

THE DIFFERENCES BETWEEN PRE-PRIMARY SCHOOL GIRLS AND BOYS REGARDING THEIR MORPHOLOGICAL AND MOTOR ABILITIES

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Abstract

The aim of the research is to apply a composition of 43 variables in total (14 morphological and 29 motoric variables) on the sample of 393 respondents (169 girls and 224 boys) of the pre-primary school age (4, 5 and 6 years old) from Primorsko-Goranska County (including nursery schools from Fužina, Kostren, Delfin, Delnica, Zamet, Maestral, Krnjevo and Galeb). The aim of this application is to determine univariate and multivariate statistical significance of differences in arithmetic means of applied morphological and motoric variables between pre-primary school girls and boys. The obtained information would allow more optimal, accurate and efficient way of modelling, diagnosis, planning, programming and controlling of kinesiological activities of pre-primary school children. The results showed that there is multivariate statistical significance of differences at the level $p=.00$ between two sexes. On the basis of obtained univariate values it can be concluded that boys with statistically significant differences in arithmetic means of morphological variables with reduced amount of panniculus adiposus and increased transversal dimension of skeleton along with increased values of height and weight, make better results in motor variables of explosive power of legs, partial body coordination, flexibility while lying down and endurance (3-minute polygon) which is seen through statistically significant differences in arithmetic means and better values of pulse before and after the activity. The girls with increased morphological values of voluminosity of soft tissue achieve better results in a static strength of arms and shoulders, repetitive strength of abdomen, flexibility of hamstrings, flexibility of hip and endurance – running over 'sliding polygon' for 3 minutes.

Key words: boys, girls, pre-primary school, morphological characteristics, motor abilities, differences

Introduction

It is known that anthropological characteristics (morphological, motoric, functional, intellectual and others) represents potentials that are expected to be optimally transformed from birth on under the influence of learning and practising, which depends on endogenous and exogenous conditions in which a child grows up and develops. Until the age of 2 motoric development of children depends mainly on neurological maturing, whereas the later development is more influenced by physical exercises of formed movement (Starc, Čudina Obradović, Pleša, Profaca & Letica, 2004). Also, children's organism does not change simultaneously in all anthropological segments during their growth, but changes of one system occur before changes of another organ system. There is also high genetic influence of certain anthropological dimensions, and differences in sexes and possessing motoric knowledge (Pejčić & Malacko, 2005; Malacko, 2009). Starting from the fact that all anthropological dimensions are connected by significant and less significant positive or negative links, children's organism can be seen as the network of interactive components and elements because practically there are no independent anthropological features or characteristics, which means that development of one characteristic has influence on the changes of the other (Malacko & Popović, 2001). It is necessary that there is equal and comprehensive development of anthropological features of children in the pre-primary school age

having in mind that there are differences between certain anthropological segments which should be more uniformly and efficiently transformed, neutralized and/or made equal (Trajkovski-Višić, Plavec & Rastovski, 2008).

The aim of the research

The aim of the research is to determine univariate and multivariate statistically significant differences of applied morphological and motoric variables between girls and boys of pre-primary school age, and the obtain information may allow more optimal, uniform and efficient way to model, diagnose, plan, program and control kinesiological activities of pre-primary school children.

Methods

Participants

The system of 43 variables in total (14 morphological and 29 motoric variables) was applied on the sample of 393 respondents (169 girls and 224 boys) belonging to the pre-primary school age (4, 5 and 6 years old) from Primorsko-Goranska County (including nursery schools from Fužina, Kostren, Delfin, Delnica, Zamet, Maestral, Krnjevo and Galeb).

Instruments

For the purposes of estimating morphological characteristics the following variables have been applied: *longitudinal dimension of the skeleton* –

