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Short notice
Kratko saopštenje

The Changes in the Status of the Foot Arch, Motor Abilities and Morphological Characteristics Under the Influence of Training Processes of Sports School

Promene u statusu svoda stopala, motoričkim sposobnostima i morfološkim karakteristikama pod uticajem trenažnog procesa školice sporta

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Abstract: *The aim of the study was to examine the influence of training processes modeled after the School of Sport of Faculty of Pedagogy, on changes in the status of the foot arch, motor abilities and morphological characteristics of preschool and young school children. The study was of longitudinal character. The experimental training program was conducted from 1st September 2018 till 1st December 2018. The follow-up included 92 subjects in total, divided into two sub-samples: one comprised of experimental group subjects, 45, and the other, control group of 47 subjects. The analysis of the status of the foot arch was performed with a Digital Computer Podoscope. For the assessment of the motor abilities a battery of motor abilities was used, modeled after Bala, Stojanović, Stojanović, (2007). Measurement of morphological characteristics was performed with the application and adherence to the International Biological Program. Using the MANOVA and χ2 test, the results obtained after the final measurement show statistically significant changes in motor abilities, morphological characteristics, and the status of the arch of the foot in children.*

Keywords: *Postural status, motor abilities, morphological characteristics, School of Sport of Faculty of Pedagogy.*

Sažetak: *Cilj istraživanja bio je da ispita uticaj trenažnog procesa po modelu „Školice sporta“ Pedagoškog fakulteta Bijeljina na promene u statusu svoda stopala, motoričkim sposobnostima i morfološkim karakteristikama dece predškolskog i mlađeg školskog uzrasta oba pola. Istraživanje je bilo longitudinalnog karaktera. Trenažni eksperimentalni program je trajao od 1.9.2018. do 1.12.2018.godine. Praćenjem je obuhvaćeno 92 ispitanika, podeljenih u dva subuzorka, jedan koji su činili ispitanici eksperimentalne grupe, njih 45, i drugi koji su činile ispitanici kontrolne grupe, njih 47. Analiza statusa svoda stopala izvršena je digitalnim kompjuterskim podoskopom. Za procenu motoričkih sposobnosti primenjena je baterija motoričkih testova po modelu Bala, Stojanović, Stojanović, (2007). Merenje morfoloških karakteristika izvršeno je uz primenu i poštovanje Internacionalnog biološkog programa. Primenom Manove i χ^2 testa dobijeni rezultati nakon finalnog merenja pokazuju statistički značajne promene u motoričkim sposobnostima, morfološkim karakteristikama, statusu svoda stopala kod dece.*

Ključne reči: *Posturalni status, motoričke sposobnosti, morfološke karakteristike, školica sporta.*

Introduction

During the growth period there are the three critical periods in which significant fast growth takes place (at the age of 6–24 months, 5–8 years and 11–14 years). During this period of life, the children are at increased risk of de-

Uvod

Tokom perioda rasta postoje tri kritična perioda u kojima se odvija izuzetno brz rast (u uzrastu od 6–24 meseca, 5–8 godina i 11–14 godina). U toku ovog perioda života kod dece povećan je rizik od nastanka deformiteta

veloping spinal deformities, therefore the regular diagnostic examinations are vital in order to prevent and correct the deformities. In addition to the radiographic method for the detection of spinal curvature, the Moiré method, 3SPACE, Spinal Mouse, Spinal Touch, Zebris medical are also used, which analyse the spinal column with great accuracy (Jager, Kristof, Kiss, 2015). While some postural disorders are typical for the growth and development of the individual the others can be harmful with a negative impact on the quality of life. Most of the postural problems begin in childhood. Body posture depends on many factors, including age, gender, race, somatic structure of the joint-skeletal system and muscles, mental status, lifestyle, utilisation of physical activities. Muscle strength is an important aspect of physical fitness and health, and a decrease in muscle strength can cause significant functional limitations (Takken, Elst, Spermon, Helders, Prakken, van der Net, 2003). Maintaining the correct postural status also depends on the correct position of the feet and the height of the arches of the feet. The imbalance in one joint is manifested in all other joints, and due to the lowered arches of the feet the knees move towards the medial part disrupting the entire posture in a chain. Echarri, & Forriol (2003) state that at the age from 3 to 4 years the prevalence of deformity in children is up to 70%. In addition to many negative outcomes related to the health and psychosocial status of the children and youth, the weight gain is certainly responsible and associated with the negative changes in the body posture. The data from eminent institutions around the world (USDHHS, 2004) and scientists (Kelly et al., 2004; Jackson et al., 2003; Reilly et al., 2003) indicate that nowadays the children are less mobile and lead a sedentary lifestyle - the life with numerous benefits and pleasures that are available to them today through the technical and technological achievements, which has the negative consequences for their current health, but also their health in the future. The children who are 6 to 12 years old, that have better-developed motor abilities and skills, spend more time doing the physical activities and less sedentary lifestyle compared to those children who have a reduced level of developed motor abilities (Houwen, Hartman, & Visscher, 2009). In order for children to adequately develop motor abilities, they need exercise and programmed guidance by professionals (Robinson, & Goodway, 2009). The American National Association for Sports and Physical Education (NASPE) promotes programmed physical exercise in early childhood, encouraging better motor development. The literature in kinesiology is more dedicated to the analysis of motor abilities through transverse measurements than to their development at the youngest

