Developmental Characteristics of Younger School-Aged Boys in Relation to the Socio-Economic Environment

Características del Desarrollo de Niños Menores en Edad Escolar en Relación con el Entorno Socioeconómico

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SUMMARY: The main goal of this research was to determine whether there is a statistically significant difference in the anthropometric characteristics of fourth grade elementary school students, who live in different demographic environments in Montenegro. The research was conducted on a sample of 120 students, fourth grade elementary school, male (60 students from urban areas and 60 students from rural areas). To measure anthropometric characteristics, 12 measures were applied (Body height, arm length, leg length, shoulder width, elbow diameter, knee diameter, body weight, upper arm circumference, lower leg circumference, skin fold of the back, skin fold of the upper arm, skin fold of the abdomen). After conducting research with the application of appropriate statistical procedures: descriptive analysis, multivariate analysis of variance (MANOVA) and analysis of variance (ANOVA), it was noticed that there is a statistically significant difference in the treated space of anthropometric characteristics. Boys from rural areas are more dominant than boys from urban areas in the longitudinal and transverse dimensionality of the skeleton and in volume on certain body segments, and boys from urban areas are more dominant than boys from rural areas in body weight and subcutaneous fat, which puts them at risk for obesity.

KEY WORDS: Anthropometric characteristics; Students; Primary school; Urban and rural environment.

INTRODUCTION

A necessary precondition for normal growth and development is health. Body height and body weight are the most sensitive indicators of the health status and living standard of school-age children (Tomac *et al.*, 2012). The influence of exogenous and endogenous factors on the growth and development of children has been determined many times so far (Dragutinovic, 2019). The influence of genetic factors and environmental factors is manifested differently in certain phases of ontogenetic growth and development of children (Bozic-Krstic *et al.*, 2003). It is known that living habits, socioeconomic status, geographical characteristics and environment are sometimes more dominant factors, than genetic factors in varying children's growth and development (Zsidegh *et al.*, 2007; Jones *et al.*, 2009). Also, hypokinesia in combination with inadequate nutrition has a strong impact on increasing the average value of body weight, volume and subcutaneous adipose tissue in school-age children (Horvat *et al.*, 2009). Technological progress and expansion of electronic media, internet, video games, computers, etc. it has passivated children of the youngest age for whom physical activity is of special importance. Consumption of so-called "fast food" as well as the lack of playgrounds and green areas in urban areas have an adverse effect on the growth and development of children (Bala, 2006).

One of the basic tasks in working with children is to take care of their optimal growth and development. A particularly sensitive period of development is the school age of children, where all participants in the educational system play a major role. This primarily refers to teachers, school staff, but also to parents who have an important role in children's development (Dragutinovic, 2019).

Within the school curriculum, Physical Education has a very strong influence on the formation of students'

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personalities. Therefore, it is very important to pay the greatest attention to the period in the development of personality when it is built and formed, and when that development can be most influenced, and that is the period of school age (Mikic *et al.*, 2001).

Regular monitoring of physical growth and development contributes to the detection of growth and development abnormalities, early identification of obesity and malnutrition in children. The results of the monitoring enable a more individual approach to students and better programming of physical education classes.

Research focused on the anthropometric characteristics of school-age children living in different demographic environments indicates differences in most cases.

Aberle *et al*. (2009) and Momcilovic & Momcilovic (2018) determined that school-age children differ in certain anthropometric characteristics, body height and body weight, living in different demographic environments.

The obtained results indicate that students who come from urban areas have more pronounced values in the mentioned parameters than children from rural environment Also, the results of some research conducted by Reilly & Dorosty (1999) and Reilly (2007), show that overweight and obesity have been found in school-age children and that a strong influence of these characteristics on the state of children's health has been expressed.

Following the level of physical activity and body mass index in school-age children, Joens-Matre *et al*. (2008) found that children living in urban areas predominantly have higher body weights than children living in rural areas.

The influence of environmental factors on the anthropometric characteristics of children was investigated (Tinazci & Emiroglu, 2009; Vasic *et al*., 2012) and it was concluded that students living in urban areas have a significantly higher body mass index and the percentage of adipose tissue from students living in rural areas and that this is due to their reduced physical activity.

Observing geographical regions and especially towns and villages in Montenegro, one can notice differences in cultural, socio-economic, religious and other differences between the population. In this paper, attention is focused on the study of the effect of exogenous factors on the morphological status of students of the same age, living in Montenegro, in different demographic environments.

