069
Arm span / Raspon ruku	.589	.879	.108
Arm length / Dužina ruke	.724	.672	.132
Shoulder width / Širina ramena	..671	.758	.123
Pelvic width / Širina karlice	.610	.851	.111
Wrist diameter / Dijametar ručnog zgloba	..805	.536	.147
Body weight / Telesna težina	1.009	.261	.184
Circumf. of upper arm / Obim nadlaktice	.522	.948	.095
Circumf. of forearm / Obim podlaktice	.697	.715	.127
Abdominal skinfold / Kožni nabor trbuha	1.038	.231	.190
Back skinfold / Kožni nabor leđa	.424	.994	.077
Triceps skinfold / Kožni nabor nadlakta	.908	.382	.166
TGMD-2	.631	.412	.620

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

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

By looking at Table 4, which shows the normality of distribution of anthropometric variables of girls tested by the Kolmogorov - Smirnov test, it can also be concluded

Iz tabela 4 u kojoj su prikazane normalnosti distribucije antropometrijskih varijabli, devojčica testirane Kolmogorov – Smirnov testom može se takođe konsta-

that there is no statistically significant deviation of the tested distribution from the normal one. As in the previous cases, it is concluded that without standardization and normalization of variables, all parametric methods of data analysis can be applied in the continuation of the research.

The table of analysis of differences at the multivariate and univariate level by gender is presented below, all at the level of statistical significance p <0.01.

Table 5. *Differences in morphological characteristics at the multivariate and univariate level by gender*

tovati nepostojanje statistički značajnog odstupanja testirane distribucije od normalne. Kao i u predhodnim slučajevima, konstatuje se da se bez standardizacije i normalizacije varijabli mogu primenjivati sve parametrijske metode obrade podataka u nastavku istraživanja.

Dalje je prikazana tabela analize razlika na multivarijatnom i univarijatnom nivou po polu, a sve na nivou zaključivanja statističke značajnosti p < 0,01.

Tabela 5. *Razlike u morfološkim karakteristikama na multivarijatnom i univarijatnom nivou po polu*

Variable / **Varijable**	***df***	***f***	***Chi-Square***	***P***
Body height / Telesna visina	3	.117	.001	.733
Arm span / Raspon ruku	3	.175	.002	.677
Arm length / Dužina ruke	3	6.378	.062	.013
Shoulder width / Širina ramena	3	1.574	.016	.213
Pelvic width / Širina karlice	3	.037	.000	.849
Wrist diameter / Dijametar ručnog zgloba	3	7.683	.074	.007
Body weight / Telesna težina	3	4.926	.049	.029
Circumf. of upper arm / Obim nadlaktice	3	8.733	.083	.004
Circumf. of forearm / Obim podlaktice	3	.484	.005	.488
Abdominal skinfold / Kožni nabor trbuha	3	.787	.008	.377
Back skinfold / Kožni nabor leđa	3	.487	.005	.487
Triceps skinfold / Kožni nabor nadlaktice	3	13.328	.122	.000
TGMD-2	3	4.023	.065	.014

F=5,750; P=0,000

Legend: *F-value of the multivariate Wilks' F-test; P- statistical significance of multivariate Wilks' F-test; f-value of f ratio for univariate test; Chi Square - magnitude of impact; p-statistical significance of the univariate f-test*

F=5,750; P=0,000

Legenda: *F-vrednost multivarijatnog Wilksovog F testa; P- statistička značajnost multivarijatnog Wilksovog F testa; f-vrednost f odnosa za univarijatni test; Eta Squared-veličina uticaja; p-statistička značajnost univarijatnog f testa*

Based on the results shown in Table 5 which discusses the differences in morphological characteristics between boys and girls in the whole sample, and based on Wilks' F-test and its statistical significance, a statistically significant difference by gender from the aspect of morphological characteristics is found. On the basis of the univariate f-test, individual differences indicate that the differences were observed in the following variables: *Wrist diameter* and *Skin fold of the upper arm* in favor of boys, as well as in the following variables: *Arm length* and *Upper arm circumference* in favor of girls. A significant difference was also observed in the variable Biotic motor knowledge (TGMD-2) in favor of better, i.e., lower average values for boys. Based on the magnitude of impact on the expressed differences within the