kičmenog stuba, te su redovni dijagnostički pregledi od vitalnog značaja u cilju prevencije i korekcije deformiteta. Pored radiografske metode za detekciju zakrivljenosti kičmenog stuba, koriste se još i (Moiré metoda, 3SPACE, Spinal Mouse, Spinal Touch, Zebris medical) koje sa velikom preciznošću analiziraju kičmeni stub (Jager, Kristof, Kiss, 2015). Pojedini posturalni poremećaji su tipični za rast i razvoj individue, dok neki pak drugi, mogu biti štetni i mogu negativno uticati na kvalitet života. Većina posturalnih problema počinje u detinjstvu. Držanje tela zavisi od mnogih faktora, uključujući starost, pol, rasu, somatsku strukturu koštano-zglobnog sistema i mišića, mentalni status, način života, upražnjavanje fizičkih aktivnosti. Mišična snaga je važan aspekt fizičke spremnosti i zdravstvenog stanja, a smanjenje mišićne snage može prouzrokovati značajna funkcionalna ograničenja (Takken, Elst, Spermon, Helders, Prakken, van der Net, 2003). Održavanje pravilnog posturalnog statusa zavisi i od pravilnog položaja stopala i visine svodova stopala. Neravnoteža u jednom zglobu, manifestuje se na sve druge zglobove, te usled spuštenih svodova stopala kolena se kreću ka medijalnom delu narušavajući lančano čitavu posturu. Echarri, & Forriol (2003) navode da u uzrastu od 3 do 4 godine prevalenca deformiteta kod dece iznosi do 70%. Povećana telesna masa je pored niza negativnih ishoda koji se odnose na zdravlje i psihosocijalni status dece i omladine, svakako odgovorna i povezana sa negativnim promenama u držanju tela. Podaci eminentnih institucija u svetu (USDHHS, 2004) i naučnih radnika (Kelly et al., 2004; Jackson et al., 2003; Reilly et al., 2003) navode da se današnja deca sve manje kreću, i da masovno vode sedentarni način života uz mnogobrojne pogodnosti i ugođaje koji su im danas na raspolaganju preko tehničko tehnoloških dostignuća, što ima negativne posledice po trenutno zdravlje, ali i njihovo zdravlje u perspektivi. Deca koja u uzrastu od 6 do 12 godine imaju bolje razvijene motoričke sposobnosti i veštine, više vremena provode u kretnim aktivnostima i manje upražnjavaju sedentarni način života u odnosu na onu decu koja imaju smanjen nivo razvijenosti motoričkih sposobnosti (Houwen, Hartman, & Visscher, 2009). Da bi deca adekvatno razvijala motoričke sposobnosti, potrebno im je vežbanje i programirano usmeravanje od strane stručnih lica (Robinson, & Goodway, 2009). Američka nacionalna asocijacija za sport i fizičko vaspitanje (NASPE) propagira bavljenje programiranim fizičkim vežbanjem u ranom dečijem uzrastu, podstičući bolji motorički razvoj. Literatura u kineziologiji više je posvećena analizi motoričkih sposobnosti kroz transverzalna merenja nego njihovom razvoju u najmlađem uzrastu. Zadatak

age. The task of programmed exercise in preschool and younger school age is to build a variety of motor movement structures that will enable learning and solving complex motor tasks adapted to different and specific contexts of movement (Clark, Metcalfe, 2002). Understanding motor development is complex, because over the years, kinesiologists around the world have discovered a large amount of exact information about when and in what order motor abilities appear and what affects them. Some studies emphasise that the behavior of parents and their life habits are significantly related to the habits of their children aged 5 to 10 years (Ulrich, 2004). Many countries in the world are subjected to the influence of fast and poor-quality nutrition, acquiring poor eating habits and therefore, the chronic conditions of obesity, increased skin folds, voluminousness and similar in children of school and preschool age. Of particular concern is the fact that obesity and poor eating habits are transmitted from youth to later stages of life which reflects not only on the quality of life but also the health of the individual; which later leads to chain reactions and impacts related to material costs for treating diseases which to a greater or lesser extent directly correlate with obesity. It is important to identify the risk factors related to morphological characteristics in children as a whole and, accordingly, to lead future efforts in the prevention and treatment of not only obesity but also impaired morphological status overall. The aim of this study was to examine the changes in postural status, motor abilities and morphological characteristics under the influence of training processes of the School of Sports of the Faculty of Pedagogy.

Method

The research was of a longitudinal character. The training experimental program lasted from 1st September 2018 to 1st December 2018 with two trainings of 45 minutes per week. The follow-up included 92 subjects, divided into two sub-samples, one consisting of experimental groups, 45, and the other consisting of control subjects, 47. All subjects at the time of the measurements were 6 years old (+/- 6 months) and were the students of preschool institutions "Chika Jova Zmaj" and "Kolibri" from Bijeljina. The experimental group worked according to the program of the School of Sports of the Faculty of Pedagogy, while the control group realised regular activities according to the program of the Ministry of Education and Culture of the Republic of Srpska. The analysis of the status of the arch of the foot was performed with a Digital Computer Podoscope.

programiranog vežbanja u predškolskom i mlađem školskom uzrastu je izgradnja raznovrsnih motoričkih kretnih struktura koje će omogućiti kasnije učenje i rešavanje složenih motoričkih zadataka prilagođenih različitim i specifičnim kontekstima pokreta (Clark, Metcalfe, 2002). Razumevanje motoričkog razvoja je kompleksno, jer godinama unazad kineziolozi širom sveta otkrivaju veliki broj egzaktnih informacija o tome kada i kojim redosledom se pojavljuju motoričke sposobnosti i šta sve na njih utiče. Neke studije naglašavaju da je ponašanje roditelja i njihove životne navike značajno povezano sa navikama njihove dece u uzrastu od 5 do 10 godine (Ulrich, 2004). Mnoge zemlje u svetu podležu uticaju brze i nekvalitetne ishrane, stičući loše prehrambene navike, a sa njima i hronična stanja gojaznosti, povećanih kožnih nabora, voluminoznosti i slično kod dece školskog i predškolskog uzrasta. Posebno zabrinjava činjenica da gojaznost i loše prehrambene navike iz mladosti se prenose i u kasnije faze života, što se odražava ne samo na kvalitet života ljudi, nego i zdravlje individue koje povlači lančane reakcije i uticaje koje se odnose i na materijalne troškove za lečenje bolesti koje u većoj ili manjoj meri direktno koreliraju sa gojaznošću. Značajno je identifikovati faktore rizika koji se odnose na morfološke karakteristike kod dece u celini te u skladu sa tim voditi buduće napore u prevenciji i lečenju ne samo gojaznosti nego i narušenog morfološkog statusa u celini.

Cilj ovog rada bio je ispitati promene u posturalnom statusu, motoričkim sposobnostima i morfološkim karakteristikama pod uticajem trenažnog procesa „Školice sporta" Pedagoškog fakulteta.