the height of the body (HEB), the length of the leg (LEL), the length of the arms (LEA), *voluminosity of the body* – the weight of the body (WEB), perimeter of the upper arm (PUA), perimeter of the upper leg (PUL), perimeter of the abdomen (PAB), perimeter of the hips (PHI), *transversal dimension of the skeleton* – diameter of the elbow (DEL), diameter of the hand (DHA), diameter of the knee (DKN), *panniculus adiposus* – skin crease of the upper arm (SUA), skin crease of the back (SCB) and skin crease of the upper leg (SUL). The morphological characteristics are measured by standard procedure according to the methods of International Biological Program – IBP. For the purposes of estimating motor abilities the following variables have been applied: *agility* – moving the dice (MD1, MD2), *coordination* – walking backwards and with hand support (BS1, BS2), *coordination of the rhythm* – hopscotch (HP1, HP2, HP3), *explosive strength of the legs* – standing long jump (SJ1, SJ2, SJ3), *static strength of arms and shoulders* – endurance while hanging (EWH), *repetitive strength of the abdomen* – lifting the abdomen for 15 and 30 seconds (L15, L30), *flexibility of hamstrings* – bent while sitting (BS1, BS2, BS3), *flexibility of the hips* – spreading the legs on the wall while lying - left and right (SL1, SR1, SL2, SR2, SL3, SR3), *flexibility while lying* – spreading the arms while lying (SL1, SL2, SL3) and *endurance* – pulse before the activities (PBA), pulse during activities (PDA), pulse after activities (PAA) and 3-minute polygon (3MP). The variables of moving dice, lifting the abdomen (adapted and measured in the fifteenth and thirtieth second) and bent while sitting are carried out according to the methods of "Mediterranean American International Schools" (1988, after Živić & Hraski, 1995); standing long jump and endurance while hanging are carried out according to the methods described in "The models of hierarchical structure of motoric abilities" (Gredelj, Metikoš, Hošek & Momirović, 1975). Three variables (walking backwards with hand support, spreading the arms while lying and hopscotch) are constructed according to the author Trajkovski-Višić (2004). The estimation of endurance has been carried out by applying the variable 3-minute polygon (running around 4 posts, running over a utility bench, running over the mat, jump over a short 10-cm beam and running over 5 circles). This test has been checked on the basis of examining cardio-vascular functional abilities of children belonging to pre-primary school age (Trajkovski-Višić, Plavec & Antonić, 2007).

Procedure

The calculation of statistically significant differences between arithmetic means of girls and boys has been made by the methods of univariate and multivariate analysis of variant (ANOVA/MANOVA) in the statistical package SPSS Statistics 17.0.

Results

It can be seen clearly from the calculated statistical values presented in the tables 1 and 2 that there is statistically significant difference between

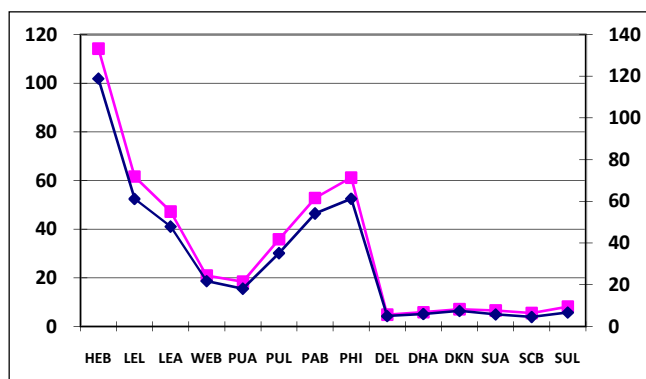
arithmetic means of girls and boys (M1-M2) at the level .00 ($p = .00$) in the whole system of (multivariate) applied 14 morphological (Table 1) and 29 motor variables (Table 2).

Table 1: The differences between girls (M1) and boys (M2) regarding morphological variables

Vars.	ANOVA/MANOVA			
	M1	M2	F	p
HEB	114.21	*118.88	0.83	0.36
LEL	*61.60	61.15	0.69	0.40
LEA	47.21	*47.89	3.26	0.07
WEB	20.90	*21.72	3.52	0.06
PUA	*18.37	18.11	1.85	0.17
PUL	*35.80	35.16	2.54	0.11
PAB	52.78	*54.15	11.61	*0.00
PHI	*61.55	61.21	0.40	0.52
DEL	4.80	*4.94	11.76	*0.00
DHA	5.81	*5.96	13.36	*0.00
DKN	7.04	*7.39	35.46	*0.00
SUA	6.52	*5.72	8.27	*0.00
SCB	5.48	*4.53	13.59	*0.00
SUL	8.14	*6.67	26.52	*0.00

Wilks' Lambda = .57, $F = 20.32$, $p = .00^*$, M1 – arithmetic mean of girls, M2 – arithmetic mean of boys, F – F test, p – significance ($p_{.05}$), * – better results

Concerning specific (univariate) morphological variables (Table 1), it can be seen that girls have better numeric values (shaded variables are marked with *) in 4, and boys in 10 morphological variables (Graph 1). The girls have longer legs and increased perimeters of upper arm, upper leg and hips, whereas the boys have bigger height, length of arms, weight, perimeter of abdomen, diameters of elbows, hands and knees, skin crease of upper arm, back and lower leg.



