Gender-related morphological characteristics in preschool children of Kolubara district

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Abstract

The aim of this study was to establish the gender-related differences among children 6-6.5 years of age in anthropometric characteristics so as to observe their development and make more appropriate selection for participation in guided and organised physical activities. A battery of 7 anthropometric measurements was used on the representative sample of 175 subjects of both genders from Valjevo (M=45 aged 6 and M=83 aged 6.5; F = 44 aged 6 and F=43 aged 6.5). The multivariate analysis of variance showed the existence of statistically significant differences (p=0.00) in the anthropometric space of the two ages analysed regarding the gender. Through the individual analysis, the differences at age 6 were found in the Upper arm skin fold variable (p=0.03) and the Back-skin fold (p=0.00), whereas with the 6.5-year-old subjects, the differences were found in the Body height variable (p=0.03), Upper arm skin fold (p=0.00) and Back skin fold (p=0.02), both in favour of the boys. It can be assumed that the differences are the result of the endogenous and exogenous factors upon the children's organism in the period of childhood in a smaller urban community of the southwest Serbia.

Keywords preschool age · morphology · differences

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Introduction

The human physique, in this case children's, is represented by the components of anthropological status that are the most prominent features of latent dimensions. Therefore, the physique affects, in a certain degree, the development and improvement of other human characteristics and abilities, while being exceptionally pronounced at the childhood age and very much affected by the various endogenous and exogenous factors.

The intensity of an individual's growth, according to Rolland Cachera, is not always the same, but rather happens in successive phases and is conditioned by various influences, both genetic and exogenous factors (Rolland Cachera, 1995). According to the research of Ivanovic (2009), the body proportions, under the influence of hereditory and exogenous factors, affect the growth and development of bone and muscle tissue and the formation of somatotype.

For this particular research, the subcutaneous fat was of a greater importance as it can greatly affect the motor behaviour in preschool children. The issue of differences in anthropometric features of preschool children has already been studied by Bala, 1981; Bala 1991; Hu & Bentler, 1998; Bala, Jakšić, & Popović, 2009; Đurić, 1997; Božić-Krstić et al., 2000; Božić-Krstić et al., 2003; Bala, 2004; Ružić, 2004; Pejčić & Malacko, 2005; Sabo, 2002; Poček, 2006; Sabo, 2006; Popović, 2008; Veselinović, Milenković, & Jorgić, 2009, Pavlović & Marinković, 2013. They emphasise the existance of statistically significant differences among the subjects of different genders and ages in the morphological space. The influence of various endogenous and exogenous factors upon

the growth and development of the child's body has been reported. No statistically significant differences between boys and girls have been found in terms of the half year height growth. When it comes to weight, the discrepancies between preschool boys and girls have been found, with boys having somewhat greater body mass (Božić-Krstić, Rakić & Pavlica, 2003).

The research problem of this study was the analysis of differences in morphological features of 6 and 6.5-year-old children of different genders; field of research were the anthropometric features, while the objective was to offer a greater contribution towards the understanding of morphological features in preschool children, as well as to provide a solid basis for the best selection and successful control of the anthropometric features development in children. The starting presuppositions were: H1: there are statistically significant differences in the morphological space of children of different genders

at the age of 6. H2: there are statistically significant differences in the morphological space of children of different genders at the age of 6.5.

Method

The method applied here was that of description, non-experimental observation meaning one measurement of the chosen morphological variables. The plan of the research was ex post facto which is one of the non-experimental research plans.

The sample of the research included a total of 175 subjects (M=45 aged 6 and M=43 aged 6.5; F=44 aged 6 and F=43 aged 6.5), boys and girls of PU "Milica Nozica" in Valjevo. In view of gender, the structure of subjects was a total of 88 boys (50.28%) and 87 girls (49.71%).

Table 1. Sample structure according to gender and age

Age	Boys	Girls	Total
6-year-old	45 (51.1%)	44 (49.9%)	89 (50.1%)
6.5-year-old	43 (50.0%)	43 (50.0%)	86 (49.1%)
Total	88 (49.9%)	87 (50.1%)	175 (100%)

The sample of anthropometric variables consisted of a battery of 7 anthropometric measurements:

I for longitudinal skeleton assessment:

1) Body height (mm).

II for volume and body mass assessment:

1) Body mass (kg),
2) Stretched forearm circumference (mm) and
3) Stretched upper arm circumference (mm);

III for subcutaneous fat tissue assessment the following skin folds were measured:

1) Upper arm skin fold (mm),
2) Abdomen skin fold (mm),
3) Back skin fold (mm).

