ANALYSIS OF NUTRITIONAL STATUS OF PRIMARY SCHOOL CHILDREN IN MONTENEGRO

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REVIEW ARTICLE

Abstract: Nutritional analysis is a very important segment in monitoring the growth and development of school-age children. The aim of this study was to define the nutritional status based on the results of previous studies with samples taken from the population of primary school students in Montenegro. The analysis included 11 studies with a total of 8619 respondents of both sexes, which mainly dealt with the assessment of the nutritional status of respondents aged 6 to 15 years. Based on the analysis of the research results, it was determined that malnutrition and obesity are significantly present in children of primary school age of both sexes in Montenegro. Taking into account malnutrition and obesity together, the percentages range from 20-40%, which is typical for the Mediterranean countries of Europe, including Montenegro. Also, it was found that the application of different nutrition assessment standards gives different results that sometimes differ significantly on the same sample of respondents.

Key words: primary school, nutrition, obesity, children.

1. Introduction

In order to monitor the proper growth and development of primary school children, the analysis of the degree of nutrition is a very important segment. Based on the determination of the degree of nutrition, it is possible to define whether the child is in the phase of insufficient nutrition, normal nutrition, over nutrition or even obesity. Monitoring the status of nutrition, in addition to helping to understand the current situation, can also serve as a prognostic factor for the future health of respondents (Nikšić & sar., 2021). The level of malnutrition of children can also be a very important indicator of impaired health status, especially if it is a phase of malnutrition or even obesity. Nutritional status is one of the important indicators of the health status and physical abilities of an individual and the entire population, as well as psychophysical capabilities and potential for normal and healthy growth and development (Vorgučin, 2010). Accordingly, research that deals with the analysis of nutrition in children, aims primarily to define the extent to which children's

nutrition deviates from normal and then to define the causes that lead to this deviation.

