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NUTRITIONAL STATUS AND PREVALENCE OF OBESITY IN PRIMARY-SCHOOL CHILDREN AND ITS ASSOCIATION WITH PHYSICAL ACTIVITY LEVEL

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Original research

ABSTRACT
Childhood overweight and obesity represent a growing public-health challenge worldwide, but data from Bosnia and Herzegovina are limited. This cross-sectional study assessed the nutritional status of 5,678 primary-school pupils (2,853 boys and 2,825 girls) in Sarajevo Canton by measuring height and weight, classifying body-mass index (BMI) with WHO growth charts and grouping weekly extra physical activity into ≥ 3 h or ≤ 2 h outside regular physical-education lessons. Normal body mass was recorded in just over half of the children (50.6 %), while 22.7 % were overweight, 18.2 % obese and 8.3 % below the normal range; only one child in three met the ≥ 3 h activity threshold. Chi-square testing showed no significant dependence between BMI category and physical-activity group, and Spearman's correlation revealed no meaningful monotonic relationship between raw BMI values and weekly activity hours. Although a high prevalence of excess body mass was confirmed, the anticipated inverse association with reported physical-activity level was not observed. The findings highlight the need for more nuanced, longitudinal research—incorporating objective activity tracking, dietary assessment and narrower age bands—to clarify the complex interplay of behavioral and environmental factors influencing childhood obesity in the Bosnian context.

Keywords: obesity, physical activity, nutritional status

INTRODUCTION

The prevalence of obesity worldwide, including in neighboring countries, is more evident than ever before. The incidence of this condition has been rising steadily, and because it has been monitored intensively over the past 30–40 years, a dramatic increase has been recorded during that period. In most countries where records are kept systematically, the number of obese individuals has tripled to quintupled (Bray, 2007; Bray, 2008; Bray, 2011). For example, in the 1970s some 14.5 % (around 25 million) of the population of the United States of America was obese (Fryar et al., 2015), whereas contemporary data place that proportion at 34.9 % (about 80 million) (Ogden et al., 2014). Lobstein (2010) reports that in some countries the number of obese individuals has quadrupled since the 1960s. An increase in obesity is evident across all age groups of the population, and childhood obesity in particular poses a serious global challenge. Obesity in early and late childhood represents one of the greatest challenges to public health in the 21st century. Over the past five decades the trend towards overweight and obesity in children, based on body-mass index (BMI), has mirrored that observed in

that observed in adults (Lobstein, 2010; Wang & Lobstein, 2006). Expert projections are not encouraging, as they predict that the number of obese individuals worldwide will continue to rise, creating not only public health but also a socio-economic problem. In addition to dietary habits, a sedentary lifestyle—manifested in children as reduced physical activity and an increased number of hours spent using electronic devices—directly contributes to the development of obesity. Beyond these lifestyle issues, negative factors within the school system itself also drive obesity. Pupils have at most two Physical and Health Education lessons per week, often combined into a single double period, and thus achieve little real physical activation. Extra sports or recreational activities involving children or the entire family are recommended, but they are only rarely implemented. The likely reason is that such activities require both financial and time commitments from parents, which limits their uptake across the broader population of children and adolescents (Abazović et al., 2016). All these factors are plausible and very concrete, underlying the progressive increase in the number of obese children and young people in the setting studied. The worldwide rise in obesity and in the incidence of obesity-related chronic diseases, together with clear and growing statistical evidence, has brought this problem to the forefront of medical interest (Abazović et al., 2016).

In view of the foregoing, the fundamental objective of the present research was to determine the nutritional status and prevalence of obesity among primary-school children and to examine its association with the level of physical activity.

METHODS

Sample of Participants

The study sample comprised 5,678 children from twelve primary schools in Sarajevo Canton, namely 2,853 boys (50.2 %) and 2,825 girls (49.8 %) across all nine grades. The relevant ministry, the individual schools, and the participants' parents granted consent for all procedures, which were conducted in conformity with the Helsinki Declaration

Variables

The following basic anthropometric measurements were taken for all participants:
- Body height (BH)
- Body mass (BM)

On the basis of these two directly measured variables, the body-mass index (BMI) was calculated for every participant. To classify the children according to BMI, the paediatric growth charts recommended by the World Health Organization—which incorporate growth and developmental factors—were used. Each child was thus placed into one of five categories: underweight, moderately underweight, normal body mass, overweight, and obese.

