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INFLUENCE OF SOCIOECONOMIC AND DEMOGRAPHIC PARAMETERS ON OBESITY IN CHILDREN AGED 7 TO 11 IN NORTH BAČKA REGION

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Abstract. In the Republic of Serbia obesity is growing into a major problem. The aim of the study is to determine nutritional status in children aged 7-11 and to identify possible factors affecting obesity. A cross-sectional anthropological survey was carried out in primary schools in rural and urban places of North Bačka region in Vojvodina (North part of the Republic of Serbia). The investigation was performed between 2017-2020 and included 1057 boys and 1085 girls aged 6.50-11.49 years. The body mass index (BMI kg/ m^2) was calculated and the assessment of nutritional condition was based on IOTF. Using logistic regression we tested interactions of obesity with socioeconomic and demographic factors. Underweight is present in 5.53% of children (3.78% in boys and 7.28% in girls). Overweight prevalence was detected in 18% of subjects (19.02% in boys and 17.69% in girls) and obesity prevalence in 9.73% of subjects (11.54% in boys and 7.93% in girls). A significant relationship between certain sociodemographic parameters and BMI values and the occurrence of obesity in both sexes was found. The results indicate that exceed weight is present in 27.73% of subjects and represent a public health issue in younger shool-aged children of this region in Vojvodina.

Key words: nutritional condition, obesity, children, Vojvodina, Serbia.

Introduction

A large number of children is affected by obesity, and the prevalence has increased during the past decades all over the world (Zhang et al. 2018), both in developed and developing countries (Ng et al. 2014). This trend has also been observed in Serbia where according to the WHO definitions, prevalence of overweight/obesity increased in 7–9-year-old children from 30.7% in 2015 to 34.8% in 2019, and according to the IOTF standards, the increase was from 22.8% to 30% (Marković et al. 2021). According to the World Health Organization (WHO), in primary school children severe obesity ranged from 1.0% in Swedish and Moldovan children to 5.5% in Maltese children. The prevalence was higher among children whose mother's educational level was lower and among boys compared to girls (Spinelli et al. 2019). Many factors affect obesity, among which socioeconomic and demographic factors play a significant role. It is well known that socioeconomic status (SES) is a major risk factor for childhood obesity (Schienkiewitz et al. 2018), and the prevalence tends to be highest in socioeconomically disadvantaged children (Shrewsbury & Wardle, 2008). Recent investigations has revealed a north-south gradient with a higher prevalence of exceed weight in children from southern Europe (Ahrens et al. 2014). It was also observed that parental education (Muthuri et al. 2016) and urbanization (Zhang et al. 2016) show contradictory findings, which is assumed to be related to the level of country development. In several

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studies maternal education was negatively associated with childhood obesity which means that children whose mothers have lower education are more often obese (Ruiz et al. 2016).

In this paper we wanted to present a detailed overview of the nutritional status of children aged 7 to 11 in the northern Bačka region of Vojvodina. We aimed to present the current situation of obesity in this region and explore the relationship between obesity and socioeconomic and demographic parameters.

Material and Methods

The investigation was performed on children who attended primary schools in North Bačka. The North Bačka District is one of seven administrative districts of the autonomous province of Vojvodina, Serbia. According to the 2011 census results, it has a population of 186.906 inhabitants (Census of population, 2011). North Bačka District comprises three municipalities and 45 local communities. The cross-sectional study was performed in 32 primary schools in the period between 2017- 2020 and included 2142 children (1057 boys and 1085 girls) aged 6.50-11.49 years. Age was calculated as the difference between the date of birth and date of data collection. Each age group was categorized according to the midpoint of an age range, so the group of participants aged 7 years included all participants between 6.50 and 7.49 years. The subjects were grouped into five age categories (6.50-11.49). The research protocol was approved by the Provincial Secretariat for Education, Regulations, Administration and National Minorities – National Communities, Scientific Committee of the Department for Biology and Ecology, University of Novi Sad and primary school principles. Informed consent was obtained from participants and their parents before data collection and the inclusion of subjects was on voluntary basis.