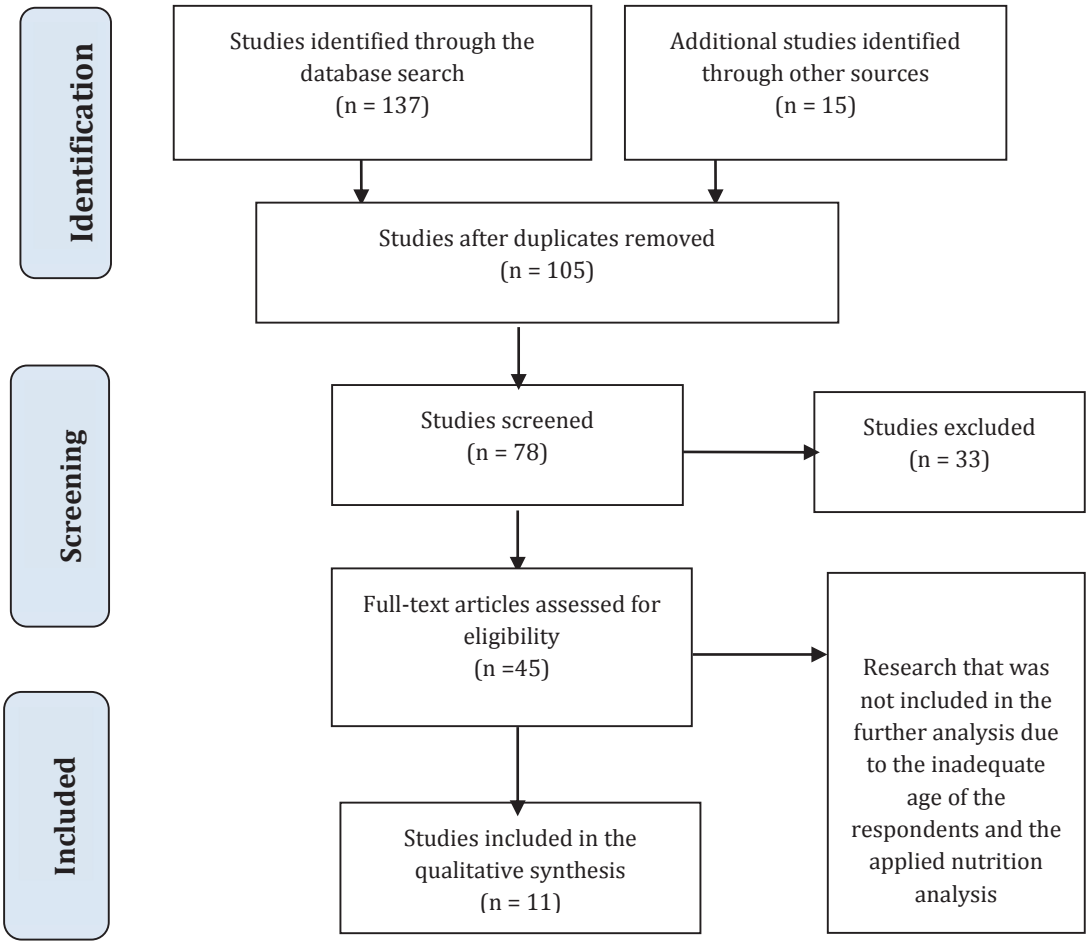
Decades ago, obesity has been recognized as one of the leading public health problems of the modern world and poses a high risk of developing various chronic diseases (Rossner, 2002; Gomes et al., 2004; Flodmark et al., 2014). The results of a large epidemiological study assessing global trends in body weight status from 1975 to 2016 found that childhood obesity has increased almost eightfold in the last 40 years (Abarca-Gómez et al., 2017). Obesity, which occurs at the earliest age in children, generally remains a problem in adulthood, carrying with it risks such as cardiovascular disease, diabetes, disorders of the locomotor system, deformities and more. Accordingly, school age is considered to be very important in order to act on the prevention of obesity and malnutrition (Procter, 2007; Strauss & Pollack, 2001).
Malnutrition and obesity occur due to various factors, and the main are insufficient physical activity, unbalanced diet in terms of abundant and poor quality fast food, genetic predisposition to obesity, health anomalies, socio-economic factors of the family and others. Also, in low- and middle-income countries and developing countries such as Montenegro, two thirds of obese people in the world live and it is assumed that in these countries the number of obese children will grow over the years (Ng et al., 2014). Economically more developed countries are recording a declining trend in obesity among children. Between 1985 and 2014, the number of obese children in China declined from an initial 0.1% to 7.3% (Song et al., 2016; Wang et al., 2017).
The interest of the scientific community in Montenegro in monitoring the nutritional status of school-age children was quite insufficient until the beginning of the 21st century, and then there is somewhat more intensive research indicating that obesity as a public health problem today has not bypassed Montenegro (Vasiljevic et al., 2015; Martinović et al., 2015; Vasiljević, Bjelica, & Gardašević, 2018; Jakšić et al., 2019; Banjević, 2019). Most often, the analysis of obesity in school-age children is monitored by comparing the body mass index (BMI) with the percentile values of standardized assessment scales (curves), which are mainly defined by the World Health Organization (WHO), the Center for Disease Control and Prevention (CDC) and the International Obesity Working Group (IOTF). In all these cases, very simple and inexpensive procedures that can be applied to large samples and give a roughly clear picture of the nutritional status of the respondents. In the absence of their standardized percentile curves for monitoring the nutritional status of respondents, countries such as Montenegro use some of the above. The aim of this research is to define the nutritional status based on the results of previous research with samples taken from the population of primary school students in Montenegro.

2. Methods

The following electronic databases were used to search the used literature: PubMed, MEDLINE, Google Scholar. The search was performed using the following keywords (alone or in combination): primary school, nutrition, obesity, children. The search strategy has been modified for each electronic database, where possible, in

order to increase sensitivity. All titles and abstracts are considered for potential papers to be covered by the analysis. Relevant studies were obtained after a detailed review, if the inclusion criteria were met.

The criteria for systematization included in the analysis are as follows: that the sample was taken from the population of primary school students from Montenegro, that the studies are transversal or longitudinal, that some of the standards of the World Health Organization, the Center for Control are included to define percentile values. and disease prevention, the International Working Group on Obesity or the Center for National Health and Nutrition (NHANES), and that the research was published in the period from 2015 to 2020. The analysis includes research with samples of both sexes, chronological age from 6 to 15 years, which corresponds to the age of primary school students in Montenegro. The selection of the selection of works is shown in Graph 1.



Graph 1. Flow diagram

3. Results

Table 1 presents the basic elements of the research included in this review. According to the criterion related to the selection of standardized assessment scales used by researchers to determine the nutritional status of respondents, research can be divided into 4 groups: research in which the assessment scale (percentile scale) of the World Health Organization was applied (Malović, 2019; Baćović, 2020), Center for Disease Control and Prevention (Vailjević et al., 2015; Vasiljević, Bjelica, & Gardašević, 2018; Banjević, 2019), International Working Group on Obesity (Jakšić et al., 2019; Banjari and et al., 2020), Center for National Examination of Health and Nutrition (Šćepanović et al., 2019) and a combination of the aforementioned scales (Martinović et al., 2015; Jakšić et al., 2017 ; Milašinović et al., 2019).

