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MORPHOLOGICAL CHARACTERISTICS AND NUTRITIONAL STATUS IN SCHOOL CHILDREN

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Abstract

Due to the numerous side effects caused by the modern way of life, there is an urgent need to monitor the morphological characteristics and nutritional status of school children. The purpose of this research was to establish a level of morphological characteristics and nutritional status in young school children, as well as to determine differences according to gender. This research was carried out on 60 children from the five grades of the three different Primary schools in Montenegro, 34 boys ($10,92 \pm 0,29$ years) and 26 girls ($10,81 \pm 0,29$ years). The Morphological characteristics were evaluated by a battery of four variables: body height, body weight, waist circumference, hip circumference, and then the values of the body mass index have been calculated. The significance of the differences between boys and girls was determined by t-test for small independent samples. The level of nutrition was established and indicates that there are six underweight children (10%), 35 with normal weight (58,3%), and 19 overweight children (31,7%). Also, boys have a higher percentage of overweight, as many as 15 (44,1%), while girls have only 4 (15,4%). There are no significant differences between boys and girls in morphological parameters at all, although the boys have slightly higher numerical values in all parameters. The obtained results indicate that a third of school children are overweight, and almost half of boys at this age also are overweight. These findings confirm the need to perform more comprehensive research of morphological indicators and nutritional status in children.

Keywords: anthropometric characterises, BMI, level of nutrition, pupils

Introduction

The modern way of life has influenced the fact that children today spend as much as half of their waking time in their sedentary position (Colley et al., 2013), which is an alarming fact. Especially when it is known that sedentary lifestyle and hypokinesia, with an improper diet of the most important factors of obesity, which is associated with increased cardio-metabolic risk in children (Andersen, Riddoch, Kriemler, & Hills, 2011; Ekelund et al., 2012; Veijalainen et al., 2016). Therefore, some authors warn that younger generations may live less healthy and shorter lives than their parents (Olshanski et al., 2005). The World Health Organization (WHO) indicates that as many as 340 million children and adolescents aged 5-19 were overweight or obese. The prevalence of overweight and obesity among children and adolescents aged 5-19 has risen dramatically from just 4% in 1975 to just over 18% in 2016 (World Health Organization, 2021). WHO's a response to this situation was adopted *WHO Global Strategy on Diet, Physical Activity and Health* (World Health Organization, 2021).

It should also be noted that overnutrition in the period of younger school age is a predictor of obesity (Djoric & Vukicevic, 2020). That is why numerous authors point out that monitoring morphological changes in the population can be crucial in preventing future public health problems, such as obesity (Popovic, Bjelica, Masanovic, & Vukotic, 2018; Masanovic, Vukotic, Bjelica, & Popovic, 2018). Monitoring the morphological and nutritional status of young school children has multiple benefits, because they are important indicators of quality of life and health during childhood and show the process of growth and development, and are also predictors of health status during life (Park, Falconer, Wiener, & Kinra, 2012; Pokos, Lauš, and Badrov, 2014).

Regular monitoring of physical growth and development contributes to determining the degree of nutrition and early identification of obesity and malnutrition and thus enables a more individual approach to students and better programming of physical education (Smajić et al., 2017; Banjevic, 2019). In this regard, recently, numerous studies have been looking at the growth and development, ie determining the morphological and nutritional status

of children (Vasiljevic, Bjelica, Popovic, & Gardašević, 2015; Banjevic, 2019; Ugrinić et al., 2019; Bacovic, 2020; Veljkovic, Katanic, & Ilic 2020; Bjelica et al., 2021; Stanković, Đođević, Hadžović, Đorđević and Katanić, 2021). When it comes to children of younger primary school age, the authors point out that the situation is not great, so Bjelica et al. (2021) warn that at this age, every fourth child is obese.

However, it should be noted that in general there is variation in the data on morphological characteristics and nutritional status. So, in this study, we tried to give answers to some questions. Therefore, this study aimed to establish a level of morphological characteristics and nutritional status in young school children, as well as to determine differences according to gender.

After the research, useful data will be obtained that will show the state of morphological characteristics and the level of nutrition of fifth-grade students in primary schools in Montenegro, as well as whether there is a difference by gender. Based on these data, it will be possible to monitor students and, by their nutritional status, provide guidelines regarding participation in physical activities and the promotion of healthy lifestyles.

Methods

Sample of respondents

The sample of respondents in this study consisted of children of primary school age, more precisely, children of the five grades. This research was carried out on 60 children from the five grades of the three different Primary schools in Montenegro, 34 boys (10,92±0,29 years) and 26 girls (10,81±0,28 years) following the Helsinki Declaration.