Metod

istraživanje je bilo longitudinalnog karaktera. Trenažni eksperimentalni program je trajao od 1.9.2018. do 1.12.2018. godine sa po dva termina od 45 minuta sedmično. Praćenjem je obuhvaćeno 92 ispitanika oba pola, podeljenih u dva subuzorka, jedan koji su činili eksperimentalne grupe, njih 45 (od toga 21 dečak i 24 devojčice), i drugi koji su činile ispitanici kontrolne grupe, njih 47 (od toga 23 devojčice i 24 dečaka). Svi ispitanici u trenutku merenja imali 6 godina (+/- 6 meseci) i bili su polaznici predškolskih ustanova „Čika Jova Zmaj" i „Kolibri" iz Bijeljine. Eksperimentalna grupa radila je po programu Školice sporta Pedagoškog fakulteta, dok je kontrolna grupa realizovala aktivnosti po programu Ministrastva prosvete i kulture Republike Srpske. Analiza statusa svoda stopala izvršena je digitalnim kompjuterskim podoskopom.

Table 1. *Global plan for the experimental program*

Tabela 1. *Globalni plan eksperimentalnog programa.*

Experimental program for the strength development / **Eksperimentalni program za razvoj snage**	***Number of treatments /*** **Broj tretmana**
1. Elements of basic sports - Gymnastics / Elementi bazičnih sportova - Gimnastika	6
2. Elements of basic sports - Athletics / Elementi bazičnih sportova - Atletika	6
3. Exercises for the development of motor skills - polygons / Vežbe za razvoj motoričkih sposobnosti - poligoni	5
4. Corrective exercise / Korektivno vežbanje	7
7. PNF - proprioceptive neuromuscular facilitation / PNF - proprioceptivna neuromuskularna facilitacija	after each treatment / posle svakog tretmana
Total treatments / **Ukupno tretmana:**	***24***

The status of the arch of the foot was analysed with a Digital Computer Podoscope, as follows:

1. No deformity
2. I degree of deformity
3. II degree of deformity
4. III degree of deformity
5. IV degree of deformity

For the assessment of the motor abilities a battery of motor abilities was used according to the model of Bala, Stojanović, Stojanović, (2007).

I To estimate the factors structuring the movement:

1) Backward field (0.1 s),

II To estimate the excitation intensity factor of motor units:

2) Standing long jump (cm),

3) Running 20 m high start (0.1 s),

III To estimate the factors of functional synergy and tone regulation:

4) Hand tapping (freq.),

5) Wide-angle seated forward bend (cm),

IV To estimate the excitation duration factor of motor units:

6) Trunk lifting while lying on the back for 60 s (frequency),

7) Flexed arm hangs (0.1 s).

The measurement of morphological characteristics was performed with the application and respect of the International Biological Program.

The following anthropometric measures were selected as a sample of measuring instruments for the purpose of this study:

I To assess the longitudinal dimensionality of the skeleton:

1) Body height,

2) Arm span,

II To assess the transverse dimensionality of the skeleton:

3) Shoulder width,

Status svoda stopala digitalnim kompjuterskim podoskopom je analiziran softverski na sledeći način:

1. Nema deformiteta
2. I stepen deformiteta
3. II stepen deformiteta
4. III stepen deformiteta
5. IV stepen deformiteta

Za procenu motoričkih sposobnosti primenjena je baterija motoričkih sposobnosti po modelu Bala, Stojanović, Stojanović, (2007).

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 (frek.),

5) Pretklon u sedu raznožno (cm),

IV Za procenu faktora trajanja ekscitacije motoričkih jedinica:

6) Podizanje trupa za 60 s (frek.),

7) Izdržaj u zgibu podhvatom (0,1 s).

Merenje morfoloških karakteristika izvršeno je uz primenu i poštovanje Internacionalnog biološkog programa.

Kao uzorak mernih instrumenata za potrebe rada bile su izabrane sledeće antropometrijske mere:

I Za procenu longitudinalne dimenzionalnosti skeleta:

1) Telesna visina,

2) Raspon ruku,

II Za procenu tranverzalne dimenzionalnosti skeleta:

3) Širina ramena,

III Za procenu volumena i mase tela:

4) Telesna težina,

5) Srednji obim opružene nadlaktice,

III To estimate body volume and weight:
4) Body mass,
5) Medium circumference of the extended upper arm,
6) Medium circumference of the bent upper arm,
IV To estimate the subcutaneous adipose tissue:
7) Skinfold of the abdomen,
8) Skinfold of the back,
9) Skinfold of the upper arm,
V To assess body nutrition:
10) Body mass index

Statistical data processing consisted of several stages. Firstly, the basic descriptive indicators were calculated at the initial and final measurement for both analysed groups. Using Multivariate analysis of variance, the differences between the experimental and control groups at the initial and final measurements were calculated. The analysis of the status of the arch of the foot was realised by calculating the $\chi 2$ test and the contingency coefficient.

Results

In accordance with the methodology of kinesiological research the results section presents six tables where the results of the initial and final measurements in motor abilities, morphological characteristics and the status of the arch of the foot are presented.

Table 2. *Differences in the initial measurement in motor abilities between the groups of subjects*

Variables / Varijable	*Group /* Grupa	*AM /* AS	*S*	*f*	*p*
Backward field / Poligon natraške (s)	E	44.00	12.29	0.186	0.66
	C / K	42.48	10.43		
Running 20 m high start / Trčanje 20m	E	5.93	1.32	0.098	0.75
	C / K	5.83	0.61		
Flexed arm hangs / Izdržaj u zgibu	E	12.64	12.95	1.096	0.30
	C / K	9.14	6.19		
Trunk lifting while lying on the back / Podizanje trupa	E	15.23	8.04	2.901	0.09
	C / K	11.24	7.19		
Hand tapping / Taping rukom	E	44.39	6.08	2.110	0.15
	C / K	47.53	8.84		
Standing long jump / Skok u dalj	E	73.77	23.39	0.030	0.86
	C / K	74.88	15.64		
Wide-angle seated forward bend / Pretklon u sedu	E	76.19	6.93	0.007	0.93
	C / K	76.00	8.58		

F=1.521; P=0.188

Legend: *AM - arithmetic mean; S - standard deviation; F - value of multivariate Wilks F test; P - statistical significance of the multivariate Wilks F test; f - value of univariate f test; p - statistical significance of univariate f test.*

6) Srednji obim savijene nadlaktice,
IV Za procenu potkožnog masnog tkiva:
7) Kožni nabor trbuha,
8) Kožni nabor leđa,
9) Kožni nabor nadlaktice.
V Za procenu telesne uhranjenosti:
10) Indeks telesne mase

Statistička obrada podataka sastojala se iz nekoliko etapa, prvo su izračunati osnovni deskriptivni pokazatelji na inicijalnom i finalnom merenju za obe analizirane grupe. Primenom Multivarijatne analize varijanse izračunate su razlike između eksperimentalne i kontrolne grupe na inicijalnom i finalnom merenju. Analiza statusa svodova stopala realizovana je izračunavanjem χ^2 testa i koeficijenta kontigencije.