Na osnovu rezultata prikazanih u tabeli 5 koja govori o razlikama u morfološkim karakteristikama između dečaka i devojčica u celokupnom uzorku, a na osnovu Wilksovog F testa i njegove statističke značajnosti konstatuje se statistički značajna razlika po polu u morfološkom prostoru. Pojedinačne razlike ukazuju na osnovu univarijatnog f testa da su razlike ispoljene u varijablama: *Dijametar ručnog zgloba* i varijabli *Kožni nabor nadlakta* u korist dečaka, kao i u varijablama: *Dužina ruke* i *Obim nadlaktice* u korist devojčica. Značana razlika ispoljena je i u varijabli Biotičkih motoričkih znanja *(TGMD-2)* u korist boljih tj. manjih prosečnih vrednosti za dečake. Na osnovu veličine uticaja na ispoljene razlike unutar polnog di-

gender dimorphism, the greatest credit can be attributed to the variable *Triceps skinfold* with as much as 12.2%. The variables *Upper arm circumference* and *wrist diameter* contributed to this difference slightly less with some 8% and the smallest contribution to statistically significant differences was made by the variable *Arm length* with about 6%.

morfizma najveća zasluga se može pripisati varijabli *Kožni nabor nadlakta* čak 12,2%. Nešto manje su razlici doprinele varijable *Obim nadlaktice* i *Dijametar ručnog zgloba* sa nekih 8% i najmanji doprinos statistički značajnim razlikama ispoljen je u varijabli *Dužina ruke* oko 6%.

Table 6. *Correlation and regression analysis of biotic motor knowledge for both genders*

Tabela 6. *Korelaciona i regresiona analiza biotičkih motoričkih znanja za oba pola*

***Variable* / Varijabla**	***Boys* / Dečaci**				***Girls* / Devojčice**			
	r	***p***	***Beta***	***pbeta***	***r***	***p***	***Beta***	***pbeta***
Body height / Telesna visina	-0.14	0.17	-0.86	0.18	-0.17	0.14	-0.33	0.51
Arm span / Raspon ruku	-0.09	0.28	0.23	0.75	-0.14	0.19	0.25	0.72
Arm length / Dužina ruke	0.34	0.01	0.54	0.22	-0.01	0.49	0.01	0.99
Shoulder width / Širina ramena	-0.28	0.03	0.40	0.45	-0.14	0.18	-0.04	0.93
Pelvic width / Širina karlice	-0.13	0.19	0.09	0.58	-0.22	0.07	-0.15	0.31
Wrist diameter / Dijametar ručnog zgloba	-0.26	0.03	-0.07	0.69	0.14	0.19	0.17	0.25
Body weight / Telesna težina	-0.22	0.07	-0.40	0.80	0.28	0.03	0.21	0.32
Circumf. of upper arm / Sr. obim opruž. nadlaktice	-0.03	0.43	-0.27	0.41	0.41	0.00	0.42	0.13
Circumf. of forearm / Sr. obim opruž. podlaktice	0.08	0.29	0.59	0.07	-0.01	0.47	-0.17	0.47
Abdominal skinfold / Kožni nabor trbuha	-0.02	0.45	-0.32	0.47	0.10	0.27	0.05	0.88
Back skinfold / Kožni nabor leđa	0.12	0.20	0.45	0.18	0.26	0.04	0.10	0.59
Triceps skinfold / Kožni nabor nadlaktice	-0.18	0.11	-0.42	0.11	-0.15	0.16	0.21	0.38
R	0.61				0.65			
R^2	0.38				0.42			
P	0.08				0.05			

Legend: *r - Pearson correlation coefficient; p - level of statistical significance for r; Beta - regression coefficient; pbeta - level of significance of the regression coefficient; R - multiple correlation coefficient; R2 - coefficient of determination; P - significance of multiple correlation coefficient*

Legenda: *r - Pirsonov koeficijent korelacije; p - nivo statističke značajnosti za r; Beta – regresioni koeficijent; pbeta - nivo značajnosti regresionog koeficijenta; R - koeficijent multiple korelacije; R^2 - koeficijent determinacije; P - značajnost koeficijenta multiple korelacije*

When looking at the results from Table 6, it can be concluded that the system of predictor variables in girls in the given sample of participants had a statistically significant effect on the criterion variable TGMD-2, while it cannot be said for boys, where the predictor system of anthropometric variables was not statistically significant. The multiple correlation coefficient was R = 0.65 for girls and R = 0.61 for boys. The percentage of common variation between the system of predictor variables and the examined criterion was slightly higher in girls, 42%, than in boys, 38%. Based on the standardized Beta re-