The primary goal of this study is to determine whether there are statistically significant differences in anthropometric characteristics in fourth grade primary school students who come from different demographic backgrounds, urban and rural environment in Montenegro.

MATERIAL AND METHOD

The search and data collection was performed during 2019 in six primary schools in Montenegro. The schools were selected from Bijelo Polje, Podgorica and Bar, which satisfied the territorial representation of the northern, central and southern regions of Montenegro. Three schools were located in an urban area, one from each city, while three schools were located in a rural area. Measurements were conducted on a sample of 120 respondents, fourth grade elementary school students, male, age 10 years +/- 6 months. The total sample was divided into two subsamples: 60 boys attending the fourth grade of primary school in an urban environment and 60 boys attending the fourth grade of primary school in a rural environment.

For the purposes of this study, a sample of respondents was selected by random selection.

Twelve manifest measures were used in order to assess anthropometric characteristics: body height AVIS, arm length ADUR, leg length ADUN, shoulder width ASˇIR, elbow diameter ADIL, knee diameter ADIK, body weight AMAS, upper arm circumference AOBN, lower leg circumference AOBP, skin fold of the back AKNL, skin fold of the upper arm AKNN, skin fold of the abdomen AKNT.

Statistical data processing. The data obtained by measurement were processed by descriptive and comparative statistics.

Within the descriptive statistics for all variables of morphological space of students were calculated: arithmetic mean (M), standard deviation (SD), minimum score (MIN), maximum score (MAX), range between minimum and maximum score (VSˇ), distribution asymmetry coefficient results (Skewness a3) and the coefficient of curvature of the distribution of results (Kurtosisa4).

The significance of the differences between the subsamples was verified by multivariate analysis of variance and univariate analysis of variance. The results of the subsamples were compared at significance levels of 0.05 and 0.01. All statistical data processing was done using the Statistical Package for Social Sciences software (SPSS 20.0).

RESULTS

Based on the performed measurements, the following Tables show the parameters of descriptive statistics. All results are grouped in tables according to residential status.

Insight into the results shown in Table I, the presence of a normal distribution was observed in most of the applied variables. The deviation of the distribution curve to the right can be observed in the variables skin back fold (AKNL) and skin fold of the abdomen (AKNT), which indicates a negative asymmetry of the distribution, that is, there is an increased grouping of results in the zone of higher values. The leptokurtic curve indicates increased homogeneity of the distribution of results in the analyzed variables.

By analyzing the obtained results in boys from rural areas (Table II), it is noticeable that there were no significant deviations from the normal distribution in most variables. The slope of the peak of the Gaussian curve exists in the variables skin back fold (AKNL) and the variable upper arm circumference (AOBN). The results of the analyzed variables have a positive asymmetry, which indicates that the results of lower values prevail. The leptokurticcurve indicates increased homogeneity of the distribution of results in the analyzed variables.

Based on the presented results of multivariate analysis of variance (Table III), we see that there are statistically significant systemic differences between subsamples in the treated space of anthropometric characteristics (Sig = .00).

After statistical processing of data by multivariate tests (Table IV), it is confirmed for all four indicators (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, Roy's Largest Root) statistical significance Sig = .00, the fact that there are statistically significant differences between subsamples in the space of anthropometric characteristics.

Table I. Central and dispersion parameters of anthropometric characteristics (boys-urban environment).

Variable	N	Range	Min.	Max.	Mean	Std. Deviation	Variance	Skewness	Kurtosis
AVIS	60	22.00	134.00	156.00	144.03	5.77	33.34	.33	-.67
ADUR	60	21.00	59.00	80.00	66.10	5.43	29.54	.71	-.01
ADUN	60	18.00	65.00	83.00	74.20	5.14	26.44	.13	-.99
A_IR	60	8.00	31.00	39.00	33.46	2.01	4.05	.93	.55
ADIL	60	2.30	7.00	9.30	7.91	.57	.32	.47	-.21
ADIK	60	3.70	9.50	13.20	10.98	.74	.55	.75	1.77
AMAS	60	21.50	30.00	51.50	40.24	6.16	38.02	.01	-1.20
AOBN	60	9.50	18.00	27.50	23.49	2.53	6.43	-.20	-.67
AOBP	60	11.00	27.00	38.00	32.11	2.52	6.38	.12	.09
AKNL	60	7.80	5.30	13.10	11.42	1.63	2.68	-2.46	4.55
AKNN	60	12.90	6.20	19.10	11.26	2.77	7.68	.36	1.07
AKNT	60	11.20	6.00	17.20	13.16	1.97	3.90	-1.37	3.65

Variables, N - number of entities, Range - range of variation, Min. - minimum value, Max. - maximum value, Mean - arithmetic mean, Std. Dev.– standard deviation, square root of variance, Variance - variance, mean square deviation, Skewness - distortion, Kurtosis - curve.

