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Prevalence of Overweight and Obesity in Hungarian Children and Adolescents

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Keywords
Overweight · Obesity · Prevalence · Children and adolescents · Prevention

Abstract
Background/Aims: The prevalence of overweight and obesity in children and adolescents is increasing worldwide, and this condition is a risk factor for cardiovascular mortality. The aim of this study was to assess the prevalence of overweight and obesity among the 3–18-year-old population in Szolnok City and the surrounding areas. ***Methods:*** Anthropometric data from healthy, white individuals recruited from nursery, elementary, and secondary schools were used to assess the prevalence of obesity and overweight in Szolnok City and the surrounding area, Jász-Nagykun-Szolnok county, Hungary. Healthy subjects numbering 6,824 (54% boys) were included; overweight and obesity were defined according to the relevant guidelines. ***Results:*** Overweight individuals constituted 13.4% of the population and 6.6% were obese. The total prevalence was higher in boys (21.6%) than in girls (18.1%). The peak of the prevalence was observed at age 10 in both sexes (boys 33%, girls 27%) followed by a gradual decrease, which was more significant in the case of girls. ***Conclusions:*** On the basis of the recent Hungarian data, we have not detected any changes in overweight and obesity in the age group 3–9 years and we have found a significant decrease in the age group 7–14 years. Prevention of overweight and obesity in early childhood is essential.

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Introduction

The increasing number of overweight and obese children and adolescents has become a serious and alarming phenomenon worldwide. Between 1980 and 2013, the prevalence of overweight and obesity increased from 10 to 12.7% in the population aged 2–19. This rate is even worse in industrialized countries: during the period analyzed, the prevalence increased from 16.9 to 23.8% in boys and from 16.2 to 22% in girls [1]. It raises concerns regarding future cardiovascular disease risks in this population [2].

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Table 1. Prevalence of overweight and obesity in 3 European studies between 2002 and 2013

	Overweight, %		Obese, %		Total, %	
	boys	girls	boys	girls	boys	girls
HELENA (12.5–17.5 years) [5]						
European	19.4	15.9	7.4	4.0	26.8	19.9
Hungarian	17.3	13.7	6.1	3.6	23.4	17.3
ENERGY (10–12 years) [3]						
European	20.4	17.7	5.4	4.1	25.8	21.8
Hungarian	27.7	22.6	6.8	4.1	34.5	26.7
IDEFICS (2–9 years) [4]						
European	11.4	14.1	6.8	7.1	18.2	21.7
Hungarian	10.4	11.7	5.8	6.2	16.2	17.9

Recently, several studies have been carried out in Europe in order to assess the prevalence of overweight and obesity in children and adolescents, such as HELENA, ENERGY, and IDEFICS [3–5]. Hungary also took part in the aforementioned researches. Measurements were carried out in Pécs, Nagykanizsa, Mohács, and Zalaegerszeg in 2007; therefore, data regarding Hungarian children and adolescents have also been published (Table 1). While in the age groups 2–9 and 12.5–17.5 years, the prevalence of overweight and obesity in Hungary was lower than the European average, the prevalence was higher in the age group 10–12 years. Antal et al. [6] conducted a study in Budapest, Hungary in 2005 focusing on children aged 7–14 years (n = 1,928); the prevalence of overweight and obesity was 20%, and 7.3% respectively [6].

Elevated body mass index (BMI) is not merely an aesthetical problem, but the consequences of this abnormal condition may result in several diseases. These obese children are more prone to have early atherosclerosis, hypertension [7], or diabetes mellitus [8] as adults. Moreover, this condition may also result in insulin resistance, metabolic syndrome, and dyslipidemia; it may contribute to the development of asthma and obstructive sleep apnea; furthermore, non-alcoholic fatty liver disease, gastroesophageal reflux, tibia vara (Blount disease) may also be developed; even the psychic condition of a person may be affected (depression) [9].

