Int. J. Morphol.,
40(5):1289-1293, 2022.

Nutritional Status of Younger Primary School Children in Urban and Rural Areas of Montenegro in Relation to Sex and Age During COVID-19 Pandemic: A National Study

Estado Nutricional de los Niños más Pequeños de la Escuela Primaria en Áreas Urbanas y Rurales de Montenegro en Relación con el Sexo y la Edad Durante la Pandemia de COVID-19: Un Estudio Nacional

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BACOVIC, D.; MALOVIC, P.; VREVIC, E.; BOJANIC, D. & LJUBOJEVIC, M. Nutritional status of younger primary school children in urban and rural areas of Montenegro in relation to sex and age during COVID-19 pandemic: a national study. *Int. J. Morphol., 40(5)*:1289-1293, 2022.

SUMMARY: Prevention and correction of overweight in children and adolescents is also very important for many reasons. According to previous research, the problem tends to vary according to sex, and different ages and the lifestyle in rural and urban areas has changed drastically in recent years and decades. Regarding the above-mentioned, the main goal of this research was to determine the nutritional status of young school children in urban and rural areas of Montenegro in relation to sex and age. The sample in this research has consisted of children aged 6 and 9 (younger school age). The total sample in this research is 800 male and female children who belong to the urban and rural areas of Montenegro. The sample of variables used in this study was: body mass index-percentile values (BMI), and waist circumference and body height ratio (WHtR) which were used as indicators to assess nutritional status. Based on obtained results it could be generally concluded that there are no statistically significant differences in nutritional status between primary school children from urban and rural areas of Montenegro, which is the opposite of what was expected based on previous research, but also which is very important since all subjects in the future can be treated as homogeneous groups when it comes to the impact of environment and lifestyle on the nutrition status of younger school children. On the other hand, it is important to emphasize that the main limitation of this research is that measurements were carried out in the middle of the COVID-19 pandemic, and the recommendation could be that after the end of the pandemic, special "COVID teams" should be formed, which would consist of experts from various fields of physical culture, sports, and medicine, all with the aim of influencing possible problems with nutritional status and physical activity of young school children caused by a pandemic.

KEY WORDS: Nutritional status; Level of physical activity; Young school children; Urban and rural areas; Montenegro.

INTRODUCTION

Underweight, overweight, and obesity during childhood and adolescence are associated with negative health consequences throughout life. Prevention and correction of overweight in children and adolescents is also very important for many reasons. The first relates to the fact that weight loss and maintenance after weight loss is difficult to achieve, and there is a high chance that excess weight in childhood and adolescence is likely to lead to overweight and obesity in later life. Second, being overweight in childhood and adolescence is associated with a higher risk and earlier onset of chronic disorders such as diabetes type 2. Third, obesity in childhood and adolescence has detrimental psychosocial consequences and reduces educational attainment. It is also important to point out that children and adolescents are more susceptible to uncritical acceptance of advertising messages through the media when it comes to food than adults, which increases children's exposure to unhealthy foods and increases the risk of developing these problems (Must *et al*., 1992; Lobstein *et al*., 2004; Singh *et al*., 2008; Abdullah *et al*., 2011; Park *et al*., 2012; Caird *et al*., 2014; Quek *et al*., 2017; cited in NCD Risk Factor Collaboration, 2019). Since the 1970s, the prevalence of overweight, defined as Body mass index (BMI) values at or above the 95th percentile, has more than doubled

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Received: 2022-06-29 Accepted: 2022-07-16

for pre-school children aged 2-5 years and adolescents aged 12-19 years, and it has more than tripled for children aged 6-11 years (Liu *et al*., 2008). There are many studies that point out that urbanization and lifestyle imposed by new living conditions are one of the main reasons for the increase in overweight and obesity, and that is the best shown by BMI growth. It was considered that, above all, nutrition, but also other segments of the lifestyle in the urban areas, are the dominant factor that causes this epidemiological problem. Most of the studies focused their research exclusively on the urban population, and it turned out that they unjustifiably bypassed rural areas. However, the study that posed a research question that had not been considered for many years was a global study involving populations from over 200 countries (NCD Risk Factor Collaboration, 2019) and the conclusions reached in this study are reflected in the fact that there is a greater increase overweight and obesity in adults in rural areas. Interestingly, although there are a significant number of studies, not much attention has been paid to the BMI growth rate in the period 1985-2017, in rural areas, where is observed almost twice an increase than in urban areas, for both men and women (NCD Risk Factor Collaboration, 2019). However, the mentioned study among others, included also the Montenegrin population, but only approximate data are given for each of the populations from included countries, and not all age categories are processed. Also, it is not clear how the respondents were divided by the area in which they live, which may be a significant methodological problem, primarily because it is not exactly defined whether they were classified in urban or rural areas, based on personal statements, or official records. From the above, it can be noticed that there has been a change in the trend when it comes to the nutritional status of people belonging to urban and rural areas, so the question is why this happened and what will be the situation with young school children who belong to urban and rural areas of Montenegro. It is assumed that more and more attention will be paid to this issue in the coming period, both in developed and developing countries around the world.