Rezultati

u skladu sa metodologijom kineziloških istraživanja, u poglavlju rezultati, prikazano je šest tabela, gde su predstavljeni rezultati inicijalnog i finalnog merenja u motoričkim sposobnostima, morfološkim karakteristikama i statusu svoda stopala.

Tabela 2. *Razlike na inicijalnom merenju u motoričkim sposobnostima između grupa ispitanika*

F=1,521; P=0,188

Legenda: *AS – aritmetička sredina; S – standardna devijacija; F – vrednost multivarijatnog Wilksovog F testa; P – statistička značajnost multivarijatnog Wilksovog F testa; f – vrednost univarijatnog f testa; p – statistička značajnost univarijatnog f testa.*

By projecting the results in Table 2 where the values are presented from the initial measurement in motor abilities between groups of subjects, we can conclude that there is a good discriminative measurement in most of the measured variables, except in the variables *Fixed arm hangs* and *Trunk lifting while lying on the back.* By comparing arithmetic means and standard deviations it is concluded that it is possible to classify three standard deviations into one arithmetic mean in all variables except in the variables *Fixed arm hangs* and *Trunk lifting while lying on the back*. Observing the values of the multivariate Wilks F test and its statistical significance (F = 1.521; P = 0.188) it is concluded that at the initial measurement there were no differences between the groups at the multivariate level. An individual analysis of each variable and univariate f test and its statistical significance shows that the differences do not exist at the univariate level in any of the analysed variables.

Projekcijom rezultata u tabeli 2. gde su prikazane vrednosti na inicijalnom merenju u motoričkim sposobnostima između grupa ispitanika, možemo zaključiti da postoji dobra diskriminativnost merenja u većini izmerenih varijabli, sem u varijablama *Izdržaj u zgibu i Podizanje trupa*. Komparacijom aritmetičkih sredina i standardnih devijacija konstatuje se da je moguće svrstati tri standardne devijacije u jednu aritmetičku sredinu u svim varijablama sem u varijabli *Izdržaj u zgibu i Podizanje trupa*. Posmatrajući vrednosti multivarijatnog Wilksovog F testa i njegove statističke značajnosti (F=1,521; P=0,188), zaključuje se da na inicijalnom merenju nisu postojale razlike između grupa na multivarijatnom nivou. Pojedinačnom analizom svake varijable i univarijatnog f testa i njegove statističke značajnosti uočava se da razlike ne postoje ni na univarijatnom nivou ni u jednoj analiziranoj varijabli.

Table 3. *Differences in the final measurement in motor abilities between groups of subjects*

Tabela 3. *Razlike na finalnom merenju u motoričkim sposobnostima između grupa ispitanika*

***Variables* / Varijable**	***Group* / Grupa**	***AM* / AS**	***S***	***f***	***p***
Backward field / Poligon natraške (s)	E	37.91	12.53	0.89	0.34
	C / K	40.36	12.12		
Running 20m high start / Trčanje 20m	E	5.66	0.66	0.00	0.94
	C / K	5.65	1.32		
Fixed arm hangs / Izdržaj u zgibu	E	8.67	8.35	0.04	0.83
	C / K	8.30	9.69		
Trunk lifting while lying on the back / Podizanje trupa	E	16.91	8.93	0.12	0.72
	C / K	14.27	9.01		
Hand tapping / Taping rukom	E	53.67	8.65	0.07	0.79
	C / K	53.18	10.10		
Standing long jump / Skok u dalj	E	97.56	23.60	7.87	0.00
	C / K	84.72	21.87		
Wide-angle seated forward bend / Pretklon u sedu	E	83.14	10.85	2.70	0.00
	C / K	79.32	12.24		

F=2.029; P=0.05

Legend: *AM - arithmetic mean; S - standard deviation; F - value of multivariate Wilks F test; P - statistical significance of the multivariate Wilks F test; f - value of univariate f test; p - statistical significance of univariate f test.*

F=2,029; P=0,05

Legenda: *AS – aritmetička sredina; S – standardna devijacija; F – vrednost multivarijatnog Wilksovog F testa; P – statistička značajnost multivarijatnog Wilksovog F testa; f – vrednost univarijatnog f testa; p – statistička značajnost univarijatnog f testa.*

In Table 3 the review of the obtained values at the final measurement shows good discriminativity of the measurement in all analysed variables, except in the variables *Fixed arm hangs* and *Trunk lifting while lying on the back*, as well as at the initial measurement. The analysis of the relationship between arithmetic means and standard deviations in all other variables is such that three standard deviations

Pregledom dobijenih vrednosti na finalnom merenju u tabeli 3. uočava se dobra diskriminativnost merenja u svim analiziranim varijablama sem u varijablama *Izdržaj u zgibu i Podizanje trupa* kao i na inicijalnom merenju. Analiza odnosa aritmetičkih sredina i standardnih devijacija u svim drugim varijablama je takva da mogu tri standardne devijacije da se svrstaju u jednu

can be classified into one arithmetic mean. The result of the multivariate Wilks F test and its statistical significance (F = 2,029; P = 0.05) shows the existence of statistically significant differences between the groups at the level of inference p <0.05, which speaks in favor of the positive effect on the experimental group by the presented model. Individual analysis and the values of the univariate f test shows that the differences were expressed in two variables, namely the variable for estimating the excitation factor of motor units *Standing long jump,* and the variable for estimating the factors of functional synergy and tone regulation *Wide-angle seated forward bend.*

aritmetičku sredinu. Rezultat multivarijatnog Wilksovog F testa i njegova statistička značajnost (F=2,029; P=0,05) prikazuju postojanje statistički značajnih razlika između grupa na nivou zaključivanja p<0,05, što govori u prilog pozitivnog uticaja koji je izvršen na eksperimentalnu grupu modelom rada Školice sporta Pedagoškog fakulteta. Pojedinačnom analizom i vrednostima univarijatnog f testa vidi se da su razlike ispoljene u dve varijable, i to varijabli za procenu faktora intenziteta ekscitacije motoričkih jedinica *Skok u dalj* i varijabli za procenu faktora funkcionalne sinergije i regulacije tonusa *Pretklon u sedu.*