Kada se pogledaju rezultati iz Tabele 6 može se konstatovati da je sistem prediktorskih varijabli kod devojčica na datom uzorku ispitanika, imao statistički značajan uticaj na kriterijsku varijblu *TGMD-2,* dok se to ne može konstatovati za dečake, gde prediktorski sistem antropometrijskih varijabli nije bio statistički značajan. Koeficijent multiple korelacije je kod devojčica iznosio R=0,65, a kod dečaka R=0,61. Procenat zajedničkog varijabiliteta između sistema prediktorskih varijabli i ispitivanog kriterijuma je bio nešto veći kod devojčica, 42%, nego kod dečaka, 38%. Na osnovu standardizovanog re-

gression coefficient, it can be concluded that none of the predictor variables from the mentioned set had a statistically significant effect on the criterion variable TGMD-2 in both groups of examinees.

Discussion

In accordance with the goals of the research and the hypotheses set, this research analysed the morphological characteristics and motor abilities of children, aged 6 and 7, of both genders from Belgrade from the aspect of differences and relations.

The results of the research indicate that boys have slightly higher average values of measures for the transverse dimensionality of the skeleton and subcutaneous adipose tissue. While girls have higher values of measures that assess the longitudinal dimensionality of the skeleton and in part the volume and mass of the body. Differences in the manifestation of physical development in the analyzed subsamples are the result of the specifics of the overall maturation process, the amount of motor activity, the status of the muscular, bone-joint and most importantly endocrine system (Jakšić, 2016). Based on the calculated values of the body mass index, i.e., nutritional status for both genders, which was (BMI=16.49±1.93kg/m2) for boys, and (BMI=15.67±1.72 kg/m2) for girls, it can be concluded that children are of normal nutritional status, and that girls had a slightly lower values of body mass index, which explicitly reflected higher average values of subcutaneous adipose tissue in boys as well as higher average values of longitudinal dimensionality of the skeleton in girls. Nowadays, body mass index serves for a quick but approximate assessment of nutritional status. It is important from the aspect of prevention and taking appropriate measures in childhood and adult obesity, but not in assessing morphological characteristics and structure (WHO, 2000). Therefore, it is best used along with the assessment of anthropometric measures, in order to further help in defining them. Thus, there are no significant changes in subsamples when it comes to growth and development. It can be concluded that during this period it happens evenly for both genders, and that girls are slightly lighter but with lower average values of subcutaneous fat, which indicates the fact that they will enter the phase of intensive growth faster since they have less subcutaneous mass, and that their length measures are somewhat larger. A similar study conducted by (Pelemiš, Mandić, Momčilović, Momčilović, & Srdić, 2021) which indicates that the percentage of malnourished girls in Serbia is slightly higher than the percent-

gresionih koeficijenta Beta, može se zaključiti da nijedna prediktorska varijabla iz navedenog skupa nema statistički značajan uticaj na kriterijsku varijablu *TGMD-2* kod obe grupe ispitanika.

Diskusija

U skladu sa ciljevima istraživanja, u ovom istraživanju analiziran je prostor morfoloških karakteristika i motoričkih sposobnosti dece, starosti 6 i 7 godina različitog pola iz Beograda sa aspekta razlika i relacija.