Anthropometric measurements included body height and weight and were taken on participants wearing light clothing and without shoes. Height was measured with anthropometer (±1mm; SieberHegnerMaschinen AG Zürich Switzerland) with the head positioned in the Frankfurt plane, and portable and electronic digital scale was used to measure weight with accuracy ±0.1kg. Body mass index was calculated from the ratio of weight/height^2 (kg/m^2). Subjects were classified into underweight, normal weight, overweight and obese categories according to age- and sex specific cut-off points proposed by the International Obesity Task Force (IOTF) (Cole et al., 2000). Overweight and obesity were defined as having a BMI above the age and sex-specific thresholds respectively the equivalent of BMI > 25 kg/m^2 and the equivalent of BMI > 30 kg/m^2. Socioeconomic and demographic parameters included: parents education, physical activity, number of children in the family, settlement size, urban/rural environment and ethnicity. Educational level of parents was based on the highest level completed by each respondent and was grouped into three categories: primary, secondary, higher/high education. Number of children in the family included three groups: 1-2, 3, 4 and more children. Physical activity involved engaging in some form of physical activity outside of school, and respondents were divided into two groups based on their response to two of the questions: YES I do some sports in my free time, NO I don't do some sports in my free time. With regard to the settlement size respondents were grouped into four groups: <1000, 1000-10.000, 10.000-20.000, >100.000. To take into account the effect of urbanization, type of locality was categorized into rural and urban. With regards to ethnicity, the four most numerous ethnic groups were investigated: Serbs, Hungarians, Croats and Romas.

Data were analyzed with SPSS software for Windows version SPSS Statistics version 21 (SPSS Incorporation, Chicago, USA). The data analysis included: Descriptive statistics (the mean, standard deviation, range, frequency and the related percentage); One-factor analysis of variance (ANOVA) for assessing the variance among the BMI categories; Chi-squared test for assessing differences in percentage frequence of general obesity; Linear univariate regression analysis to determine the relationship between BMI and socioeconomic and demographic factors; Binary logistic regression analysis determined the individual impact of each variable on obesity. The overall significance level was set at $P < 0.05$.

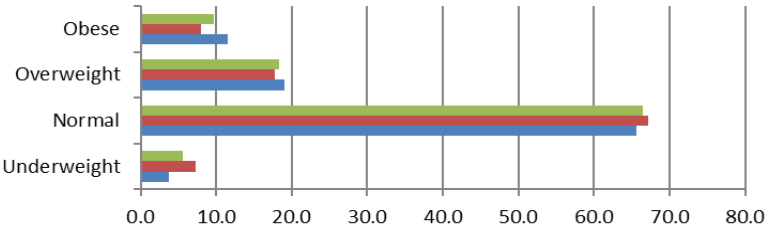
Results

The results indicate that the subjects' parents have mostly secondary education (fathers 60.67%; mothers 53.87%). A slightly higher percentage of mothers have higher / high education (30.93%) compared to fathers (21.58%), while a lower percentage of parents of both sexes have completed only primary school (fathers 17.74%; mothers 15.19%). The largest number of children grows in a family with one or two children (73.24% boys; 69.63% girls), while the smallest number of children comes from families with 4 or more children (boys 5.90%; girls 8.80%). More than half of the surveyed children have some additional physical activity outside school (boys 57.69%; girls 53.70%) and mostly live in settlements with over 100,000 inhabitants (boys 52.04%; girls 53.27%) and 1000-10,000 inhabitants (boys 39.92%; girls 38.53 %). The children are mostly of Serbian (60.63%) and Hungarian nationality (35.82%), while members of Croatian (2.05 %%) and Roma (1.49%) nationality are present in significantly lower number. The results indicate that average values of BMI increase with age and are higher in boys than girls in each age (Table 1).

Table 1. Mean values of BMI according to sex and age

	Age (years)	N	Mean	SD	Minimum	Maximum
Boys	7	139	17.32	3.21	13.16	30.37
	8	276	17.45	2.83	13.02	28.67
	9	259	18.31	3.07	12.96	29.25
	10	260	19.16	4.13	12.77	35.13
	11	123	19.75	3.61	13.81	28.44
	Total	1057	18.33	3.49	12.77	35.13
Girls	7	123	16.60	2.50	12.50	24.23
	8	274	17.05	2.83	12.95	32.45
	9	265	17.68	2.99	12.54	27.21
	10	281	18.23	3.37	11.80	30.52
	11	142	19.62	4.01	12.87	33.10
	Total	1085	17.79	3.27	11.80	33.10

Most children, of both sexes, are normally nourished. Underweight is represented in the lowest percentage 5.6%, overweight in 18.3%, and obesity 9.7%. Boys are more often overweight and obese, while girls are more often underweight (Figure 1).



	Underweight	Normal	Overweight	Obese
Total	5.6	66.4	18.3	9.7
Girls	7.3	67.1	17.7	7.9
Boys	3.8	65.7	19.0	11.5

Figure 1. The prevalence of nutritional categories in boys and girls

The results of the linear regression analysis (Table 2) indicate that together all examined socioeconomic and demographic factors significantly affect BMI values and together explain 9% of variability. Gender, age, mother's education and the number of children in the family have the most significant influence on BMI.