The research was realised after the parental consent was obtained considering that all the subjects were minors, which meant application of the Declaration of Helsinki regarding the rights of children participation in research. For the anthropometric features measurements, we used the

anthropometer, decimal digital scales, tailor's centimeter tape measure and John Bull calipers.

In the statistical method of data processing, the fundamental descriptive statistics of anthropometric variables were established: arithmetic mean (AM), standard deviation (S) minimal (MIN) and maximal (MAX) values of the assessment results, coefficient of variation (CV), especially for the two samples analysed. The regularity of the results distribution was established using Kolmogorov-Smirnov test. The existance of statistically significant differences between the two subgroups (male and female), for all the variables analysed in 6 and 6.5-year-olds, was tested using multivariant (MANOVA) and univariant (ANOVA) variance analysis, and taking into account the level of significance p≤0.05. Box's M-test indicator and the values of levels of freedom were followed to satisfy the assumption on homogeneity of the variance and co-variance matrices.

Results

Based on the descriptive statistics (Table 2), it is noticeable that with the 6-year-old different gender analyzed subjects the values of the arithmetic mean

of anthropometric measurements are exceptionally homogenous in both groups of boys and girls variable for the longitudinal skeleton assessment (Body height). Also, a lesser variability of the results is noticeable in the body volume assessment (Stretched both upper arm and forearm circumference) in both subgroups of subjects.

The values of Kolmogorov-Smirnov test (KSp) show the normality of the distribution of variables analyzed in both 6-year-old subgroups (Table 2).

The assumption on the homogeneity of the variance and covariance matrices was not disturbed, since the statistical significance of the Box's M-test indicator was 0.08 with values of the degrees of freedom in 28 subjects aged 6. Based on the F values

(Table 2) it can be concluded that there is a statistically significant difference (P=0.00) between the 6-year-old boys and girls as regards their anthropometric features, observing the full system of applied variables. The individual analysis of each variable analyzed confirmed the existence of statistically significant discrepancies in the variables for the assessment of:

1) Subcutaneous fat, upper arm skin fold (p=0.03) and
2) Back skin fold (p=0.00) in favor of the boys.

No statistically significant differences were found in the rest of the morphological variables analyzed (p>0.05).

Table 2. Descriptive statistics and the difference analysis of results in the 6-year-old group of subjects

Variable	Gender	MIN	MAX	M	S	CV	KSP	f	p
Body height (cm)	♂	115.11	133.40	126.14	3.92	3.11	0.65	0.56	0.46
	♀	116.20	139.0	124.52	4.29	4.19	0.56		
Body mass (kg)	♂	17.87	42.68	24.92	4.17	27.53	0.32	0.49	0.48
	♀	17.21	31.36	25.59	4.25	36.58	0.35		
Stretched upper arm circumference (mm)	♂	165	252	194.25	23.18	11.93	0.66	2.25	0.14
	♀	155	243	187.31	30.34	16.20	0.56		
Stretched lower arm circumference (mm)	♂	160	235	185.02	16.67	9.01	0.71	3.14	0.08
	♀	150	217	179.16	14.48	8.08	0.69		
Abdomen skin fold (0,1 mm)	♂	28	210	73.89	45.45	61.51	0.04	0.23	0.64
	♀	32	180	78.07	37.03	47.43	0.03		
Upper arm skin fold (0,1 mm)	♂	3.83	24.10	9.54	4.12	42.06	0.06	**4.97**	**0.03**
	♀	3.94	25.61	10.06	3.44	30.16	0.09		
Back skin fold (0,1 mm)	♂	3.84	26.2	6.95	3.68	59.74	0.08	**7.20**	**0.00**
	♀	3.97	27.16	7.85	3.91	57.46	0.07		

F=5.15   P=0.00

Legend: M – boys; F – girls; MIN – minimal values; MAX – maximal values; M – mean; S – standard deviation; CV – coefficient of variation; KSP – level of statistical significance Kolmogorov Smirnov test of distribution normality; f – univariate f-test; p – level of statistical significance f-test; F – multivariate Wilkson F-test; p – statistical significance of multivariate F-test

As was the case with the homogeneity of the results in the subgroup of 6-year-old subjects, similar results show homogeneity in the 6.5-year-old subgroup of subjects. This homogeneity was observable in the skeletal longitudinality assessment, Body height in both subgroups of different gender as well as in the body volume variable assessment (Stretched upper arm circumference and Stretched

forearm circumference), while a greater variability of the results was observable in the rest of the variables as a consequence of the said factors at this age.

The values of Kolmogorov-Smirnov test (KSp) show normality in the distribution of the variables analysed in both subgroups of 6.5-year-olds, except in the variable Abdomen skin fold in the female

subgroup, which can be a consequence of a greater variability of results (Table 3).