Rezultati istraživanja ukazuju da su dečaci nešto većih prosečnih vrednosti mera za procenu transverzalne dimenzionalnosti skeleta, te potkožnog masnog tkiva, dok devojčice prednjače u merama za procenu longitudinalne dimenzionalnosti skeleta i jednim delom volumenu i masi tela. Različitosti u ispoljavanju telesnog razvoja kod analiziranih subuzorka, posledica su specifičnosti ukupnog sazrevanja, količine kretnih aktivnosti, stanja mišićnog, koštano–zglobnog i po najviše endokrinog sistema (Jakšić, 2016). Na osnovu izračunatih vrednosti indeksa telesne mase tj. stanja uhranjenosti za oba pola koji je za dečake iznosio (ITM=16,49±1,93kg/m^2), a za devojčice (ITM=15,67±1,72kg/m^2) uočava se da su deca normalnog stanja uhranjenosti, te da su devojčice sa nešto manjih vrednostima indeksa telesne mase, što se eksplicitno odrazilo na veće prosečne vrednosti potkožnog masnog tkiva kod dečaka kao i veće prosečne vrednosti longitudinalne dimenzionalnosti skeleta kod devojčica. Danas indeks telesne mase služi za brzu, ali okvirnu procenu stanja uhranjenosti, njegova upotreba je značajna sa stanovišta prevencije i preduzimanja odgovarajućih mera kod gojaznosti dece i odraslih, ali ne i kod procene morfoloških karakteristika i strukture (WHO, 2000). Stoga ga je najbolje koristiti uz procenu antropometrijskih mera, kako bi dodatno pomogao u definisanju. Dakle, nema značajnih promena u subuzorcima kada je reč o rastu i razvoju. Može se konstatovati da on u ovom periodu teče ravnomerno za oba pola, te da su devojčice za nijansu lakše ali sa manjim prosečnim vrednostima potkožne masti u organizmu, što ukazuje na činjenicu da će brže ući u fazu intenzivnog rasta s obzirom da imaju manje potkožnih masti, te da su im dužinske mere nešto veće. Slično spovedeno istraživanje od strane (Pelemiš, Mandić, Momčilović, Momčilović, & Srdić, 2021) koje ukazuje da je procenat pothranjenih devojčica u Srbiji nešto veći od procenta dečaka, normalno uhranjenih takođe neznatno veći, rizično

age of boys, the percentage of normally fed girls is also slightly higher, at-risk of obesity is twice as lower and obese almost the same. Therefore, the findings obtained in the mentioned study are in line with our results obtained when it comes to the nutritional status, and the fact that girls enter the pre-adolescent phase earlier as well as the phase of intensive growth. Even earlier research by Stupar, Popović, & Peka (2014) in preschool children in the territory of Vojvodina showed that 8.62% of boys and 9.78% of girls were obese. The growth and development of preschool children is largely conditioned by genetic predispositions, especially when it comes to the longitudinal dimensions of the skeleton, which does not mean that the same cannot be said for nutrition, socio-economic status and physical activity that can affect growth and development. of the same (De Privitellio, Caput-Jogunica, Gulan, & Boschi, 2007). Some researchers, with their experimental programs, managed to positively influence the morphological characteristics of preschool children. These facts are supported by research that had an additional program of physical activities in which, compared to groups that did not have a physical exercise program, showed a reduction in body fat and volume and body weight (Kinkela, & Marić, 2013; Bocca, Corpeleijn, Van den Heuvel, Stolk, & Sauer, 2014). The tendency of earlier involvement of children in programmed physical activities inevitably leads to modification in terms of more useful effect on the youngest in the broadest sense (Dobrila, Sporiš, & Hraski, 2003).

Therefore, there is no doubt that programmed physical activity is successful in transforming anthropological status in preschool children. When looking at the results of the test for the assessment of biotic motor knowledge "The Test of Gross Motor Development" (TGMD-2), it is concluded that the boys achieved better average values in most parts of this test. It can be concluded that by working on improving all types of coordination, which are integral parts of assessment in this motor test, children solve more complex motor problems better, use their potentials more rationally and economically and thus enable their other motor abilities to be maximized. Therefore, in preschool age, with the development of coordination, all other types of motor abilities also develop indirectly. Kamenov (1997) points out that with physical activity, children overcome negative emotional states and satisfy their needs. Children are encouraged through physical activity, even shy children, and mistakes in their behavior are eliminated. According to most experts in the field of child psychoanalysis, physical activity is a type of therapy that serves as a vent for unpleasant feelings,