Table 4. *Differences on initial measurement in morphological characteristics between the groups of subjects.*

Tabela 4. *Razlike na inicijalnom merenju u morfološkim karakteristikama između grupa ispitanika*

***Variables* / Varijable**	***Group* / Grupa**	***AM* / AS**	***S***	***f***	***p***
Body height / Telesna visina	E	121.91	3.714	1.34	0.25
	C / K	123.91	4.83		
Body mass / Telesna masa	E	23.40	4.83	0.00	0.98
	C / K	23.44	5.01		
Shoulder width / Širina ramena	E	24.64	1.68	1.32	0.26
	C / K	25.52	2.07		
Arm span / Raspon ruku	E	117.11	4.40	0.03	0.86
	C / K	116.70	7.27		
Skinfold of the abdomen / Kožni nabor trbuha	E	10.53	15.43	0.24	0.62
	C / K	7.88	5.88		
Skinfold of the back / Kožni nabor leđa	E	8.13	6.15	0.53	0.47
	C / K	10.07	6.67		
Skinfold of upper arm / Kožni nabor nadlaktice	E	9.53	3.66	0.27	0.60
	C / K	10.34	3.75		
Circumference of the bent upper arm / Obim savijene nadlaktice	E	20.43	2.41	0.40	0.53
	C / K	21.16	3.31		
Circumference of the outstretched upper arm / Obim opružene nadlaktice	E	19.68	2.50	0.63	0.43
	C / K	20.57	2.95		
Body Mass Index / Body Mass Index	E	15.63	2.33	0.16	0.69
	C / K	15.21	2.80		

F=0.246; P=0.061;

Legend: *AM - arithmetic mean; S - standard deviation; F - value of multivariate Wilks F test; P - statistical significance of the multivariate Wilks F test; f - value of univariate f test; p - statistical significance of univariate f test.*

F=0,246; P=0,061;

Legenda: *AS – aritmetička sredina; S – standardna devijacija; F – vrednost multivarijatnog Wilksovog F testa; P – statistička značajnost multivarijatnog Wilksovog F testa; f – vrednost univarijatnog f testa; p – statistička značajnost univarijatnog f testa.*

Table 4 presents the differences at the initial measurement in morphological characteristics between the groups of subjects. Review of descriptive indicators of arithmetic mean and standard deviation shows good discriminativity of measurements in all analysed variables, except in the variables for the assessment of subcutaneous adipose tissue: Skinfold of the abdomen and Skinfold of the back. Based on

U tabeli 4. prezentovane su razlike na inicijalnom merenju u morfološkim karakteristikama između grupa ispitanika. Pregledom deskriptivnih pokazatelja aritmetičke sredine i standardne devijacije uočava se dobra diskriminativnost merenja u svim analiziranim varijablama sem u varijablama za procenu potkožnog masnog tkiva: *Kožni nabor trbuha* i *Kožni nabor leđa*. Na osnovu poka-

the indicators of the multivariate Wilks F test and its statistical significance (F = 0.246; P = 0.061;) it can be concluded that at the initial measurement there were no differences between the groups in the analysed morphological characteristics. The values of the univariate f test were not statistically significant in any of the analysed variables at the initial measurement of morphological characteristics.

Table 5. *Differences on final measurement in morphological characteristics between groups of subjects*

zatelja multivarijatnog Wilksovog F testa i njegove statističke značajnosti (F=0,246; P=0,061;), može se konstatovati da na inicijalnom merenju nisu postojale razlike između grupa u analiziranim morfološkim karakteristikama. Vrednosti univarijatnog f testa nisu bile statistički značajne ni u jednoj analiziranoj varijabli na inicijalnom merenju morfoloških karakteristika.

Tabela 5. *Razlike na finalnom merenju u morfološkim karakteristikama između grupa ispitanika*

Variables / Varijable	*Group* / Grupa	*AM* / AS	*S*	*f*	*p*
Body height / Telesna visina	E	128.53	6.01	0.041	0.84
	C / K	128.22	7.15		
Body mass / Telesna masa	E	26.50	6.32	0.987	0.32
	C / K	27.97	6.51		
Shoulder width / Širina ramena	E	25.67	1.87	1.292	0.12
	C / K	25.60	2.76		
Arm span / Raspon ruku	E	122.24	6.45	0.769	0.38
	C / K	123.73	8.05		
Skinfold of the abdomen / Kožni nabor trbuha	E	8.86	5.76	6.976	0.01
	C / K	13.78	9.64		
Skinfold of the back / Kožni nabor leđa	E	8.10	3.46	2.069	0.15
	C / K	10.67	10.08		
Skinfold of upper arm / Kožni nabor nadlaktice	E	12.11	4.57	4.251	0.04
	C / K	16.30	11.26		
Circumference of the bent upper arm / Obim savijene nadlaktice	E	20.59	2.60	0.214	0.64
	C / K	20.90	3.13		
Circumference of the outstretched upper arm / Obim opružene nadlaktice	E	19.83	2.77	0.054	0.81
	C / K	19.98	3.05		
Body Mass Index / Body Mass Index	E	15.87	2.53	2.639	0.10
	C / K	16.86	2.74		

F=4.071; P=0.000;

Legend: *AM - arithmetic mean; S - standard deviation; F - value of multivariate Wilks F test; P - statistical significance of the multivariate Wilks F test; f - value of univariate f test; p - statistical significance of univariate f test.*

F=4,071; P=0,000;

Legenda: *AS – aritmetička sredina; S – standardna devijacija; F – vrednost multivarijatnog Wilksovog F testa; P – statistička značajnost multivarijatnog Wilksovog F testa; f – vrednost univarijatnog f testa; p – statistička značajnost univarijatnog f testa.*

Based on the results in Table 5, where the differences in the final measurement in morphological characteristics between the groups of subjects are shown, we can conclude that there is good discriminative measurement in all analysed variables, except in variables for assessment of subcutaneous adipose tissue: Skinfold of the abdomen and Skinfold of the back. The values of the multivariate F test and its statistical significance P (F = 4,071; P = 0,000;) at the final measurement have showed the existence of statistically significant differences between the control and experimental group in morphological characteristics. Individually

Na osnovu rezultata u tabeli 5. gde su prikazane razlike na finalnom merenju u morfološkim karakteristikama između grupa ispitanika možemo zaključiti da postoji dobra diskriminativnost merenja u svim analiziranim varijablama sem u varijablama za procenu potkožnog masnog tkiva: *Kožni nabor trbuha* i *Kožni nabor leđa*. Vrednosti multivarijatnog F testa i njegove statističke značajnosti P (F=4,071; P=0,000;) na finalnom merenju su pokazale postojanje statistički značajnih razlika između kontrolne i eksperimentalne grupe u morfološkim karakteristikama. Pojedinačno posmatrano vidimo da su

observed we can see that those differences are expressed in two variables for the assessment of subcutaneous adipose tissue, namely, Skinfold of the abdomen and Skinfold of the upper arm, which is probably the result of the influence of programmed exercise applied to the experimental group.

te razlike izražene u dve varijable za procenu potkožnog masnog tkiva, a to su*: Kožni nabor trbuha i Kožni nabor nadlaktice,* što je verovatno plod uticaja programiranog vežbanja koji je primenjen na ispitanicima eksperimentalne grupe.