Table 2. Influence of socioeconomic and demographic parameters on BMI

Socioeconomic and demographic variables	Beta	t	P
Gender	-0.082	-3.843	**0.000**
Age (years)	0.241	11.187	**0.000**
Father's education	-0.010	-0.386	0.700
Mother's education	-0.086	-3.235	**0.001**
Physical activity	-0.023	-0.993	0.321
Number of children in the family	-0.098	-4.510	**0.000**
Settlement size	-0.021	-0.266	0.790
Urban /rural environment	0.007	0.095	0.924
Ethnicity	-0.030	-1.362	0.173

In both sexes, the education of mothers shows a negative relationship with the values of BMI, ie with the increase of education, the values of BMI decrease, and this is the case with the influence of the education of the father in girls. BMI values are lower in both sexes in children who come from families with a larger number of children. Settlement size also negatively affects BMI. Lower BMI values were observed in children from larger settlements and in urban areas (Table 3).

Table 3. Influence of socioeconomic and demographic parameters on BMI in boys and girls

Socioeconomic and demographic variables	Boys			Girls		
	Beta	t	p	Beta	t	p
Father's education	-0.052	-1.656	0.098	-0.082	-2.641	**0.008**
Mother's education	-0.083	-2.660	**0.008**	-0.139	-4.552	**0.000**
Physical activity	-0.037	-1.197	0.232	-0.044	-1.430	0.153
Number of children in the family	-0.109	-3.563	**0.000**	-0.061	-2.002	**0.046**
Settlement size	-0.071	-2.328	**0.020**	-0.089	-2.937	**0.003**
Urban /rural environment	0.066	2.137	**0.033**	0.098	3.256	**0.001**
Ethnicity	0.008	0.253	0.800	0.001	0.024	0.981

The results of the binary logistic regression analysis (Table 4) indicate that obesity in boys is most negatively related to the education of mothers and the number of children in the family.

Table 4. Results of binary logistic regression analysis of socioeconomic and demographic parameters on obesity in boys

Socioeconomic and demographic variables	B	Wald	Sig	OR	95% C.I.for EXP(B) (Lower-Upper)
Father's education	-0.181	1.290	0.256	0.835	0.611-1.140
Mother's education	-0.373	6.011	**0.014**	0.688	0.511-0.928
Physical activity	-0.127	0.432	0.511	0.880	0.602-1.287
Number of children in the family	-0.407	10.309	**0.001**	0.666	0.519-0.853
Settlement size	-0.157	2.724	0.099	0.855	0.611-1.140
Urban /rural environment	0.287	2.207	0.137	1.332	0.913-1.944
Ethnicity	-0.112	0.474	0.491	0.894	0.650-1.230

In girls (Table 5), all factors significantly affect obesity except the number of children in the family.

Table 5. Results of binary logistic regression analysis of socioeconomic and demographic parameters on obesity in girls

Socioeconomic and demographic variables	B	Wald	Sig	OR	95% C.I.for EXP(B) (Lower-Upper)
Father's education	-0.517	7.779	**0.005**	0.596	0.415-0.858
Mother's education	-0.518	9.289	**0.002**	0.597	0.428-0.832
Physical activity	-0.729	9.877	**0.002**	0.482	0.306-0.760
Number of children in the family	-0.104	0.786	0.375	0.901	0.716-1.134
Settlement size	-0.336	9.151	**0.002**	0.715	0.575-0.888
Urban /rural environment	0.753	10.917	**0.001**	2.124	1.359-3.320
Ethnicity	0.370	5.298	**0.021**	1.448	1.056-1.984

Discussion

In the current study the overall prevalence of overweight and obesity was 18.3 % and 9.7% respectively, while 5.6% were underweight. The remaining 66.4% were of normal weight. Comparing these results with the data previously obtained in the North Bačka District for children aged 8 to 14 (Pavlović, 1999), an increase in the prevalence of overweight and obesity in today's children has been observed. A study conducted more than two decades ago recorded moderate obesity in 8.6% of boys and 7.5% of girls, and obesity in 3.6% of children. The results of the study were obtained according to the reference values of NHANES I, which should certainly be taken into account when interpreting the current findings, given that the results between different studies can vary significantly depending on which criterion was used. The average values of the Body Mass Index in today's children in the North Bačka region are 18.33 kg/m2 for boys and 17.79 kg/m2 for girls. In comparison with the results of Pavlović (1999), where the average values of the Body Mass Index for children aged 7 to 11 were 16.97 kg/m2 in boys and 16.86 kg/m2 in girls, an increase in the average values of the Body Mass Index is also observed. According to the recent data on prevalence and trends of overweight and obesity in European children (Garrido-Miguel et al. 2019) the combined

prevalence of overweight and obesity in children aged 2 to 13 years changed from 20.6% during 1999 to 2006 to 21.3% during 2011 to 2016. Additionally, the prevalence of obesity in this age group changed from 4.4% during 1999 to 2006 to 5.7% during 2011 to 2016. The results obtained for European countries, compared to the data obtained in this study, indicate a high prevalence of exceed weight in children of North Bačka region.