MATERIAL AND METHOD

In terms of time constraint, the research is of transversal character, and it consists of a one-off measurement of the corresponding anthropometric characteristics of young school children who belong to Montenegro.

Sample of subjects. The sample in this research is represented by children aged 6 and 9 (younger school age), ie. children of the first and fourth grade of primary school. The total sample in this research is 800 male and females children belonging to the urban and rural areas of Montenegro. Out of the total sample, 586 children belong to urban areas (288 males and 298 females), while 214 children belong to rural areas of Montenegro (105 males and 109 females). The above-mentioned age was sampled for the reason that there is a need to examine the nutritional status in two different cycles of primary school, ie. to compare the lifestyle habits of children in urban and rural areas at the time when children start school when the influence of the environment should have a more dominant role, and at the moment when the second cycle of primary school begins when children, does not matter from which areas they come, potentially adopt passive lifestyle habits.

Sample of measures. The sample of variables used in this study was body height, body weight, and waist circumference on the basis of which the following anthropometric indices were calculated: body mass index-percentile values (BMI) and waist circumference-to-height ratio (WHtR), which were used as indicators to assess nutritional status of young school children who belong to urban and rural areas in Montenegro.

Method of data processing. All data required for this study were processed in a specialized data processing program IBM SPSS statistics 23.0. Data were processed by descriptive and comparative statistical procedures. Differences in nutritional status of young school children from urban and rural areas of Montenegro, were determined using discriminant parametric procedures and t-test for small independent samples, with a statistical significance of $p<0.05$.

RESULTS

In Table I showed the structure of all respondents belonging to urban areas of Montenegro in relation to sex according to percentile values of BMI. Based on the percentile values of BMI with overweight, there were 105 respondents (17.92 %), of which 56 boys (9.56 %) and 49 girls (8.36 %), and 78 respondents were obese (13.3 %), of which 51 boys (8.7 %) and 27 girls (4.6 %).

Table I. Distribution of percentile values of BMI among young school children belonging to urban areas of Montenegro in relation to sex

BMI - percentile	M		F		Total	
	N	%	N	%	N	%
Underweight	8	1.37	17	2.90	25	4.27
Normal-weight	172	29.35	206	35.15	378	64.5
Overweight	56	9.56	49	8.36	105	17.92
Obesity	51	8.7	27	4.60	78	13.3
Total	287	48.98	299	51.02	586	100

Table II. Distribution of percentile values of BMI among young school children belonging to rural areas of Montenegro in relation to sex.

BMI - percentile	M		F		Total	
	N	%	N	%	N	%
Underweight	5	2.34	5	2.34	10	4.68
Normal-weight	60	28.04	78	36.45	138	64.49
Overweight	18	8.41	14	6.54	32	14.95
Obesity	22	10.28	12	5.60	34	15.88
Total	105	49.07	109	50.93	214	100

Table III. T-test values between arithmetic means of variables for assessing the nutritional status of male children belonging to urban and rural areas of Montenegro.

Variable	U		R		t-test	Sig.
	N	Mean±SD	N	Mean±SD		
BMI	287	65±29.09	105	68±28.66	-.908	.364
WHtR	287	.47±.05	105	.47±.06	-.370	.712

Table IV. T-test values between arithmetic means of variables for assessing the nutritional status of female children belonging to urban and rural areas of Montenegro.

Variable	U		R		t-test	Sig.
	N	Mean±S	N	Mean±SD		
BMI	299	58±30.8	109	53±29.93	1.602	.110
WHtR	299	.46±.04	109	.45±.04	.678	.498

Table V. T-test values between arithmetic means of variables for assessing the nutritional status of male children of the first grade of primary school belonging to urban and rural areas of Montenegro.

Variable	U		R		t-test	Sig.
	N	Mean±S	N	Mean±SD		
BMI	139	62±29.54	48	65±29.81	-.575	.566
WHtR	139	.46±.05	48	.46±.04	.412	.681

Table VI. T-test values between arithmetic means of variables for assessing the nutritional status of male children of the fourth grade of primary school belonging to urban and rural areas of Montenegro.

