

Research Article

Overweight and obesity prevalence in Bulgarian schoolchildren: A comparison between two international standards

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Abstract

Objective: To perform a comparative analysis of the nutritional status of schoolchildren assessed by two international standards.

Methods: In 2011 a cross-sectional survey on a nationally representative sample of 4360 schoolchildren aged 6 - 18 years was conducted. Height and weight were measured. Overweight and obesity of schoolchildren were assessed by BMI, using the WHO Growth Reference 2007 and the IOTF standard 2000. The prevalence of overweight and obesity in the schoolchildren evaluated by each standard was compared.

Results: The combined prevalence of overweight and obesity in the studied children according to the WHO reference standards was 30.2% versus 25.3% established by the IOTF standard. Values for obesity were respectively 12.7% and 8.4%.

The overweight prevalence in all studied age groups (6-9; 10-13; 14-18) assessed on the basis of WHO reference values was similar compared to those for pre-obesity evaluated by the IOTF standards. The obesity prevalence among children was evaluated at higher values when WHO reference values were applied as the differences in obesity prevalence were significant for boys aged 6-9 years (IOTF -11.1%, WHO -20.4%) and 10-13 years (IOTF -9.6%, WHO -17.1%) and for girls aged 10-13 years (IOTF -6.7%, WHO -10.8%).

Conclusion: The differences between rates of obesity in children and adolescents assessed by the most applied standards represent challenges in the current evaluation of obesity and related health risks in this age at individual and national level.

Keywords: BMI, assessment, schoolchildren

1. Introduction

The assessment of the growth and development of children and adolescents based on anthropometric indices is a prerequisite for determination of child nutritional and health status^{1,2}.

The anthropometric data received in the study of schoolchildren in Bulgaria is a basis for planning, conducting and evaluating the intervention programs related to health and nutrition promotion³.

The currently used child growth standards in Bulgaria were created on the basis of a study conducted 30 years ago (1980-1982) in a representative sample of practically healthy children, however, the recruited children were only of a Bulgarian ethnic origin⁴. The mentioned standards and their application do not result in an adequate assessment of overweight and obesity because only the Height-for-age (HA) and Weight-for-age (WA) anthropometric indices are included in the Bulgarian standards, while the international criteria Weight-for-Height and Body Mass Index have not been used.

The aim of the present study is to perform a comparative analysis of the nutritional status of children and adolescents in Bulgaria assessed by an anthropometric indicator (Body Mass Index) following the WHO Growth Reference⁵ 2007 and the International Obesity Task Force standard⁶ (IOTF) 2000.

2. Material and Methods

A cross-sectional survey on a nationally representative sample of 4360 schoolchildren aged 6-18 years was conducted in 2011. Two-stage cluster random sampling was carried out. The sampling frame was based on lists of all schools in the country, including 36 randomly selected schools in the survey. The distribution of the schoolchildren by urban/rural residence in the samples reflected the actual distribution of children and adolescents according to their places of residence in the different age groups determined by the locations of the schools. Schoolchildren participated in the study after obtaining an informed consent from one of their parents.

The assessment of nutritional status is constituent of a large study on nutrition, nutritional and health status of schoolchildren in Bulgaria. Height, weight were measured following a standardized WHO methodology. The body mass was measured by an electronic scale, Tanita UM-072 Model, especially designed for children and measurement accuracy was in the range of up to 10 g. The height of children was measured by stationary stadiometer as the accuracy of measurement obtained was 0.1 cm. All measurements were taken in light clothing and without shoes. Body Mass Index (BMI) was calculated by the quotient of body weight in kilograms by height in m² and converted into z-score adjusted by age and sex using WHO Anthro Plus⁷ software.

The IOTF and WHO reference standards were used to classify overweight and obesity in the schoolchildren using BMI cut-offs by age and gender. Overweight and obesity prevalence in the schoolchildren evaluated by each standard was compared.

3. Statistical Methods

The processing of data was performed using the statistical package SPSS 17.0. The methods applied are: frequency analysis of qualitative variables, quantitative aspects of variation analysis, z-test for proportions-dependent/independent groups.

4. Results

A total sample of 4360 schoolchildren, with an average age of 12.7±3.5 years, participated in this study. The girls represented 50.4% of the sample, whereas boys – 49.6%. The percentage of boys in the different age groups varied within the range of 47-55%.

Prevalence of overweight and obesity among schoolchildren aged 6-18 years using IOTF and WHO reference standards are presented in Figure 1-2 and Figure 3-4. In general, pre-obesity (overweight) ranged from 13.9% to 22.9% among boys, and from 3.9% to 22.5% among girls, whereas obesity is within the range of 6.6% - 24.9% among boys, and 5.1% - 23.1% among girls.