Table 1. *Review of selected previous research*

Study	Aim Study	Gen	N	Age	Var.	Nut. Stand	Results		
							♂		♀
Vailjević i sar., 2015	Analysis of the state of nutrition of children of preschool age and the youngest school age.	♂ ♀	51 53	6 - 7	BW BH BMI	CDC	90-92	percentiles	54-84
Martinović i sar., 2015	Determine prevalence of and contributing factors for overweight and obesity among Montenegrin schoolchildren	♂ ♀	2076 2021	7 - 13	BW BH BMI	WHO CDC IOTF	♂ 2,90-4,60% 64,80-70,40% 17,10-19,50% 7,00-15,00%	 underweight normal weight overweight obesity	♀ 4,10-6,20% 74,20-76,80% 14,00-15,60% 3,5-6,5
Jakšić i sar., 2017	Investigate OWOb and contributing factors among schoolchildren of Podgorica.	♂ ♀	565 568	7 - 12	BW BH BMI	WHO CDC IOTF	♂ 0.90-1.40% 61,60-67,80% 20,00-23,50% 7,60-17,50%	 underweight normal weight overweight obesity	♀ 2,60-3,90% 72,70-74,10% 17,30-18,80% 4,50-6,90%
Vasiljević i sar., 2018	Analyze the state of nutrition of children of the first cycle in primary school (first, second and third grade).	♂ ♀	497 498	6 - 9	BW BH BMI	CDC	♂ 78 - 93	 percentiles	♀ 68 – 74

Šćepanović i sar., 2019	Determine body height, body mass, menarche and nutritional status in children aged 13 and 14 in urban and rural areas in Montenegro.	♂ ♀	219 211	13 - 14	BW BH BMI	NHANES I	♂ 17,20% 68,50% 9,50% 4,80%	underweight normal weight overweight obesity	♀ 9,90% 75,70% 10,80% 3,60%
Banjević 2019	Determine eventual existence of statistically significant differences in morphological characteristics and body mass index with boys and girls of younger school age.	♂ ♀	32 28	8	BW BH BMI WC HC	CDC	♂ 3,12%, 84,38%, 9,37% 3,12%.	underweight normal weight overweight obesity	♀ 3,57% 82,14% 10,71% 3,57%
Jakšić i sar., 2019	Investigate the association between inflammation, oxidative stress, vitamin D, copper and zinc in pre-obese and obese children compared to controls.	♂ ♀	129 73	7 - 15	BW BH BMI WHtR	IOTF	♂♀ 42,1% normal weight 40,6% overweight 17,3% obesity		
Malović, 2019	Determine anthropometric indices as indicators of obesity of children in Montenegro.	♂ ♀	66 69	7 - 8	BW BH BMI WHR WHtR	WHO	♂♀ 2,96% underweight 58,52% normal weight 22,22% overweight 16,30% obesity		
Milašinović i sar., 2019	Evaluate a nutritional status of healthy children from Montenegro according to three most common worldwide references.	♂ ♀	747 733	9 - 13	BW BH BMI	WHO CDC IOTF	♂ 2,2-7,5 56,7-63,0 17,8-23,8 7,5-17,1	underweight normal weight overweight obesity	♀ 3,6-10,5 69,7-73,9 14,4-19,5 3,4-6,0

Banjari i sar., 2020	Investigating poverty and other correlates of childhood underweight and obesity in two urban regions with lower and higher economic development.	♂ ♀	124 100	7, 5	BW BH BMI	IOTF	♂ 1,6% 71,00% 16,10% 11,30%	under weigh t norma l weigh t overw eight obesit y	♀ 1,00% 65,00% 24,00% 10,00%
Baćović, 2020	Determine obesity and differences in nutritional status of school children in Central and Southern region in Montenegro	♂ ♀	189	7 - 8	BW BH BMI WHR WHtR	WHO	♂♀ 5,28% underweight 58,74% normal weight 19,58% overweight 16,40% obesity		

Gend. – Gender, N - number of subjects, Var. – Variables, Nut. Stand. – Nutrition standard, BW – Body weight, BH – Body height, BMI - body mass index, WC - waist circumference, HC - hip circumference, WHtR – Vaist to height ratio, WHO – World health organization, CDC - Centers for disease control and prevention, IOTF - International Obesity Task Force, NHANES I - National health and nutrition examination surveys.