Variable	U		R		t-test	Sig.
	N	Mean±SD	N	Mean±SD		
BMI	148	68±28.49	57	71±27.64	-.645	.519
WHtR	148	.47±.05	57	.48±.07	.767	.444

Table VII. T-test values between arithmetic means of variables for assessing the nutritional status of female children of the first grade of primary school belonging to urban and rural areas of Montenegro

Variable	U		R		t-test	Sig.
	N	Mean±S	N	Mean±SD		
BMI	145	56±30.69	59	53±29.25	.729	.467
WHtR	145	.46±.04	59	.46±.04	-.027	.978

Table VIII. T-test values between arithmetic means of variables for assessing the nutritional status of female children of the fourth grade of primary school belonging to urban and rural areas of Montenegro.

Variable	U		R		t-test	Sig.
	N	Mean±S	N	Mean±S		
BMI	154	61±31	50	53±30.6	1.645	.102
WHtR	154	.46±.05	50	.45±.05	1.183	.238

Table II showed the structure of all respondents belonging to rural areas of Montenegro in relation to sex according to percentile values of BMI. Based on percentile BMI values with overweight, there were 32 respondents (14.95 %), of which 18 boys (8.41 %) and 14 girls (6.54 %), and 34 respondents were obese (15.88 %), of which 22 boys (10.28 %) and 12 girls (5.6 %).

When it comes to the values of all three presented variables for the assessment of nutritional status in Table III, it can be noticed that there are no statistically significant differences between male children belonging to urban and rural areas of Montenegro. In the BMI variable, children belonging to rural areas show slightly higher numerical values, while in the WHtR variable both groups of respondents have identical values.

When it comes to the values of all presented variables for the assessment of nutritional status in Table IV, it can be noticed that there are no statistically significant differences between female children belonging to urban and rural areas of Montenegro. In the variables BMI and WHtR, children belonging to urban areas show slightly higher numerical values.

Based on results in Table V when it comes to the grade that children attend, it can be noted that there are no statistically significant differences between male children attending the first grade of primary school in urban and rural areas of Montenegro. In the variable BMI, children belonging to rural areas show slightly higher numerical values, while in the variable WHtR both groups of respondents have identical values.

When it comes to the values of all variables for assessing nutritional status shown in Table VI, it can be noticed that there are no statistically significant differences between male children attending the fourth grade of primary school in urban and rural areas of Montenegro. In all presented variables, children belonging to rural areas show slightly higher numerical values.

When it comes to the values of all presented variables for assessing nutritional status in Table VII, it can be noticed that there are no statistically significant differences between female children attending the first grade of primary school in urban and rural areas of Montenegro. In variable BMI,

children belonging to urban areas show slightly higher numerical values, while in the variable WHtR both groups of respondents have identical values.

When looking at the values of the presented variables for the assessment of nutritional status in Table VIII, it can be noticed that there are no statistically significant differences between female children attending the fourth grade of primary school in urban and rural areas of Montenegro. In the variables BMI and WHtR, children belonging to urban areas show slightly higher numerical values.