In addition to the anthropometric variables mentioned, the weekly level of physical activity was recorded for every participant, on the basis of which the children were divided into two groups:
- ≥ 3 h per week
- ≤ 2 h per week

This grouping made it possible to determine exactly how many children, on a weekly basis and in addition to their regular Physical and Health Education classes, engaged in extra organized sports activities

Statistical analysis

Frequencies were calculated for all variables. BMI cut-off values were defined at half-year intervals, providing a detailed insight into the actual nutritional status recorded in the sample. Additionally, Chi-square test and Spearman's rank-order correlation were conducted in order to observe whether observed distributions differ significantly from the expected distribution and to determine correlation strength and direction, respectedly. Significance level was set at $p<0.05$.

RESULTS

The chi-square test is used to examine the independence of two variables, that is, to determine whether the distributions differ from the theoretical ones. The results presented in Table 2 indicate a significant departure of the observed distributions from the theoretical distributions.

Table 1: Observed frequency distributions for physical-activity level, body-mass index, and body-mass index grouped into three categories.

PAL	N	BMI	N	BMI 3 class	N
≥3	1892	Underweight	128	BMI	469
≤2	3786	Moderately underweight	341		
		Normal body mass	2874	Optimal BMI range	2874
		Overweight	1289	BMI above optimal range	2324
		Obese	1035		

Table 2: Values of the chi-square test for the variables physical-activity level (PAL), BMI, and BMI in three categories.

Test Statistics			
	NTA	ITM (Binned)	ITM 3 Grade
Chi-Square	631.778[a]	4148.852[b]	1681.233[c]
df	1	4	2
Asymp. Sig.	.000	.000	.000

Based on the results shown in Table 3, it can be stated that no statistically significant associations were found between the domains studied. Specifically, no significant correlation ($p = 0.819$) was detected between nutritional status (BMI) and the weekly level of physical activity. Likewise, no significant correlation ($p = 0.535$) was recorded between physical-activity level and BMI when the latter was broadly classified into three categories (below, at, and above the threshold for normal BMI).

Table 3: Spearman's rho correlations for the variables PAL, BMI, and BMI in three categories

Correlations					
			NTA	BMI (Binned)	BMI 3 Grade
Spearman's rho	NTA	ρ	1.000	-.003	-.008
		p (2-tailed)	.	.819	.535
		N	5678	5667	5667
	BMI (Binned)	ρ	-.003	1.000	.969**
		p (2-tailed)	.819	.	.000
		N	5667	5667	5667
	BMI 3 Grade	ρ	-.008	.969**	1.000
		p (2-tailed)	.535	.000	.
		N	5667	5667	5667

**. Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

The primary aim of this study was to determine the nutritional status and prevalence of obesity among primary-school children and to establish its relationship with physical-activity level.

After determining the level and structure of the children's physical activity and performing a full sub-analysis by sex, age, and school attended, no statistically significant associations were identified between the researched domains.

Specifically, no statistically significant correlation ($p = 0.819$) was established between nutritional status expressed as BMI and the level of physical activity measured in hours spent in organised exercise. Furthermore, no significant association ($p = 0.535$) was found between physical-activity level and BMI when BMI was collapsed into three broad categories.

Although many previous studies (Tremblay & Willms, 2003; Reilly et al., 2005; Patrick et al., 2004; Vasconcellos et al., 2014) have demonstrated links between physical-activity level and BMI, those results do not accord with our findings. Tremblay and Willms (2003), for example, reported that children with normal body mass are significantly more physically active than their overweight or obese peers. The same authors concluded that specific relationships exist between certain intensity domains of activity and body composition—children with normal body mass are more active overall, whereas those with elevated body mass are less active.

Differences between studies that have found statistically significant associations and the present research are probably attributable to methodological variations, most notably sample homogeneity and size. Future research should use more homogeneous samples and finer age stratification in order to clarify the complex links between physical-activity level, BMI, obesity, and their aetiological factors.

CONCLUSION

The results indicate no statistically significant association between nutritional status, expressed as BMI, and the level of physical activity, whether measured directly or after consolidating BMI into three categories. The discrepancy between earlier studies that reported such an association and the present findings can likely be explained by sample heterogeneity and the wide age range of the participants analysed.

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Conflict of Interest

The authors do not have any conflicts of interest to disclose. All co-authors have reviewed and concurred with the manuscript's content, and no financial interests need to be reported.