4. Discussion

The analysis included 11 studies that mainly aimed to determine the degree of nutrition of students aged 6 to 15 years. The research analyzed a total sample of 8619 respondents of both sexes, which gives a good assumption to define certain conclusions when it comes to the nutrition of primary school students in Montenegro. To determine nutritional status, researchers used different standardized percentile assessment scales (WHO, CDC, IOTF, NHANES I). It is very important to note that by applying different standards for determining the nutritional status of respondents, we get different results for the same sample of respondents (Milašinović et al., 2019; Jakšić et al., 2017; Martinović et al., 2015). World Health Organization standards generally show the lowest percentage of malnutrition and the highest percentage of obese respondents. In contrast to WHO standards, IOTF standards show the highest percentage of malnourished subjects and the lowest percentage of obese compared to WHO and CDC standards. The values obtained by applying the CDC standard are generally between the values shown by the WHO and IOTF standards. In the study Martinović et al. (2015), WHO standards showed the highest rate of obese respondents and it is about 15.00% compared to 12.30% (CDC) and only 7.00% (IOTF) in boys and 6.50% (WHO), 5.60% (CDC) and 3.50% (IOTF) in girls. Approximately similar relationship of nutritional status was recorded in the research of Jakšić et al. (2017), where e.g. the lowest percentage of normally fed subjects showed the WHO standard (61.60%) compared to 64.10% (CDC) and 67.80% (IOTF) in boys and 72.70% (WHO and CDC) and 74.10% IOTF) in girls. A very similar relationship between the degree of nutrition of the respondents depending on the application of different standards was

confirmed in the research of Milašinović et al., (2019) where WHO standards show the lowest percentage of malnourished and normally fed subjects, while the percentage of malnourished and obese according to WHO standards is significantly higher compared to CDC and IOTF. A review of the obtained results of all studies, it is concluded that malnutrition generally ranges from 0.90 to 6.20% for male respondents and in the range of 1.00-5.28% for female respondents (Baćović, 2020; Banjari et al., 2020; Banjević, 2019; Malović, 2019; Jakšić et al., 2017; Martinović et al., 2015). A slightly higher percentage of malnutrition was observed according to IOTF standards in the study of Milašinović et al., (2019), where malnutrition was 10.50% for boys and 7.50% for girls. The highest recorded degree of malnutrition of the respondents was recorded in the research of Šćepanović et al., (2019), where malnutrition was as high as 17.20% for boys and 9.90% for girls. The reasons for the larger deviations of the percentage of malnourished subjects in the above study compared to other studies, can be found in the sample of respondents who were on average the oldest (13-14 years) and in the applied standard for nutrition assessment (NHANES I) which was only applied in this study. The results related to malnutrition and obesity of the subjects vary from research to research, which can be attributed to the characteristics of age, geographical characteristics of the sample as well as the applied standards for assessing the level of nutrition in the subjects. If we take into account only the WHO standard, the malnutrition of male respondents ranges from 17.30 to 20.00%, while in girls the range of the percentage of malnutrition is from 15.10 to 23.83% (Martinović et al., 2015; Jakšić et al., 2017; Milašinović et al., 2019). The results for malnutrition of respondents of both sexes are approximately equal in other analyzed studies where other standards (CDC and IOTF) for nutrition assessment were applied (Baćović, 2020; Malović, 2019; Banjari et al., 2020), while the percentages for malnutrition in research Banjević (2019) is slightly lower and amounts to 9.37% for boys and 10.71% for girls aged 8 years. In the research of Jakšić et al., (2019) according to IOTF standards, the highest percentage of malnourished respondents aged 6 to 15 years was recorded and it amounts to as much as 40.60%, while in the same survey 17.30% of respondents are obese. According to the above results, which were conducted on a sample of about 200 respondents of both sexes, it can be concluded that every other elementary school student has a problem with excess weight. Significantly high degree of obesity was recorded in almost all analyzed studies and according to the obtained percentages, obesity in male subjects ranged from 6.00 to 17.50% and in the range from 6.50% to 17.14% (Martinović et al., 2015; Jakšić et al., 2017; Milašinović et al., 2019; Malović, 2019; Banjari et al., 2020; Baćović, 2020).