Based on the F values (Table 3) it can be concluded that there is a statistically significant difference (P=0.00) between the boys and girls aged 6.5 as regards their anthropometric features and observing the whole system of variables applied. Based on the individual analysis of each variable analyzed, it can be concluded that there are statistically significant differences in variables:

1) For skeletal longitudinality assessment: Body height (p=0.03).
2) For upper arm subcutaneous fat assessment: Upper arm skin fold (p=0.00) and
3) Back skin fold (p=0.02) in favor of the boys.

Other variables for the morphological space assessment in children showed no statistically significant differences at this age.

Table 3. Descriptive statistics and analysis of result differences in subjects aged 6.5

Variable	Gender	MIN	MAX	M	S	CV	KSP	f	p
Body height (cm)	♂	111.62	130.75	129.23	4.96	3.84	0.55	**5.02**	**0.03**
	♀	117.20	141.9	127.16	5.21	4.39	0.44		
Body mass (kg)	♂	15.08	53.20	25.84	4.74	27.88	0.29	0.72	0.40
	♀	12.46	50.25	26.12	4.73	38.10	0.20		
Stretched upper arm circumference (mm)	♂	165	255	199.45	25.83	12.95	0.47	0.79	0.38
	♀	159	253	204.12	22.80	11.17	0.75		
Stretched lower arm circumference (mm)	♂	163	243	190.09	18.01	9.47	0.61	0.01	0.98
	♀	161	226	189.17	16.35	8.64	0.81		
Abdomen skin fold (0,1 mm)	♂	30	184	73.41	41.05	55.92	0.03	0.85	0.36
	♀	32	196	81.24	37.44	46.09	0.01		
Upper arm skin fold (0,1 mm)	♂	3.12	31.3	10.25	4.31	45.22	0.10	**10.20**	**0.00**
	♀	3.44	33.00	12.86	4.78	37.41	0.11		
Back skin fold (0,1 mm)	♂	3.97	35.89	7.16	4.26	61.01	0.06	**4.83**	**0.02**
	♀	4.00	36.12	8.14	4.77	58.35	0.08		

F=6.29   P=0.00

Discussion

The research results confirm the starting assumptions of the existence of statistically significant discrepancies in anthropometric features of children aged 6 and 6.5, considering gender of the subjects. The general dimorphism factor can be considered significant in determining body build in preschool children.

A greater variety in the skeletal longitudinality assessment variable in the subjects aged 6 is seen as a consequence of uniform growth and development of the child's body between the ages of 6 and 6.5. The homogeneity of the results, however, somewhat lesser, can be seen in the variables for body volume

assessment (Stretched upper and forearm circumference). In all other variables analyzed, a much greater variety of the results is noticeable, as a consequence of endogenous and exogenous factors, such as lifestyle, heredity (genetics), the degree of physical activity, social factors, etc., which affect the body mass and the volume of subcutaneous fat (skin fold) in particular.

Statistically significant differences in the anthropometric variables are noticeable in the morphological development of boys and girls. When observed separately, it was found that the boys had a greater skeletal longitudinality at the age of 6.5. It appears that in the period of an elder preschool age, based on the sample of subjects analyzed, the growth of long shaft bones in boys is more pronounced and

faster than in girls. The intensity of this growth and development of bones in boys resulted in the existence of statistically significant difference in their favor (Eliakim & Beyth, 2003). An important feature of the preschool age is an emphasized and striking integrity of this development, when the child's development domains (physical, cognitive, motor etc.) are closely related. The development in one domain affects the development in the other. Although the child's growth and development mostly happen in relatively regular and predictable sequences, there are significant differences amongst children in the pace of this growth and development (individuality and heterochrony laws of development). Observed individually, a child can develop much faster in one certain developmental domain than in others.

The body height and mass show no such statistically significant discrepancies between the boys and the girls in the ages analyzed. Therefore, the biological growth and development of both boys and girls is very much alike at the preschool age, which is also confirmed in the results of Bala et al. (2009).

Determination of quantitative differences in the chosen variables between the boys and girls of the age analyzed in this study, was done with the aim of indicating, and not explaining the degree and significance of these discrepancies. In order to make this research more precise and complete, it is necessary to conduct kinesiological research of longitudinal character based on a much greater number of subjects and with a greater number of variables, based on which then it would be possible to diagnose and program the body development in younger preschool population much more successfully, i.e., improve the possibility of generalization of the findings.

Theoretically speaking, this study should help in the choice of the parameters of morphological space that should be observed when working with younger children population, as well as in the choice of appropriate morphological features to be observed for growth and development assessment that could be applied in such work.

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