Table II. Central and dispersion parameters of anthropometric characteristics (boys-rural environment).

Variable	N	Range	Min.	Max.	Mean	Std. Deviation	Variance	Skewness	Kurtosis
AVIS	60	9.00	145.00	154.00	148.43	2.01	4.04	.71	.46
ADUR	60	7.00	66.00	73.00	68.50	1.69	2.87	.77	.59
ADUN	60	6.00	75.00	81.00	77.16	1.82	3.31	.58	-.63
A_IR	60	8.00	31.00	39.00	35.26	2.40	5.78	-.38	-.78
ADIL	60	2.40	7.40	9.80	8.73	.52	.27	-.36	.31
ADIK	60	3.30	9.80	13.10	11.85	.84	.71	-.78	-.02
AMAS	60	22.50	29.10	51.60	38.66	5.09	25.92	1.09	1.75
AOBN	60	11.00	17.00	28.00	24.86	2.31	5.36	-1.72	3.85
AOBP	60	10.00	26.00	36.00	32.76	2.34	5.49	-.97	1.09
AKNL	60	8.90	5.20	14.10	10.62	1.50	2.26	-1.61	6.25
AKNN	60	12.50	5.60	18.10	10.45	2.67	7.14	.40	1.09
AKNT	60	8.40	8.10	16.50	12.47	1.62	2.62	.19	2.06

Variables - variables, N - number of entities, Range - range of variation, Min. - minimum value, Max. - maximum value, Mean - arithmetic mean, Std. Dev.- standard deviation, square root of variance, Variance - variance, mean square deviation, Skewness - distortion, Kurtosis – curve.

Table III. Multivariate analysis of variance of anthropometric characteristics of boys in urban and rural environment.

Box's Test of Equality of Covariance Matrices	
Box's M	248.80
F	2.48
df1	78
df2	10622.95
Sig.	**.00**

Box's Test of Equality of Covariance Matrices - Box test for comparing variations at the multivariate level (covariance homogeneity).

Table IV. Multivariate analysis of variance - anthropometric characteristics of boys in urban and rural environment (multivariate tests).

Multivariate Tests					
Effect	Value	F	Hypothesis df	Error df	Sig.
Pillai's Trace	64	7.15	12.00	47.00	.00
Wilks' Lambda	.35	7.15	12.00	47.00	.00
Hotelling's Trace	1.82	7.15	12.00	47.00	.00
Roy's Largest Root	1.82	7.15	12.00	47.00	.00

Effect- indicators of statistical significance among subsamples, Value- values of indicators, F- effect of repeated factor, Hypothesis df- degrees of freedom, Error df-error of degree of freedom, Sig.-statistical significance.

Table V shows the results of the analysis of variance (ANOVA) of anthropometric characteristics in boys of urban and rural environment individually for each variable.

Based on the presented results, we see that there is a statistically significant difference between subsamples in the space of anthropometric characteristics in 7 of 12 variables.

Table V. Analysis of variance - anthropometric characteristics, difference of subsamples of boys in urban and rural environment.

Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
AVIS	290.40	1	290.40	15.53	.00
ADUR	86.40	1	86.40	5.33	.02
ADUN	132.01	1	132.01	8.87	.00
A_IR	48.60	1	48.60	9.87	.00
ADIL	10.08	1	10.08	33.77	.00
ADIK	11.18	1	11.18	17.63	.00
AMAS	37.76	1	37.76	1.18	.28
AOBN	28.29	1	28.29	4.79	.03
AOBP	6.46	1	6.46	1.08	.30
AKNL	9.52	1	9.52	3.84	.06
AKNN	9.76	1	9.76	1.31	.25
AKNT	7.21	1	7.21	2.20	.14

Dependent Variable, Type III Sum o Sqares- sum of squares, df- degrees of freedom, Mean Square- arithmetic mean of squares, F- effect of repeated factor, Sig.- statistical significance.

There is a statistically significant difference between the subsamples in the variables for estimating longitudinal and transverse dimensionality and body volume, namely: body height (AVIS), arm length (ADUR), leg length (ADUN), shoulder width (ASHIR), elbow diameter (ADIL), knee diameter (ADIK) and upper arm circumference (AOBN).