Graph 1. Morphology

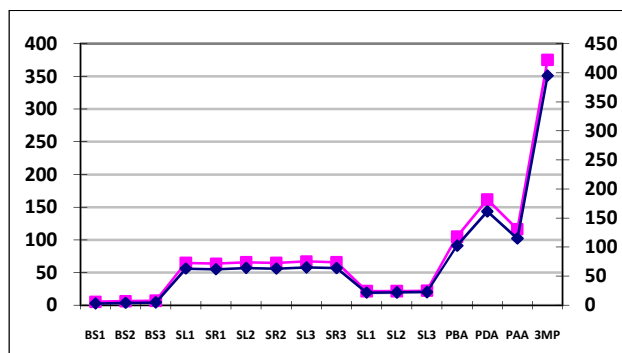
According to the overview of results in Table 2 and Graphs 2 and 3 where there are results from the system of motoric variables, it can be seen that girls are better in 14 and boys in 15 variables. The girls are better at the third performance of coordination of the rhythm (Hopscotch 3), endurance while hanging, lifting the abdomen for 15 and 30 seconds, bent while sitting in the first, second and third attempt, spreading the legs on the wall while lying also in the first, second and third attempt and increased pulse during activity. The boys are better at moving the dice 1 and 2, walking backwards with hand support 1 and 2, hopscotch 1

and 2, standing long jump 1, 2 and 3, spreading the arms while lying 1, 2 and 3, pulse before and after the activity and 3-minute polygon.

Table 2: The differences between girls (M1) and boys (M2) regarding motor variables

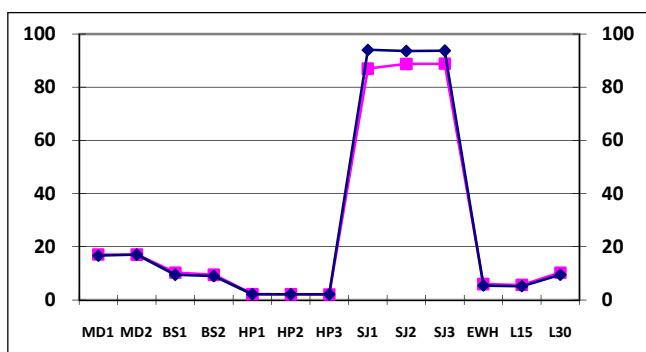
Vars.	ANOVA/MANOVA			
	M1	M2	F	p
MD1	17.07	*16.64	2.57	0.11
MD2	17.06	*17.02	0.02	0.86
BS1	10.25	*9.44	6.30	*0.01
BS2	9.47	*8.97	2.46	0.11
HP1	2.21	*2.16	0.31	0.57
HP2	2.10	*2.08	0.06	0.79
HP3	*2.04	2.06	0.05	0.81
SJ1	86.97	*94.06	9.87	*0.00
SJ2	88.74	*93.64	4.81	*0.02
SJ3	88.83	*93.77	4.46	*0.03
EWB	*5.97	5.39	0.77	0.38
L15	*5.66	5.16	3.16	0.07
L30	*10.25	9.48	2.09	0.14
BS1	*5.13	2.81	13.47	*0.00
BS2	*6.11	3.82	12.47	*0.00
BS3	*6.76	4.54	11.02	*0.00
SL1	*64.49	62.82	3.62	0.58
SR1	*63.41	61.77	3.17	0.07
SL2	*65.55	64.01	3.19	0.07
SR2	*64.63	62.84	3.29	0.07
SL3	*66.81	64.81	4.80	*0.02
SR3	*65.76	63.78	4.01	*0.04
SL1	21.46	*21.54	0.01	0.89
SL2	21.50	*21.83	0.24	0.62
SL3	22.15	*22.33	0.08	0.77
PBA	104.75	*102.34	3.35	0.06
PDA	*161.58	161.35	0.01	0.91
PAA	116.09	*114.67	1.03	0.30
3MP	375.40	*395.15	10.52	*0.00

Wilks' Lambda = 8.34, F = 2.33, p = .00*, M1 – arithmetic mean of girls, M2 – arithmetic mean of boys, F – F test, p – significance (p.05), * – better results