The sample of variables

Standardized anthropometric instruments were used to measure anthropometric characteristics. The measurement was performed according to an established international biological procedure (Eston & Reilly, 2013). To assess the anthropometric characteristics, 5 variables were measured: body height, body weight, waist circumference, hip circumference, and body mass index.
Body height was measured with an anthropometer. Respondents stood barefoot on a flat surface, in an upright position, with relaxed shoulders and folded heels. Their head was arranged so that the Frankfurt horizontal was in a horizontal position. Bodyweight was measured with a medical scale, with the subjects standing barefoot on it calmly in an upright position.

Waist circumference and hip circumference were measured with an inelastic centimetre tape, for the first measure in the middle of the distance pelvic apex and thorax, respectively, for another measure above the line separating the thigh from the sciatic regions at the point where the maximum circumference is over the posterior part.
Body mass index was calculated based on the formula: $BMI = BM (kg) / BH (m)^2$ (BM-body mass, BH-body height). Body mass index has a high correlation with the amount of body fat and for these reasons is used as an indicator of nutritional levels in children (Wilmore, Costill, & Kenney, 2008). The children were then classified according to the degree of nutrition into three groups: malnourished, normal, and overfed. The distribution according to nutritional status was made according to reference values of the World Health Organisation for body mass index for age and sex by children (Onis et al., 2007).

Data processing

Data processing was performed using the statistical program SPSS 26 (Statistical Package for Social Sciences, v26.0, SPSS Inc., Chicago, IL, USA). The basic parameters of descriptive statistics were calculated: arithmetic mean, standard deviation, minimum, maximum, skewness and kurtosis. T-test for small independent samples was used to determine differences in morphological characteristics between groups of five-grade children.

Results

Table 1 shows the descriptive values of anthropometric characteristics especially for groups of boys and girls. By looking at the table, it is noticeable that the boys achieved slightly higher numerical values than the girls in all parameters.
It is noticeable that the results of Skewness in boys are outside the normal range of distribution from -1 to 1 in several variables: BMI (1,25), waist circumference (1,27), and body mass (2,00). While in girls' slight deviation from normal values in the two variables hip circumference (1,25), and body mass (1,54). The results of Kurtosis are within the normal value of the distribution from -2.75 to 2.75 in all variables except the variable Body mass (5,49) in boys.

Table 1. Descriptive statistics of morphological characteristics of children

		Mean	SD.	Min	Max	Skew	Kurt
Boys	Age	10,92	0,29	10,42	11,33	-0,05	-1,36
	Body height	151,10	9,98	133,70	173,60	0,70	0,02
	Body mass	44,11	12,41	29,70	91,10	2,00	5,49
	BMI	19,14	3,88	14,06	31,37	1,25	2,04
	Waist circumference	73,01	11,53	55,10	110,10	1,27	2,06
	Hip circumference	81,15	10,02	66,00	113,20	1,05	1,70
Girls	Age	10,81	0,28	10,33	11,33	0,25	-0,65
	Body height	150,21	10,25	137,00	177,10	0,89	0,39
	Body mass	39,81	8,70	28,90	61,10	1,02	0,51
	BMI	17,63	3,43	13,06	27,65	1,54	2,40
	Waist circumference	69,75	10,49	54,40	95,30	0,87	0,67
	Hip circumference	76,80	11,26	60,80	104,70	1,25	1,31

Note Mean-Arithmetic mean, SD.-Standard deviation, Min-Minimum, Max-Maximum

The level of nutrition was established (Table 2) and indicates that there are six underweight children (10%), 35 with normal weight (58,3%), and 19 overweight children (31,7%). Also, boys have a higher percentage of overweight, as many as 15 (44,1%), while girls have only 4 (15,4%). As many as 73% of girls belong to the group normally fed, unlike boys, where this percentage is much lower, 47%.

Table 2. Nutritional level for children expressed numerically and as a percentage

	Boys 34 (56,7%)	Girls 26 (43,3%)	Total (60) (100%)
Underweight	3 (8,8%)	3 (11,5%)	6 (10%)
Healthy weight	16 (47,1%)	19 (73,1%)	35 (58,3%)
Overweight	15 (44,1%)	4 (15,4%)	19 (31,7%)

Based on the t-test (Table 3), there are no significant differences between boys and girls in morphological parameters at all, although the boys have slightly higher numerical values in all parameters.