Table 6. *Contingency analysis of the status of the arches of the feet on the initial measurement between the groups*

Tabela 6. *Kontigencijska analiza statusa svodova stopala na inicijalnom merenju između grupa*

Variables / **Varijabla**	***Statistics /*** **Statistici**		***Group /*** **Grupa**		***Total /*** **Ukupno**
			E	C	
The arch of the foot / Status svoda stopala	*No deformities /* Nema deformiteta	Number	5	2	7
		% within Status	71.4%	28.6%	100.0%
		% within Group	11.1%	4.3%	7.6%
		% of Total	5.4%	2.2%	7.6%
	I Grade / I Stepen	Number	0	1	1
		% within Status	0.0%	100.0%	100.0%
		% within Group	0.0%	2.1%	1.1%
		% of Total	0.0%	1.1%	1.1%
	II Grade / II Stepen	Number	29	13	42
		% within Status	69.0%	31.0%	100.0%
		% within Group	64.4%	27.7%	45.7%
		% of Total	31.5%	14.1%	45.7%
	III Grade / III Stepen	Number	10	24	34
		% within Status	29.4%	70.6%	100.0%
		% within Group	22.2%	51.1%	37.0%
		% of Total	10.9%	26.1%	37.0%
	IV Grade / IV Stepen	Number	1	7	8
		% within Status	12.5%	87.5%	100.0%
		% within Group	2.2%	14.9%	8.7%
		% of Total	1.1%	7.6%	8.7%
	Total / Ukupno	Number	45	47	92
		% within Status	48.9%	51.1%	100.0%
		% within Group	100.0%	100.0%	100.0%
		% of Total	48.9%	51.1%	100.0%

χ^2=18.61; df=4; p=0.001;

Legend: *χ2- value Chi-square of the test; df - degree of freedom; p - statistical significance of Chi-square test; E-experimental group; C-control group*

χ^2=18,61; df=4; p=0,001;

Legenda: *χ^2- vrednost Hi kvadrat testa; df- stepen slobode; p- statistička značajnost Hi kvadrat testa; Ek-eksperimentalna grupa; Ko-kontrolna grupa*

In Table 6 the status of the arch of the foot was analysed on the initial measurement between the groups. It is stated that the value of χ2 – Chi-square of the test is statistically significant at the level of inference of p = 0.01 (χ2 = 18.61; df = 4; p = 0.001;), therefore it rejects the assumption that there are no statistically significant differences at the initial measurement in analysed sample of the subjects. Individually observed on the basis of categories (simultaneous belonging to the category of variables in row and column, the percentage for a variable in a row, the percentage

U datoj tabeli 6. analiziran je status svodova stopala na inicijalnom merenju između grupa. Konstatuje se da je vrednost χ^2- Hi kvadrat testa statistički značajna na nivou zaključivanja od p=0,01 (χ^2=18,61; df=4; p=0,001;), pa se odbacuje pretpostavka o nepostojanju statistički značajnih razlika na inicijalnom merenju u analiziranom uzorku ispitanika. Pojedinačno posmatrano na osnovu kategorija (istovremena pripadnost kategoriji varijable u redu i koloni, procenat za varijablu u redu, procenat

for a variable in the column and total percentage) of the variable *Status of the arch of the foot,* it is noticed that the number of the children without foot deformities is very small (7.6%), which coincides with some of our earlier research from this area. The number of the subjects with grade I deformity is 1.1%, grade II is 45.7%, grade III is 37%, and grade IV is 8.7%. At the initial measurement the subjects of the experimental group had a lower prevalence of deformities in relation to the children from the control group.

Table 7. *Contingency analysis of the status of the arches of the feet on the final measurement between the groups*

za varijablu u koloni i ukupni procenat) varijable Status svodova stopala uočava se da je broj dece bez deformiteta stopala veoma mali (7,6%), što se poklapa sa nekim našim ranijim istraživanjima sa ovih prostora. Broj ispitanika sa I stepenom deformiteta je 1,1%, sa II stepenom je 45,7%, sa trećim stepenom je 37%, i sa IV stepenom 8,7%. Ispitanici eksperimentalne grupe imali su na inicijalnom merenju manju zastupljenost deformiteta u odnosu na decu iz kontrolne grupe.

Tabela 7. *Kontigencijska analiza statusa svodova stopala na finalnom merenju između grupa*

Variables / **Varijabla**	***Statistics /*** **Statistici**		***Group /*** **Grupa**		***Total /*** **Ukupno**
			E	C	
The arch of the foot / Status svoda stopala	*No deformity /* Nema deformiteta	*Number /* Broj	5	2	7
		% within Status	71.4%	28.6%	100.0%
		% within Group	11.1%	4.3%	7.6%
		% of Total	5.4%	2.2%	7.6%
	I Grade / I Stepen	*Number /* Broj	4	3	7
		% within Status	57.1%	42.9%	100.0%
		% within Group	8.9%	6.4%	7.6%
		% of Total	4.3%	3.3%	7.6%
	II Grade / II Stepen	*Number /* Broj	26	12	38
		% within Status	68.4%	31.6%	100.0%
		% within Group	57.8%	25.5%	41.3%
		% of Total	28.3%	13.0%	41.3%
	III Grade / III Stepen	*Number /* Broj	9	23	32
		% within Status	28.1%	71.9%	100.0%
		% within Group	20.0%	48.9%	34.8%
		% of Total	9.8%	25.1%	34.8%
	IV Grade / IV Stepen	*Number /* Broj	1	7	8
		% within Status	12.5%	87.5%	100.0%
		% within Group	2.2%	14.9%	8.7%
		% of Total	1.1%	7.6%	8.7%
	Total / Ukupno	*Number /* Broj	45	47	92
		% within Status	48.9%	51.1%	100.0%
		% within Group	100.0%	100.0%	100.0%
		% of Total	48.9%	51.1%	100.0%