Statistically significant difference in the application of the both criteria was found in the obesity percentage among 8, 9, 10 and 11-year-old boys and 12-year-old girls (p <0.05, z-test for proportions of dependent groups). The assessment of the overweight schoolchildren showed no difference in the application of these criteria.

Figure 1: Prevalence of overweight in boys 6-18 years old, estimated using WHO and IOTF classification methods differentiated by age

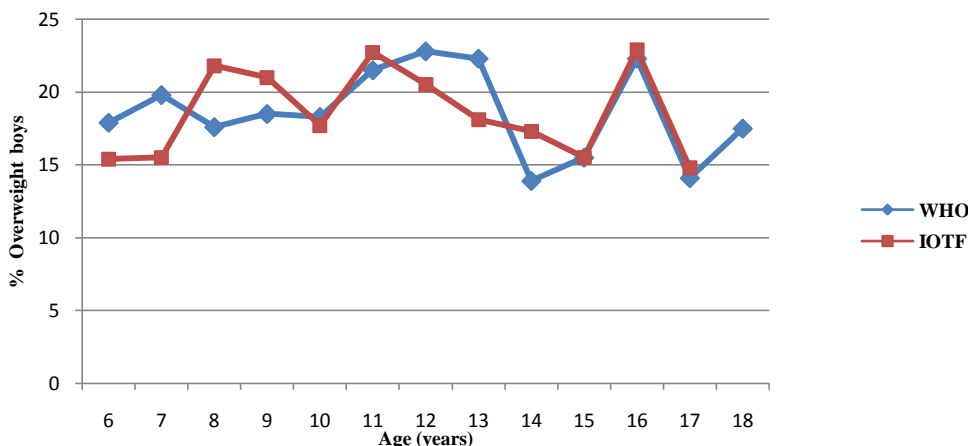


Figure 2: Prevalence of overweight in girls 6-18 years old, estimated using WHO and IOTF classification methods differentiated by age

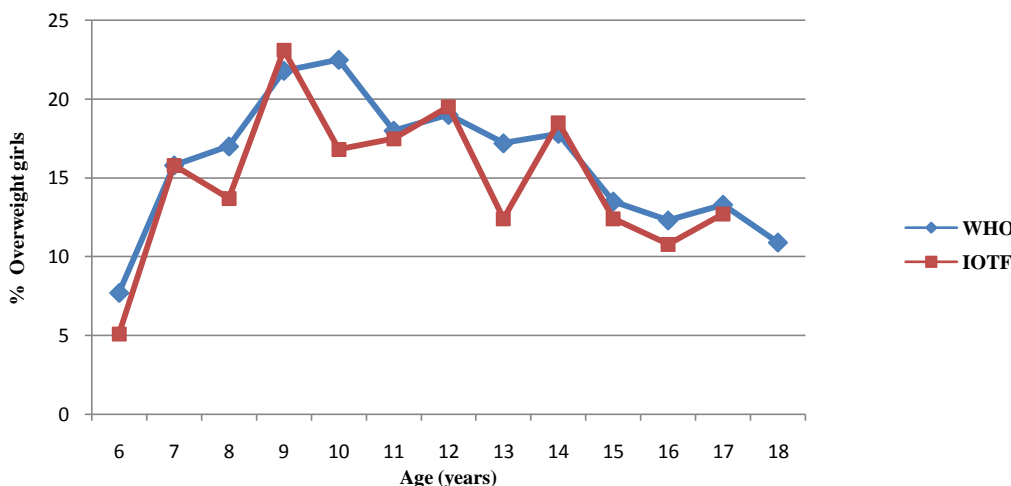
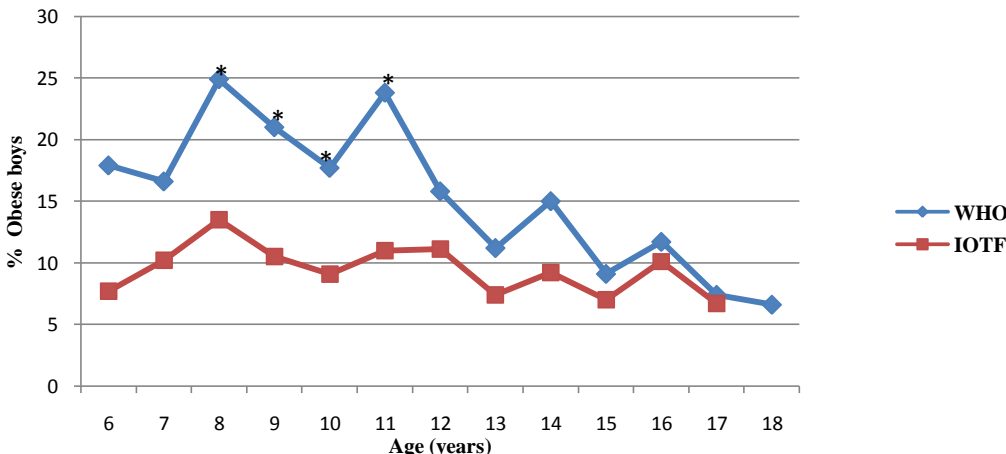
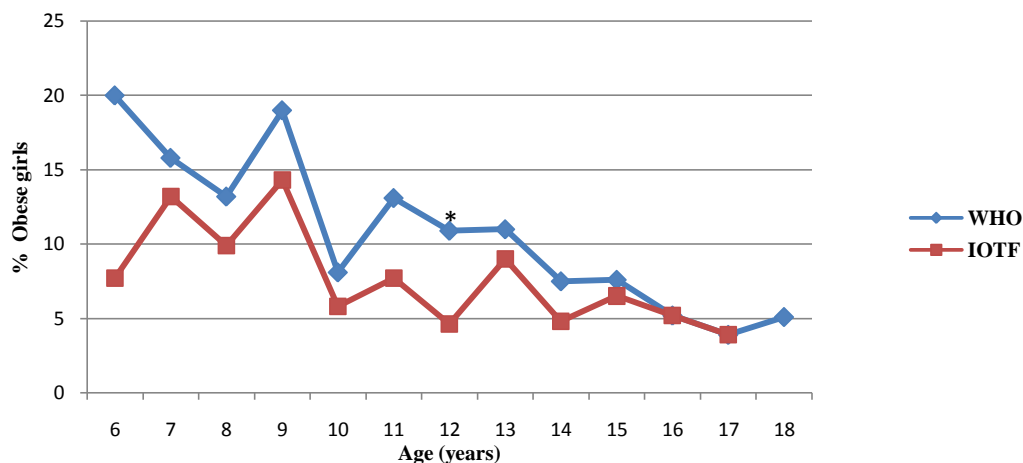