It has been found that together all examined socioeconomic and demographic factors significantly affect BMI values and together explain 9% of variability. Gender, age, mother's education and the number of children in the family exert the most significant influence on BMI. In both sexes, with the increase of mother's education, the values of BMI decrease, and this is the case with the influence of the education of the father in girls. BMI values are lower in both sexes in children who come from families with a larger number of children. Settlement size also negatively affects BMI. Lower BMI values have been observed in children from larger settlements and in urban areas. In the multivariate logistic regression analysis, education of mother and the number of children in the family are important predictors of obesity in boys, while in girls all factors significantly affect obesity except the number of children in the family. According to the earlier results (Lamerz et al. 2005), the most important sociodemographic factor explaining children's obesity status is parental education level, which is consistently inversely associated with children's body weight and adiposity. Parental education is significantly related with beliefs, health behaviours of the family, knowledge on nutrition, better nutritional and physical activity habits of the children (Shrewsbury and Wardle, 2008). In Greece (Farajian et al. 2012) it was found that paternal but not maternal education level seemed to be an important predictive factor for childhood obesity. A recent review (Spinelli et al. 2019) of cross-sectional studies published between 1990 and 2005 found that socioeconomic status was inversely associated with children's overweight or obesity in 42 % of the reviewed studies, while in the rest of the studies the authors found mixture of inverse or no associations. These relationships depend on the factors used in research. The evidence was less conclusive when family income was used as a possible variable explaining childhood obesity, while parental education showed the most consistent inverse relationship with children's obesity risk. Investigation on 8-15 aged children in Bulgaria (Mladenova and Andreenko, 2015) showed lack of distinctive influence of the parental level of education, place of residence, city-village, daily feeding regimen and sports over the nutritional status of the studied individuals.

The current results indicate that exceed weight is present in 27.73% of subjects and represents a public health issue in younger school-aged children of this region in Vojvodina. A significant relationship between certain sociodemographic parameters and BMI values and the occurrence of obesity in both sexes has been observed. Nevertheless, maternal education seems to stand out as the most significant factor influencing obesity in both sexes.

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UTICAJ SOCIOEKONOMSKIH I DEMOGRAFSKIH PARAMETARA NA GOJAZNOST DECE OD 7 DO 11 GODINA U SEVERNOBAČKOM REGIONU

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Sažetak. U Republici Srbiji, gojaznost prerasta u veliki problem. Cilj rada je bio da se utvrdi nutritivni status dece od 7 do 11 godina i mogući faktori koji utiču na gojaznost. Transferzalno antropološko istraživanje je urađeno u osnovnim školama u ruralnim i urbanim sredinama severnobačkog regiona Vojvodine (severni deo Republike Srbije). Istraživanje je sprovedeno od 2017. do 2020. godine i obuhvatilo je 1057 dečaka i 1085 devojčica, starosti od 6.50 do 11.49 decimalnih godina. Izračunat je Indeks telesne mase (ITM kg/ m^2), a nutritivni status je određen pomoću kriterijuma IOTF. Korišćenjem logističke regresione analize utvrđena je interakcija gojaznosti sa socioekonomskim i demografskim faktorima. Pothranjenost je prisutna kod 5.53% učenika (3.78% dečaka i 7.28% devojčica). Prevalencija prekomerne uhranjenosti je utvrđena kod 18% ispitanika (19.02% dečaka i 17.69% devojčica), a gojaznosti kod 9.73% ispitanika (11.54% dečaka i 7.93% devojčica). Utvrđena je značajna povezanost pojedinih sociodemografskih parametara sa vrednostima ITM i pojavom gojaznosti kod oba pola. Rezultati ukazuju da je prekomerna telesna masa prisutna kod 27.73% ispitanika i da predstavlja javno zdravstveni problem kod dece mlađeg školskog uzrasta u ovom regionu Vojvodine.

Ključne reči: nutritivni status, gojaznost, deca, Vojvodina, Srbija