Based on the obtained results, which refer to obesity and malnutrition of respondents of both sexes aged 6 to 15, it is concluded that almost every third elementary school student in Montenegro has a problem with excess weight. Certainly, the statement should be taken with a certain reserve due to the application of different standards for assessing the degree of nutrition of the respondents. Also, it should be taken into account that the prevalence of malnutrition and obesity varies depending on the region of the same state, which has been confirmed in some previous studies (Peytremann-Bridevaux, Feah, & Santos-Eggimann, 2007). The problem of the presence of excess weight in children

of both sexes at the earliest age, is confirmed by the research of Vasiljević et al., (2015) and Vasiljević, Bjelica, & Gardašević, (2018) where the average values of the obtained percentiles suggest that the complete samples are on average close to or above the limit that reflects the state of malnutrition of the respondents, especially in boys aged 6 to 9 years. The analysis of the research makes it very difficult to determine where malnutrition and obesity are more present in relation to gender, although in a slightly larger number of studies the results indicate that boys have more problems with excess weight compared to school-age girls, especially aged 6 to 9 (Vasiljević et al., 2015; Martinović et al., 2015; Jakšić et al., 2017; Vasiljević, Bjelica, & Gardašević, 2018; Milašinović et al., 2019). In general, the obtained results of nutrition of primary school respondents in Montenegro fit into the framework of some previous research. According to the results of national research, European countries can be classified into two groups based on the prevalence of overweight (including obesity) (Lobstein & Frelut, 2003). According to the mentioned researchers, the first group includes northern European countries with a lower prevalence of 10-20%, and the second group includes Mediterranean countries with a higher prevalence of malnutrition and obesity with values between 20-40%.

Almost all analyzed studies on the student population in Montenegro have confirmed that the prevalence of malnutrition and obesity is in the range of 20-40%, given that Montenegro belongs to the Mediterranean countries of Europe that have a problem with the nutritional status of children in school. Also, the obtained results are similar to the results referred to by Wijnhoven et al., (2014) according to which in Europe malnutrition (including obesity) varies depending on the region from 9 to 43% in boys and from 5 to 43% in girls, while obesity in European countries ranges from 2 to 21% in boys and 1 to 19% in girls, with higher rates in Mediterranean countries. The fact that malnutrition and obesity as the leading health problem of today have not bypassed even the youngest population of Montenegro, should be taken into account with special importance, especially because of the health problems that cause excess weight in humans. Being overweight in younger school-age students is a predictor of heart disease in adulthood. Risk factors for heart disease, such as hypertension, dyslipidemia, impaired glucose tolerance, and vascular disorders, are already present in obese children (Viner, Segal, Lichtarowicz-Krynska, & Hindmarsh 2005). Also, we should take into account the fact that very little attention is paid when it comes to obese children, it refers to the psychological and social problems of students during their stay in school. Namely, overweight children are very often exposed to verbal and physical violence at school precisely because of being overweight. Also, as children who have been victims of violence grow up, they often show elements of violent behavior in old age. Problems faced by malnourished and obese children during schooling include poor concentration during class, withdrawal and lack of communication, as well as poorer success in school compared to children whose body weight is within normal limits. The previously presented conclusions are the result of many years of observation and personal experience in working with children aged 4 to 15 years of the author of this paper. It is certainly considered necessary to further analyze these claims through scientific research work.

5. Conclusion

Monitoring the nutritional status of students is a very important segment in the phase of proper impact on their growth. Considering the results of all analyzed research, it can be concluded that obesity as the leading public health problem of the modern world has not bypassed the school population in Montenegro. This trend of obesity and malnutrition is in the range of results that are typical of developing countries, Mediterranean countries and low- and middle-income countries. The results of the obtained research make it very difficult to draw a line between the sexes when it comes to malnutrition and obesity. Also, the presence of malnutrition and obesity is evident in all growths in primary school students. The modern way of life, which is reflected in a very reduced physical activity, fast, poor quality and excessive diet, are the leading causes of malnutrition and obesity. The analysis of the research showed that it is necessary to make adequate national standards for all ages in order to assess the nutritional status of the respondents more reliably. Applying different standards that are not adapted to the population of respondents over which they are applied can give wrong conclusions which can cause consequences in the phase of prevention of malnutrition, malnutrition and obesity of respondents. The results of the analyzed research indicate the need for a more systematic and standardized approach in order to detect the nutritional status of school-age respondents in Montenegro. A more systematic approach should include all segments of the social community in order to better overcome the obviously present problem, first of all malnutrition and obesity, and then partly malnutrition of children.

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