The remaining variables indicate that there is no statistically significant difference between the subsamples.

DISCUSSION

Insight into the presented research results, it is evident that there are differences between fourth grade students of primary schools in urban and rural environments in Montenegro. Specifically, it has been shown that residency status, as one of the exogenous factors, can greatly influence the growth and development of children, especially in a sensitive period such as younger school age.

It was found that there are statistically significant differences in as many as seven of the twelve measured anthropometric variables. The difference is evident in the longitudinal and transversal dimensionality of the skeletal and the volume of individual body segments. It is important to emphasize that all these measures were more pronounced in boys from the rural environment, they had dominantly higher values of these variables compared to boys from the urban environment. In contrast, boys from urban environments had higher values of body weight and subcutaneous adipose tissue.

The obtained results indicate that boys from rural areas are larger and more developed compared to boys from urban environment who are the same age. The obtained results can be attributed to the way children live and the space where children live. More outdoor space for play and spontaneous physical activities, as well as the frequent involvement of boys in jobs characteristic of a rural area (village), may be one of the reasons for more pronounced growth and development compared to boys living in an urban area. Of course, we can add to that a healthy diet and environment, which is important for growth and development. It is noticeable based on this study that boys from urban areas had more dominant results in body weight and subcutaneous adipose tissue compared to boys from rural areas but this difference is not statistically significant. These results largely correspond to previous research conducted (Relly, 2007; Vasic *et al*., 2012; Pelemis *et al*.,

2013) on a similar sample of respondents. These points to the negative consequences of living in an urban environment, both due to the growing sedentary lifestyle, due to the predominance of technology, insufficient greenery and space to play and consumption of high-energy food. In order to prevent the negative consequences of lifestyle in urban areas, more attention should be paid to continuous physical activity through physical education classes in schools, including children in school sports sections, sport schools at clubs and pay more attention to healthy eating.

CONCLUSIONS

The results of this study showed that there are statistically significant differences between the treated subsamples, which indicate that there is a large influence of the demographic environment on the growth and development of children of younger school age. An increase in body weight and percentage of adipose tissue has been observed in children living in urban areas. This phenomenon is a consequence of a number of new circumstances where children often practice a lifestyle that includes unhealthy lifestyle habits, which is reflected in being overweight and obese, all of which is reflected in their health. By applying appropriate contents in the teaching of physical education, along with a healthy diet, certain dimensions of the body can be transformed in the desired direction. First of all, this refers to body weight and its fat component, as well as volume in certain segments of the body. Increasing urbanization in the urban area should leave room for more playgrounds, parks and greenery, which will provide younger generations with the opportunity to be more physically active and move them away from technology that is increasingly pulling them in the direction of physical inactivity.

In rural areas, it is necessary to work on building sports infrastructure, opening sports schools or organizing various sports competitions, and thus develop opportunities for sports activities in this environment and properly use all the benefits it offers to children.

These facts should raise awareness among people about the importance of children being physically active for their proper growth and development, regardless of the environment in which they find themselves.

RESUMEN: El objetivo principal de esta investigación fue determinar si existe una diferencia estadísticamente significativa en las características antropométricas de los estudiantes de cuarto grado de primaria, que viven en diferentes entornos demográficos en Montenegro. La investigación se realizó sobre una muestra de 120 estudiantes, cuarto grado de primaria, sexo masculino (60 estudiantes de zona urbana y 60 estudiantes de zona rural). Para medir las características antropométricas se aplicaron 12 medidas (Altura del cuerpo, longitud del brazo, longitud de la pierna, ancho del hombro, diámetro del codo, diámetro de la rodilla, peso corporal, circunferencia del brazo, circunferencia de la pierna, pliegue de la piel de la espalda, pliegue de la piel de la parte superior brazo, pliegue cutáneo del abdomen). Después de realizar la investigación con la aplicación de los procedimientos estadísticos apropiados: análisis descriptivo, análisis de varianza multivariante (MANOVA) y análisis de varianza (ANOVA), se observó que existe una diferencia estadísticamente significativa en el espacio tratado de características antropométricas. Los niños de áreas rurales son más dominantes que los niños de áreas urbanas en la dimensionalidad longitudinal y transversal del esqueleto y en volumen en ciertos segmentos del cuerpo, y los niños de áreas urbanas son más dominantes que los niños de áreas rurales en peso corporal y grasa subcutánea, lo que los pone en riesgo de obesidad.

PALABRAS CLAVE: Características antropométricas; Estudiantes; Escuela primaria; Entorno urbano y rural.

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