gojaznih upola manji i gojaznih gotovo isti. Dakle, nalazi dobijeni u pomenutoj studiji u skadu su sa našim dobijenim rezultatima kada je u pitanju stanje uhranjenosti, te ulazak devojčica ranije u predpubertetsku fazu i fazu intenzivnog rasta. Još ranija istraživanja Stupara, Popovića i Peke (2014) na predškolskoj deci na teritoriji Vojvodine su pokazala da je 8,62 % dečaka i 9,78 % devojčica bilo gojazno. Rast i razvoj dece predškolskog uzrasta u velikoj meri je uslovljen genetskim predispozicijama naročito kada je u pitanju longitudinalna dimenzionalnost skeleta, što ne znači da se to takođe ne može reći za ishranu, socijalno-ekonomski status i fizičku aktivnost kojima se može delovati na rast i razvoj istih (De Privitellio, Caput-Jogunica, Gulan, & Boschi, 2007). Pojedini istraživači svojim eksperimentalnim programima uspevali su pozitivno da utiču na morfološke karateristike predškolske dece. Ove činjenice potkrepljuju istraživanja koja su imala dodatni program fizičkih aktivnosti u kojima u odnosu na grupe koje nisu imale program fizičkog vežbanja dolazi do redukcije telesnih masti i volumena i mase tela (Bocca, Corpeleijn, Van den Heuvel, Stolk, & Sauer, 2014; Kinkela, & Marić, 2013). Tendencija sve ranijeg uključivanja dece u programirane fizičke aktivnosti neminovno dovodi do modifikacije u smislu utilitarnijeg delovanja na najmlađe u najširem smislu (Dobrila, Sporiš, & Hraski, 2003).

Dakle nema sumnje da je programirana fizička aktivnost uspešna u transformaciji antropološkog statusa u predškolskom uzrastu. Kada se sagledaju rezultati testa za procenu biotičkih motoričkih znanja The Test of Gross Motor Development" (TGMD-2), konstatuje se da su dečaci ostvarili bolje prosečne vrednosti u većini delova ovog testa. Može se zaključiti da radom na poboljšanju svih vidova koordinacije, koji su sastavni delovi procene u ovom motoričkom testu, deca bolje rešavaju složenije motoričke probleme, racionalnije i ekonomičnije koriste svoje potencijale i time omogućavaju da se ostale njihove motoričke sposobnosti maksimalno ispolje. Zbog toga se u predškolskom uzrasnom dobu, sa razvojem koordinacije indirektno razvijaju i svi drugi vidovi motoričkih sposobnosti. Kamenov (1997), ističe da u fizičkoj aktivnosti deca prevazilaze negativna emocionalna stanja, te nalazi zadovoljstvo svojih potreba. Deca se kroz fizičku aktivnost podstiču, čak i stidljiva deca, te se u njihovom ponašanju otklanjaju greške. Prema mišljenjima većine stručnjaka iz oblasti dečije psihoanalitike, fizičke aktivnosti su vid terapije koja

the ability to dissipate their accumulated aggression in the most painless way and to express and release their repressed emotions (Stupar, 2016). Research (Bala, Hošek, & Momirović, 2002) and this indicates that children who are not physically active can express their behavior through a kind of aberrant behavior. It is pointed out that there are few activities that "can influence such a large number of characteristics, traits and abilities with professionally guided physical education and training or sports and recreational exercise" (Findak, 2016).

When it comes to correlation, the system of predictor variables in girls had a statistically significant effect on the criterion variable TGMD-2, while this cannot be stated for boys. The values of Pearson correlation coefficient in girls indicated a mathematically negative and logically positive correlation between the predictor variable for assessing body volume and weight - *Body weight*. This correlation was statistically significant which implies that the heavier the girls, the better their scores in the criterion variable for assessing whole body coordination. The variable for the assessment of subcutaneous adipose back tissue, *back skinfold* had a mathematically positive, but logically negative statistically significant correlation with the criterion variable *TGMD-2,* so it can be stated that if the girls had more subcutaneous fat, the worse their results were. The same is the case with the variable *Body Weight*. This linearity of the results indicates that the percentage of body fat reduces the ability of girls to achieve better results in the coordination test, which is controlled by the movement structuring system. The remaining percentage can be attributed to some other characteristics and abilities of the anthropological status of the participants that were not part of this predictor system (motivation, conative characteristics, cognitive abilities), because they can have a great impact on the results in this test, especially in preschool children (Bala, Jaksic, & Popovic, 2009). In boys, a certain correlation between predictor variables and the criterion was also observed, but since the predictor system was not statistically significantly related to the criterion, it can be assumed that this happened by chance, and further interpretation would be just speculation.

Conclusion

this kind of a research should only be a guideline for further monitoring and research of the motor and morphological characteristics of preschool children. It should also be noted that it would be good to use these types of motor tests with preschool children where the child is re-

služi kao ventil za neprijatna osećanja, mogućnost da istroši svoju nagomilanu agresiju na najbezbolniji način kao i da se ispolji i oslobodi svojih potisnutih emocije (Stupar, 2016). Istraživanja (Bala, Hošek i Momirović, 2002) ukazuja da deca koja nisu fizički aktivna svoje ponašanje mogu da ispolje kroz vid aberantnog ponašanja. Ističe se da je malo aktivnosti koje „mogu profesionalno vođenim fizičkim vaspitanjem i treningom ili sportsko-rekreativnim vežbanjem uticati na tako veliki broj karakteristika, osobina i sposobnosti" (Findak, 2016).