Graph 3. Motor dimensions

Concerning 14 morphological variables, girls have better values in 4 variables, whereas boys are better in 10 variables; only in 7 variables there were statistically significant differences in arithmetic means – all on behalf of boys. In the applied system of motoric abilities (consisting of 29 variables in total), the girls have better results in 14 and boys in 15 variables; only in 10 variables there were statistically significant differences in arithmetic means (5 on behalf of girls and 5 on behalf of boys). In case of morphological characteristics, the results have showed that there are no statistically significant differences in the specific variables of longitudinal dimension of skeleton, and weight and voluminosity of the body (except in the perimeter of abdomen variable), which means that girls and boys belonging to this age grow and increase their weight and voluminosity of the body equally. On the other hand, the differentiation is starting in the transversal dimension of the skeleton (diameter of joints) and panniculus adiposus on behalf of boys because there are natural (genetic) conditions for forming larger space for joining soft muscular tissue on the ends of joints. Also the boys possess smaller amount of panniculus adiposus probably because of increased activity of movement in their free time or larger engagement in implementing pre-primary school activities as concluded by other authors (Cardon, Van Cauwenberghe, Labarque, Haerens & De Bourdeaudhuij, 2008). The results in the space of motoric abilities have shown that there are no statistically significant differences regarding particular variables of agility, coordination, coordination of the rhythm (except in the variable walking backwards with hand support – hodun1), static strength of arms and shoulders, repetitive strength of abdomen, flexibility of hips (except in the variables razn13 and raznd3) and flexibility in lying. There are statistically significant differences on behalf of boys in explosive strength of leg, flexibility of hamstrings and endurance (3-minute polygon). On the basis of the presented information it can be concluded that boys with statistically significant differences in arithmetic means of morphological variables with reduced amount of panniculus adiposus and increased transversal dimension of the skeleton and increased values of height and weight achieve better results in motoric variables of explosive strength of leg, partial coordination of the body, flexibility in lying, pulse before and after activity and endurance (3-minute



Graph 2. Motor dimensions

Discussion and conclusions

It has been expected that the differences in the arithmetic means of morphological and motoric variables between girls and boys of pre-primary school age will be statistically significant both in the whole system (multivariate) and in the specific (univariate) variables on behalf of either girls or boys. The obtained results have proved these assumptions, because there were statistically significant differences between boys and girls (in both aspects) regarding arithmetic means, and in the whole system of the (multivariate) applied variables they were .00 (p=.00).

polygon). The girls with increased morphological values of voluminosity of soft tissues achieve better values in the static strength of arms and shoulders,

repetitive strength of abdomen, flexibility of hamstrings, flexibility of hips and pulse during performing 3-minute polygon.

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RAZLIKE IZMEĐU DJEVOJČICA I DJEČAKA PREDŠKOLSKE DOBI U MORFOLOŠKIM KARAKTERISTIKAMA I MOTORIČKIM SPOSOBNOSTIMA

Sažetak

Cilj istraživanja bio je da se na uzorku 393 ispitanika (169 djevojčica i 224 dječaka) predškolske dobi, uzrasta 4, 5 i 6 godina, s područja Primorsko-goranske županije (u vrtićima Fužine, Kostrena, Delfin, Delnice, Zamet, Maestral, Krnjevo i Galeb) primijeni sustav od ukupno 43 varijabli, od toga 14 morfoloških i 29 motoričkih, s ciljem da se utvrdi univarijantna i multivarijantna statistička značajnost razlika u aritmetičkim sredinama primijenjenih morfoloških i motoričkih varijabli između djevojčica i dječaka predškolske dobi, kako bi se na temelju dobivenih informacija na što optimalniji, pravovremeniji i efikasniji način moglo vršiti modeliranje, dijagnosticiranje, planiranje, programiranje i kontroliranje kinezioloških aktivnosti djece predškolske dobi. Rezultati su pokazali da između spolova u sustavima primijenjenih varijabli postoji multivarijantna statistička značajnost razlika na razini $p=.00$. Na temelju dobivenih univarijantnih vrijednosti može se zaključiti da dječaci sa statistički značajnim razlikama u aritmetičkim sredinama morfoloških varijabli sa umanjenom količinom potkožnog masnog tkiva i povećanom transverzalom dimenzionalnošću skeleta, kao i povećanih vrijednosti u visini i težini tijela, postižu bolje rezultate u motoričkim varijablama eksplozivne snage nogu, djelimičnoj koordinaciji tijela, fleksibilnosti u ležanju i izdržljivosti (poligon 3 minute), koje pokazuju statistički značajne razlike u aritmetičkim sredinama i boljih vrijednosti pulsa pre i posle aktivnosti. Djevojčice sa povećanim morfološkim vrijednostima voluminoznosti mekih tkiva postižu bolje vrijednosti u statičkoj snazi ruku i ramenog pojasa, repetitivnoj snazi trupa, fleksibilnosti stražnje lože nogu, fleksibilnosti kuka i izdržljivosti – trčanju preko "klizećeg poligona" u trajanju od 3 minute.

Ključne riječi: dječaci, djevojčice, predškolska dob, morfologija, motorika, razlike

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