Table 3. T-test for differences in morphological characteristics between groups

	Boys	Girls	t	p
Body height	151,10	150,21	,339	,736
Body mass	44,11	39,81	1,504	,138
BMI	19,14	17,63	1,570	,122
Waist circumference	73,01	69,75	1,130	,263
Hip circumference	81,15	76,80	1,578	,120

Note t- t values, p- significant,

Discussion

The results indicate that there are 10% of malnourished children, with a normal body weight of 58,3%, while 31,7% of children are overweight. Also, boys have a higher percentage of obesity (44,1%), while girls have only (15,4%). There are no significant differences in morphological parameters between boys and girls, although boys have slightly higher numerical values in all parameters.

Although there are numerous papers on this topic, when it comes to editing the results obtained from this study, they should be compared with the results of other studies that included a similar sample of respondents. And there are not many such studies in Montenegro and in the surrounding area.

The results of this study correspond to the average values of overweight and obese children (30,4%) in the study of Djoric and Vukicevic (2020) and are slightly higher than another study (Bjelica et al., 2021) where 27.5% of children are overfed. However, in all the mentioned research, the situation is much better compared to the study that had a large sample (n-344) in Serbia, where the authors came to the result that as many as 42% of respondents are overweight and obese for the same population (pupils aged 10) in their study (Stamenković, S., Danković, G., Stanković, N., Stojanović, N., & Paunović, 2020).

By analyzing anthropometric parameters, it is noticeable that the body height of our subjects corresponds to the values of the study Bjelica et al. (2021). When observing body weight, BMI, and hip circumference, the average values in our study of the given parameters achieved by boys correspond to the coastal region (Bjelicaet al., 2021) and are slightly higher than the results of girls close to the central region. It should be noted that our values of waist circumference are slightly higher than the groups in the paper (Bjelica et al., 2021). Parameters in this study such as body height, body weight, and BMI approximately correspond to the results in the paper (Djoric & Vukicevic, 2020). When we compare the height with the results of Stamenković et al. (2020) children in Montenegro have slightly higher values than normally and over nourished children from Serbia and correspond to the values of obese children. If we look at body weight, the average values range from normal (36,03kg), overweight (47,79kg), and obese (60,04kg). The average values of obese children (Stamenković et al., 2020) are much higher than the values of our respondents. It should be noted that our results are significantly higher than the results in the study of Vasiljević, Bjelica, & Gardašević (2018), however, it should be noted that the children from this study are one year younger.

So, the obtained results indicate that one-third of school children are overweight, and almost half of boys at this age are also overweight. The data from other studies also vary, so a large National study is needed, similar to a study conducted in Germany (Kurth & Rosario, 2007) that shows the incidence of obese children aged 3 to 18 years is 8,7% and 6.,3%. Data variation also exists in relation to different EU countries, so the prevalence of obesity varies from 13% in Finland, 16% in the Czech Republic, 33% in Greece, to 36% in Italy (Cali & Caprio, 2008). So it is clear that the prevalence of obesity in EU countries and also in the World has been constantly increasing over the past 2-3 decades is worrying (Lobstein & Frelut, 2003; World Health Organization, 2021).

Based on the given information, it can be concluded that it is not enough just to point out the problem, but it is also necessary to offer a solution. It is known that leading health panels point out that the level of physical activity in children is correlated with important short-term and long-term health benefits during life (Aleksić Veljković, A., Katanić, B., & Mašanović, 2021) and therefore physical activity is considered a key factor for healthy psycho-physical development of children (Dencker & Andersen, 2008; Ortega, Ruiz, Castillo, & Sjöström, 2008). And for that reason, it is necessary to promote children's sports and physical activities. In particular, the recommendations of Rodriguez-Martinez et al. (2020) emphasize that policies and interventions at home, at school, in the community, and through the health system should be motivated to support the healthy growth and development of children, by improving nutrition and levels of physical activity.

There are certain limitations of this study and they are reflected primarily in the small sample and non-coverage of different regions and cities, so no general conclusions can be made at the level of Montenegro. Also, the groups were divided into only three groups according to their nutritional status. Accordingly, the recommendations for further research would be to conduct a survey on a larger number of respondents, and to cover different regions, as well as to make a more complete distribution according to nutritional status, especially to separate overweight and obese.

Conclusion

However, despite the mentioned limitations, this does not diminish the value of this study, which indicated the great importance of monitoring morphological and nutritional status in primary school children, as well as the need for more comprehensive research on this topic.

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