Figure 3: Prevalence of obesity in boys 6-18 years old, estimated using WHO and IOTF classification methods differentiated by age



*p<0.05, difference between the obesity prevalence assessments at the same age

Figure 4: Prevalence of obesity in girls 6-18 years old, estimated using WHO and IOTF classification methods differentiated by age

* $p < 0.05$, difference between the obesity prevalence assessments at the same age

The combined prevalence of overweight and obesity among the studied children according to the WHO reference standards is 30.2% versus 25.3% established by the IOTF standard. The values for the obesity were respectively 12.7% on the base of the WHO criteria and 8.4% regarding the IOTF criteria. Considering obesity, there is a difference of 4.3% and z-test for proportions-independent groups revealed its significance for 95% CI. Regarding overweight, the difference between two criteria (0.6%) was not significant for 95% CI.

Assessments of overweight and obesity of schoolchildren in the studied groups by gender and age (6-9; 10-13; 14-18) on the basis of Body Mass Index when using the standard proposed by Cole *et al* (the International Obesity Task Force standard, 2000) and the WHO reference standards (2007) are presented in **Table 1**.

According to the WHO reference standards the combined prevalence of pre-obesity and obesity in studied boys and girls from each age group is higher compared to the assessed one by IOTF standards as the differences in prevalence were significant among the boys aged 6-9 and 10-13 years and the girls aged 10-13 years ($p < 0.05$, z-test).

Table 1: Overweight and obesity prevalence in children aged 6-18 years old using IOTF and WHO reference standards, differentiated by age and gender

Age (years)	Gender	Pre-obesity/Overweight (%)		Obesity (%)		Overweight + Obesity (%)	
		WHO	IOTF	WHO	IOTF	WHO	IOTF
6-9	Boys	18.6	19.2	20.4*	11.1	38.9*	30.4
	Girls	17.2	16.3	15.2	12.0	32.4	28.3
10-13	Boys	21.2	19.7	17.1*	9.6	38.3*	29.3
	Girls	19.3	16.7	10.8*	6.7	30.1*	23.4
14-18	Boys	16.6	17.9	10.9	8.2	27.5	26.1
	Girls	13.8	13.2	5.9	5.1	19.7	18.3

* $p < 0.05$, difference between percentage values at the same gender and age group, z-test

The WHO reference standards resulted in higher prevalence of obesity compared to the IOTF standards, however, similar prevalence of pre-obesity (overweight) was found for both standards. The differences in pre-obesity (overweight) were not significant for all age groups, however, the differences of obesity prevalence were significant for boys aged 6-9 years (IOTF -11.1%, WHO - 20.4%) and 10-13 years (IOTF - 9.6%, WHO - 17.1%) and girls aged 10-13 years (IOTF - 6.7%, WHO - 10.8%) ($p < 0.05$, z-test).