χ^2=17.176; df=4; p=0.002;

Legend: *χ2- value Chi-square of the test; df- degree of freedom; p- statistical significance of Chi-square test; E-experimental group; C-control group*

χ^2=17,176; df=4; p=0,002;

Legenda: *χ^2- vrednost Hi kvadrat testa; df- stepen slobode; p- statistička značajnost Hi kvadrat testa; Ek-eksperimentalna grupa; Ko-kontrolna grupa*

Table 7 presents the results of contingency analysis of the status of the arch of the foot at the final measurement between the groups. Observing the obtained results after the final measurement, we notice that the value of χ2-Chi square of the test is statistically significant at the level of inference

Tabela 7. prezentuje rezultate kontigencijske analize statusa svodova stopala na finalnom merenju između grupa. Posmatrajući dobijene rezultate nakon finalnog merenja, uočavamo da je vrednost χ^2- Hi kvadrat testa statistički značajna na nivou zaključivanja od p=0,01,

of p = 0.01, but slightly lower than at the initial measurement ($\chi 2$ = 17.176; df = 4; p = 0.002;). The percentage of the children with foot deformity at the final measurement is the same as at the initial one, with the difference that there are slight improvements in certain categories of the assessed variable. These improvements can be seen in the data that shows that the number of children with the III and II degree deformity has slightly decreased. Whether this is the result of programmed exercise cannot be ascertained with certainty, bearing in mind that improvements are visible in both, the control and experimental groups.

Discussion

The research shows that motor abilities in children deteriorated by over 10% in the period 1975-2000, and that this trend continues (Bos, 2003). The obtained results in this research unequivocally show that positive effects were caused and achieved in the experimental group by a specially designed exercise program according to the model of the School of Sports of the Faculty of Pedagogy. These effects are reflected in the positive changes achieved in motor abilities and morphological characteristics in the subjects of the experimental group. Slightly positive changes were also present in the variable for assessing the status of the arch of the foot, but they were realised in both, the control and in the experimental group, and it cannot be claimed with certainty that they were realised under the influence of the experimental treatment. The reason may be a potential threat to the internal validity of the research through the current or previous activities of the subjects of the control group and the growth, development and maturation of these subjects. Tittlbach, Bappert, Bos, Woll, (2004) in their research state that children achieve positive changes in the variable for estimating the intensity factor of excitation of motor units *Standing long jump*, and variables for estimating the factors of functional synergy and tone regulation, which is in accordance with results in our study. Positive changes after the application of the experimental exercise program in children are also mentioned in Popović and Stupar, 2011; Bocca, Corpeleijn, Van den Heuvel, Stolk, & Sauer, 2014. Physical activity and fitness are positively associated with general health and cognitive abilities in children (Chen, 2017).

A sedentary lifestyle not only has a negative effect on the motor development but also the harmful effects that are especially pronounced in morphological characteristics through an increase in the body nutrition index and thus obesity in children (Duan, Hu, Wang, Arao, 2015). The changes caused in the variables *Skinfold of the abdomen* and *Skinfold of the upper arm* are the product of the effects of

ali nešto manja nego na inicijalnom merenju (χ^2=17,176; df=4; p=0,002;). Procenat dece sa deformitetom stopala na finalnom merenju je isti kao i na inicijalnom, sa razlikom da postoje blaga poboljšanja u određenim kategorijama procenjivane varijable. Ta poboljšanja uočavaju se u podacima da je blago smanjen broj dece trećeg i drugog stepena. Da li je to plod programiranog vežbanja, ne može se sa sigurnošću konstatovati, imajući na umu da su poboljšanja vidljiva i u kontrolnoj i u eksperimentalnoj grupi.

Diskusija

istraživanja pokazuju da su se motoričke sposobnosti kod dece u periodu od 1975-2000.godine pogoršale za preko 10%, i da se taj trend nastavlja i dalje (Bos, 2003). Dobijeni rezultati u ovom istraživanju nedvosmisleno pokazuju da su ostvareni i prouzrokovani pozitivni efekti kod ispitanika eksperimentalne grupe posebno dizajniranim programom vežbanja po modelu rada „Školice sporta“ Pedagoškog fakulteta. Ti efekti se ogledaju u pozitivnim promenama koje su ostvarene u motoričkim sposobnostima i morfološkim karakteristikama kod ispitanika eksperimentalne grupe. Blago pozitivne promene su bile prisutne i u varijabli za procenu statusa svoda stopala, ali one su ostvarene i u kontrolnoj i u eksperimentalnoj grupi, te se sa sigurnošću ne može tvrditi da su ostvarene pod uticajem eksperimentalnog tretmana. Razlog može da bude i potencijalno ugrožavanje interne valjanosti istraživanja kroz aktuelnu ili bivšu aktivnost ispitanika kontrolne grupe i rast, razvoj i sazrevanje ispitanika. Tittlbach, Bappert, Bos, Woll, (2004) u svom istraživanju navode da deca ostvaruju pozitivne promene u varijabli za procenu faktora intenziteta ekscitacije motoričkih jedinica *Skok u dalj,* i varijabli za procenu faktora funkcionalne sinergije i regulacije tonusa, što je u skladu sa dobijenim rezultatima u našem istraživanju. Pozitivne promene nakon primene eksperimentalnog programa vežbanja kod dece navode i (Popović i Stupar, 2011; Bocca, Corpeleijn, Van den Heuvel, Stolk, & Sauer, 2014;). Fizička aktivnost i kondicija pozitivno su povezani sa opštim zdravljem i kognitivnim sposobnostima kod dece (Chen, 2017).

Sedentarni način života ne samo da deluje negativno na motorički razvoj, štetni efekti su posebno izraženi u morfološkim karakteristikama kroz povećanje indeksa telesne uhranjenosti, a samim tim i gojaznosti kod dece (Duan, Hu, Wang, Arao, 2015). Prouzrokovane promene u varijablama *Kožni nabor trbuha* i *Kožni nabor nadlaktice* su produkt efekata programa vežbanja. Eminentni naučnici iz regiona u svojim studijama govore o pozi-

the exercise program. Eminent scientists from the region in their studies talk about the positive effects of programmed exercise on changes in morphological characteristics (Bala, Krneta, Lukač, Sadri, 2018).