Kada je povezanost u pitanju, sistem prediktorskih varijabli kod devojčica imao je statistički značajan uticaj na kriterijsku varijblu *TGMD-2,* dok se to ne može konstatovati za dečake. Vrednosti Pirsonovog koeficijenta korelacije kod devojčica ukazale su na matematički negativnu, a logički pozitivnu povezanost prediktorske varijable za procenu volumena i mase tela - *Telesna težina*. Ta povezanost je bila statistički značajna što implicira na to da što su devojčice bile teže, rezultati su im bili bolji u kriterijskoj varijabli za procenu koordinacije celog tela. Varijabla za procenu potkožnog masnog tkiva na leđima, *Kožni nabor leđa* je imala matematički pozitivnu, ali logički negatinu statistički značajnu povezanost sa kriterijskom varijablom *TGMD-2* pa se može konstatovati, da što su devojčice posedovale više potkožne masti, rezultati su im bili lošiji. Isti slučaj je i sa varijablom *Telesna težina.* Ovakva linearnost rezultata ukazuje da procenat telesne masti u telu umanjuje sposobnost devojčica u ostvarivanju boljih rezultata u testu za procenu kordinacije koji je pod kontrolom sistema za strukturiranje kretanja. Preostali procenat se može pripisati nekim drugim karakteristikama i sposobnostima antropološkog statusa ispitanika koje nisu bile deo ovoga prediktorskog sistema (motivacija, konativne karakteristike, kognitivne sposobnosti,), jer one mogu da imaju veliki uticaj na rezultate u ovom testu, pogotovo na uzrastu dece predškolskog uzrasta (Bala, Jakšić, Popović, 2009). Kod dečaka je takođe uočena određena povezanost prediktorskih varijabli sa kriterijumom, ali s obzirom da prediktorski sistem nije bio statistički značajno povezan sa kriterijumom, može se pretpostaviti da se to desilo slučajno, te bi dalja interpretacija bila samo nagađanje.

Zaključak

Ovakvo istraživanje treba da bude samo smernica u daljem praćenju i istraživanju motoričkog i morfološkog prostora dece predškolskog uzrasta. Takođe treba napomenuti da bi bilo dobro sa decom predškolskog uzrasta koristiti ovakve vidove motoričkih testova u kojima se

peatedly challenged with different situations, which, on the one hand, have a positive effect on eye accommodation, and on the other hand, improve the speed of alternative hand movements, explosiveness, and a good part of the movement structuring mechanism. This is important because not every ability can be viewed as one and the same, because children react with all their being in preschool age, and that reaction depends on many factors. It is these factors that should be part of the predictor system. Recommendations for further research could be to examine and monitor the development of general motor factor, which is very common in preschool children, and to analyse its connection with its morphological characteristics, and examine possible relations between these, which would explain the connections of certain parts of morpho-motor status of preschool children.

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.

dete više puta konfrontira sa različitim situacijama sa jedne strane koji povoljno deluje na akomodaciju oka, a sa druge strane poboljšava se i brzina alternativnih pokreta ruku, eksplozivnost, te dobar deo mehanizma za strukturiranje kretanja. To je bitno zbog toga što se ne može svaka sposobnost posmatrati kao jedna, jer deca reaguju svim svojim bićem u predškolskom uzrastu, a ta reakcija zavisi od mnoštva faktora. Upravo ti faktori trebali bi biti deo prediktorskog sistema. Preporuke za naredna istraživanja bi se mogle ogledati kroz ispitivanje i praćenje razvoja generalnog motoričkog faktora koji je veoma zastupljen kod predškolske dece, a njega suprotstaviti njihovim morfološkim karakteristikama, te ispitati eventualne relacije, koje bi objasnile povezanosti određenih delova morfo-motoričkog statusa predškolske dece.

Izjava

Izjavljujemo da su autori podjednako doprineli radu.

Konflikt interesa

Između autora ne postoji interesni konflikt.

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