5. Discussion

The survey shows high prevalence of overweight and obesity among schoolchildren in Bulgaria in the application of the two criteria for assessing the growth and development of children and adolescents (WHO reference standards and IOTF standards (Figure 1-4 and Table. 1). The incidence of overweight and obesity among the children of all studied age groups (6-9, 10-13 and 14-18) is higher than the acceptable limit of 5% for prevalence in a population group confirming the high public importance of the issue.

Since 1997, several nationally representative surveys including the assessment of nutritional status of schoolchildren have been conducted in the country as well as a number of local studies⁸⁻¹⁴. Data from these studies were processed and published applying different standards and criteria.

The established problems among the schoolchildren in Bulgaria are similar to those observed in recent decades in some of the European countries as well as in other countries worldwide as an increase in overweight among schoolchildren has been observed¹⁵⁻²³. The outcomes resulting from the nationally representative survey in 1998 showed high incidence of overweight among schoolchildren, calculated according to the previous indices and criteria of WHO² from 1995, and reflecting a period of economic problems in Bulgaria⁹. It was established that the children from low-income and low-economic-status families were exposed to the highest risk in terms of both the malnutrition resulted in underweight and stunting and the overweight and obesity²³. There is so called "Double burden of disease" – simultaneous presence of significant incidence of overweight and underweight as well as stunting in children - a condition typical during periods of economic crisis.

In 2012, the data from a nationally representative survey conducted in 2004 were published. In this survey²⁴ the prevalence of overweight and obesity among schoolchildren in Bulgaria was evaluated according to the new standards and criteria of the WHO from 2007. Due to impossibility of comparing the outcomes with those of the study conducted in 1998 and tracking the trends in the prevalence of disorders in the nutritional status of different population groups, Petrova and her colleagues recalculated the data resulting from the survey conducted in 2004 on the basis of the previous WHO criteria from 1995. Thus, the comparative analysis of the outcomes of surveys conducted in 1998 and 2004 established a reduction in obesity among the children from the age groups (6-9, 10-13 and 14-18), evaluated according to the previous indices and criteria of WHO² from 1995.

The data regarding the prevalence of overweight and obesity among schoolchildren in Bulgaria established in this survey can be compared with those of the study conducted in 2004 since the assessment was performed on the basis of WHO reference standards 2007. The comparative analysis shows an increase in obesity in schoolchildren of both sex of the studied age groups (6-9, 10-13 and 14-18) meaning that it is likely the upward trend of obesity among the school-age children has developed for the recent few years, resulting from the economic problems in the country.

The analysis of data from the present study applying the IOTF standards confirms the fact that overweight and obesity among schoolchildren in Bulgaria is a significant problem. The comparative analysis of the data from this survey with those from the study carried out in 1998 which were initially calculated using IOTF standards, shows a significant increase in obesity in all age groups, both in boys and girls on account of the double increased incidence of obesity for the last 15 years, whereas the overweight among the schoolchildren from all studied groups varies within a very narrow range⁹.

At present, both the Cole (IOTF) criteria and the new WHO standards for assessing overweight and obesity in children are used at the international level. The anthropometric assessment of nutritional status of children in both the IOTF standards and the WHO reference standards has been developed on the basis of multicenter studies, clinically validated and tested in different countries^{5,6}. The data obtained applying both standards have been processed according to the LMS method which allows determining of a reference population and creating an international standard for the evaluation of overweight and obesity among children based on the BMI at the age 2–18 years (IOTF standards) and 5–19 years (WHO reference standards), respectively. The advantages and disadvantages of both (IOTF standards and WHO reference) standards have been widely discussed in the literature²⁵⁻²⁷.

Further research is needed regarding the applicability of the international standards for the assessment of growth and development of schoolchildren in Bulgaria to unify the approach for research and facilitate the work of health professionals in practice.

At present, the significant difference in the prevalence of obesity resulted from using both criteria requires the necessity of their simultaneous application in Bulgaria for the purposes of comparability of the results obtained at both the international and national levels. The lack of adequate national criteria for the assessment of overweight in young children which is an important health problem over the last years raise a question for the necessity of reanalysis of the anthropometric standards used for assessing the growth and nutritional status of schoolchildren in our country.

6. Conclusion

The differences between rates of obesity in children and adolescents assessed by the most applied standards (Cole and WHO) represent challenges in the current evaluation of the obesity and related health risks at this age at both the individual and national level.

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