The manifested differences in motor abilities, morphological characteristics, and status of the arch of the foot in the analysed sample are partly due to the effects of exercise programs according to the model of the School of Sports of the Faculty of Pedagogy, and partly due to the specifics of the overall maturation, the condition of muscle, joint-skeletal, cardiovascular, respiratory and probably the most of the endocrine system, observed in this age.

Conclusion

The existence of statistically significant differences in the variable for assessing flexibility, *Wide-angle seated forward bend*, and higher strength of the muscles of the lower extremities (*Standing long jump*) can be explained by the greater elasticity of the lower back, and muscles and tendons of the back of the thigh (primarily *m. biceps femoris, m. semimembranosus, m. semitendinosus)* from the aspect of physiology and elasticity - physics. Considering the elasticity of the muscles and the tendons, one should know that they play a significant role in increasing mechanical work during the movement. If the active muscle or tendon lengthens, the elastic energy accumulates within these biological structures and is used to increase the results in the concentric phase of the eccentric-concentric cycle, which is better in trained children. Based on the laws of physics, the degree of accumulated energy is proportional to the applied force and induced deformation. Since the muscle and tendon are placed in the series, the same force acts on them, and the accumulated energy corresponds to the degree of deformation of the muscles or tendons or their flexibility.

If muscle tension increases abruptly (e.g., static stretching) the Golgi tendon reflex prevents muscle contraction. The consequent reduction in muscle tension prevents the muscle and tendon damage (force feedback) (Zatsiorsky, & Kraemer, 2009).

Without entering the process of adaptation of the organism on the training process, but by the biomechanical requirements that dictate different outcomes of the activity of the effectors (usually upper and lower extremities, which act as levers that drive internal forces - muscles and external - gravity or some external generator), it is needed to point out that everything that happens in the body and requires some movement or various movements, it is manifested through the extremities and torso, and sometimes by the head (Vujmilović, 2012). In addition to the influence achieved by the programmed experimental treatment, the tivnim uticajima programiranog vežbanja na promene u morfološkim karakteristikama (Bala, Krneta, Lukač, Sadri, 2018).

Manifestovane razlike u motoričkim sposobnostima, morfološkim karakteristikama i statusu svoda stopala kod analiziranog uzorka delom su posledica efekata programa vežbanja po modelu rada „Školice sporta“ Pedagoškog fakulteta, a delom su uticaj specifičnosti ukupnog sazrevanja, stanja mišićnog, koštano – zglobnog, kardiovaskularnog, respitatornog, nervnog i verovatno najviše endokrinog sistema posmatrajući analizirani uzrast.

Postojanje statistički značajnih razlika u varijabli za procenu gipkosti, *Pretklon u sedu raznožno,* i veće snage mišića donjih ekstremiteta (*Skok udalj iz mesta*) može se objasniti pojavom veće elastičnosti sa aspekta fiziologije donjeg dela leđa i mišića i tetiva sa zadnje strane natkolenice (pre svega mišića *m. bicepsa femorisa, m. semimembranosusa, m. semitendinosusa*). Uzimajući u obzir elastičnost mišića i tetiva, treba znati da one imaju značajnu ulogu u povećanju mehaničkog rada tokom pokreta. Ako se aktivni mišić ili tetiva izduže, unutar tih bioloških struktura akumulira se elastična energija i koristi se za povećavanje rezultata u koncentričnoj fazi ekscentrično-koncentričnog ciklusa koja je bolja kod trenirane dece. Na osnovu zakona fizike, stepen akumulirane energije proporcionalan je primenjenoj sili i indukovanoj deformaciji. S obzirom da su mišić i tetiva postavljeni serijski, na njih deluje ista sila, a akumulirana energija odgovara stepenu deformisanosti mišića ili tetiva ili njihove popustljivosti.

Ako se mišićno naprezanje naglo poveća (npr. statičko istezanje), Goldžijev tetivni refleks sprečava mišićnu kontrakciju. Posledično smanjenje mišićnog naprezanja sprečava oštećenje mišića i tetiva (povratna sprega sile) (Zatsiorsky, & Kraemer, 2009).

Ne ulazeći u proces adaptacije organizma u toku trenažnog procesa, biomehaničkim zahtevima koji diktiraju različite ishode aktivnosti efektora (najčešće gornjih i donjih ekstremiteta, koji se ponašaju kao poluge koje pokreću unutrašnje sile – mišići i spoljne – gravitacija ili neki spoljni generator), potrebno je samo da se istakne da se sve što se dešava u organizmu, a zahteva neko kretanje ili razne pokrete, manifestuje putem ekstremiteta i trupa, a nekada i glave (Vujmilović, 2012).

Zaključak

pored uticaja koji je ostvario programirani eksperimentalni tretman, ispoljene razlike u morfološkim karakteristikama kod analiziranog uzorka, mogu delom da zavise i od specifičnosti ukupnog sazrevanja i neophodno

manifested differences in morphological characteristics of the analysed sample may depend partially on the specifics of the overall maturation and it is necessary to constantly monitor and analyse them.

The feet grow faster than other parts of the body and their growth is completed before adolescence. To successfully treat the foot deformities the most important thing is their early detection during regular systematic examinations as well as controls by the parents, educators, and later by class teachers and teachers in the schools.

Proper shape and function of the foot directly depends on a properly built bone structure and a good balance of a muscle strength that participate in the activity of standing and walking. If this balance is disturbed the lowering of the foot arch occurs as a consequence, and in that case, it is necessary to work on strengthening the plantar region of the foot.

ih je konstantno pratiti i analizirati.

Stopala rastu brže nego drugi delovi tela i njihov rast je završen pre adolescencije. Da bi deformiteti stopala bili uspešno lečeni najvažnije je njihovo rano otkrivanje kako pri redovnim sistematskim pregledima tako i kontrolama od strane roditelja, vaspitača, a, kasnije i od profesora razredne nastave i nastavnika u školama.

Pravilan oblik i funkcija stopala direktno zavise od pravilno građene koštane strukture i dobrog balansa snage mišića koji učestvuju u stajanju i hodu. Ako je ta ravnoteža narušena, kao posledica se javlja spuštanje svodova, i u tom slučaju je potrebno raditi na jačanju plantarne regije stopala.

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