DISCUSSION

When it comes to percentile values of BMI, the results show that the total percentage of male respondents who belong to urban areas of Montenegro with overweight status is 9.56 %, while the percentage of obese respondents is 8.7 %. Regarding male respondents who belong to rural areas, the situation is very similar, where the percentage of overweight respondents is 8.41 %, while the percentage of obese respondents is 10.28 %. Also, when we consider a mean values of both variables for the assessment of nutritional status, it can be noticed that there are no statistically significant differences in nutritional status between male respondents who belong to urban and rural areas of Montenegro and both groups are in the normal-weight category. The percentage of overweight female respondents from the urban areas of Montenegro is 8.36 %, while the percentage of obese respondents is 4.6 %. When it comes to male respondents from rural areas the situation is very similar, where the percentage of overweight respondents is 6.54 %, while the percentage of obese respondents is 5.6 %. Statistically significant differences in nutritional status were not found in respondents of both sexes, and according to the results obtained, both groups of respondents belong to the normal-weight category. Also, when comparing the nutritional status of male and female respondents belonging to urban and rural areas of Montenegro in relation to age, no statistically significant differences were found. Analyzing the results in other populations, it is noted that most developed and developing countries face major problems when it comes to obesity epidemics in both urban and rural areas. Five studies were analyzed in a systematic review of children and adolescents living in urban and rural areas of the United States. From all included studies in four is stated that living in rural areas is associated with a higher prevalence or increased chance of developing obesity, compared to children living in urban areas, and also children from rural areas were 26 % more likely to develop obesity compared to children from urban areas (Johnson 3rd & Johnson, 2015). Also, the results of study which is conducted on a sample of primary and secondary school children from the United States showed that children who belong to rural areas were more obese (16.5 %) than children living in urban areas (14.3 %) (Liu *et al*., 2008). A meta-analysis conducted in China on sample of primary school children showed that the percentage of oveweight increased from 5 % to 11.7 % in the period from 1991 to 1995, but obese from 1.7 % to 6.8 % in the period from 2011 to 2015. Also in this study, it was found that the rate of overweight and obese children in the period from 1991 to 2015 was higher in children who belong to urban areas of the state of China (Guo *et al*., 2019). The prevalence of overweight and obesity is higher in urban (17 %) than in rural areas (13.5 %) in the sample of children and adolescents who live in the Asian continent (Indonesia) (Nurwanti *et al*., 2019). In the study conducted in Kenya is stated that overweight is more common in boys than in girls. Boys and girls aged 9 to 12 who attend primary school in rural areas of Kenya had higher values of BMI, hip circumference, and triceps skinfold compared to children attending primary school in urban areas of Kenya, and also they are more obese in relation to their peers from rural areas (Adamo *et al*., 2011). Biehl *et al*. (2013) found that children living in rural areas were 1.5 times more likely to develop overweight and obesity when BMI values were taken into account, and 2.2 times more likely when their WHtR ratios were taken into account. Based on the presented results in this study and the discussion that followed, it could be generally concluded that there are no statistically significant differences in nutritional status between primary school children from urban and rural areas of Montenegro, which is very important, since all subject subsamples in the future they can be treated as homogeneous groups of respondents when it comes to this issue. However, it should be taken into account that the pandemic of the COVID-19 virus had a significant impact on lifestyle habits, which could lead to the conclusions being contrary to expectations, i.e. that all children had the same rules they must follow, and soon after its completion, the lifestyle could return to normal and there is a real expectation that differences could appear. Nevertheless, this study has a valuable scientific contribution which is reflected in the fact that adequate conclusions were made at a time when regular anthropometric measurements were not available to conduct, so it will represent significant scientific literature in the future when the positive and negative effects of the pandemic will be analyzing. Also, this study can have an impact on raising public health awareness, which should be aimed at educating all responsible individuals about healthy nutrition, strengthening the physical activity of children at a very sensitive age. The stated benefits of this study should be equally focused on children in urban and rural areas, in order to minimize the impact of the environment in which children live on their

nutritional status. Since this research was conducted during the COVID-19 pandemic, it is recommended that after the end of the pandemic, special "COVID teams" be formed, which would consist of experts from various fields of physical culture, sports, and medicine, all with the aim of influencing possible problems with nutritional status and physical activity of young school children caused by a pandemic. Also, a recommendation for future research would be to test the same sample of respondents after the end of the COVID-19 pandemic, in order to check for possible differences in the results obtained.

ACKNOWLEDGEMENTS. We are grateful to the Ministry of Education and the Institute for Education for enabling us to conduct measurements in primary schools in Montenegro, by giving us official recommendations which we gave to all directors of primary schools included in this study.

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RESUMEN: La prevención y corrección del sobrepeso en niños y adolescentes es muy importante por muchas razones. Según investigaciones previas, el problema tiende a variar según el sexo, las diferentes edades y el estilo de vida en las zonas rurales y urbanas ha cambiado drásticamente en los últimos años y décadas. Con respecto a lo mencionado anteriormente, el objetivo principal de esta investigación fue determinar el estado nutricional de los niños pequeños en edad escolar en áreas urbanas y rurales de Montenegro en relación con el sexo y la edad. La muestra en esta investigación ha estado compuesta por niños de 6 y 9 años (menor edad escolar). La muestra total en esta investigación fue de 800 niños y niñas que pertenecían a las zonas urbanas y rurales de Montenegro. La muestra de variables utilizadas en este estudio fue: índice de masa corporal-valores percentiles (IMC), circunferencia de la cintura y relación talla corporal (RCCE), los cuales se utilizaron como indicadores para evaluar el estado nutricional. Sobre la base de los resultados obtenidos, se pudo concluir en general que no existen diferencias estadísticamente significativas en el estado nutricional entre los niños de primaria de las zonas urbanas y rurales de Montenegro, que es lo contrario de lo que se esperaba en base a investigaciones anteriores, pero que también es muy importante, ya que todos los temas en el futuro pueden ser tratados como grupos homogéneos en lo que respecta al impacto del medio ambiente y el estilo de vida en el estado nutricional de los niños en edad escolar más pequeños. Por otro lado, es importante recalcar que la principal limitación de esta investigación fue que las mediciones se realizaron en plena pandemia de COVID-19, y la recomendación podría ser que luego de finalizada la pandemia, equipos especiales “COVID“, que estaría integrado por expertos de diversas áreas de la cultura física, el deporte y la medicina, todo ello con el objetivo de incidir en los posibles problemas del estado nutricional y de actividad física de los jóvenes escolares provocados por una pandemia.

PALABRAS CLAVE: Estado nutricional; Nivel de actividad física; Escolares jóvenes; Zonas urbanas y rurales; Montenegro.

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