It is known that these consequences are strongly dependent on geographical characteristics and traditions. Changes in eating habits and physical activity justify the repetition of such studies from time to time in order to detect the possible alteration in prevalence of elevated BMI. Therefore, the aim of this study was to first determine the prevalence of overweight and obesity in a healthy population aged 3–18 not affected by other diseases in Szolnok City and the surrounding areas. The second objective of this study was to observe if there has been any changes in the prevalence of such conditions from the data measured previously in Hungary, and if so, what trends can be seen, and to discover if there is a difference in age and sex distribution.

Methods

Subjects

Between 2015 and 2017, 6,824 participants (3,673 boys and 3,151 girls) were involved in the study. The subjects were between ages 3 and 18, recruited from elementary, primary, and high schools in Szolnok and the surrounding area. All the patients were Caucasian and healthy – this means that they were not on any regular medications and not affected by any chronic disease. The age distribution of both boys and girls was balanced. Informed consent for measuring the required inputs was obtained from the parents of the participants.

Methods

Height and weight measurements were performed in accordance with the Hungarian professional rules [10], using a personal scale and a mechanical height rod (Kern & SOHN GmbH, Germany). The participants were categorized according to their BMI into normal weight, overweight, and obese groups by their age and sex [11].

The protocol of this clinical study was reviewed and approved by the local Institutional Ethics Committee of the University of Pécs, Hungary.

Statistics

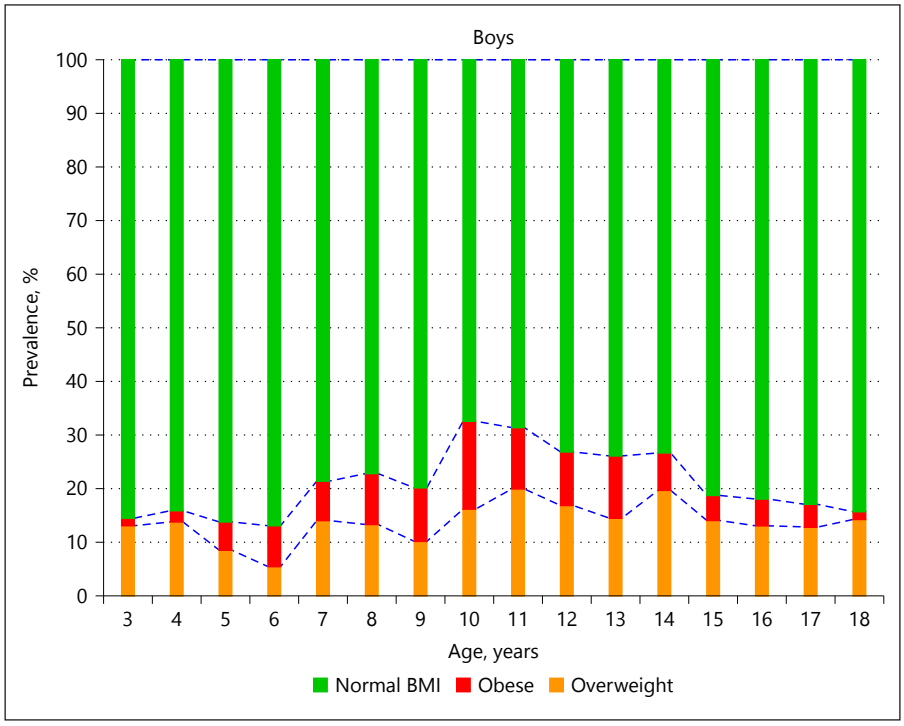
To ensure data comparison between sexes, chi-square test was carried out. Fisher's exact test was applied in order to compare the prevalence with the previous Hungarian data. For statistical tests, "p" value <0.05 was used for significance. Statistical analysis was performed with the SPSS 22.0.0.0 statistical package (SPSS Inc., Chicago, IL, USA).

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Table 2. Prevalence of overweight and obesity in boys and girls

	Boys		Girls		Total	
	n	%	*n*	%	*n*	%
Normal BMI	2,881	78.4	2,580	81.9	5,461	80
Overweight	518	14.1	397	12.6	915	13.4
Obese	274	7.5	174	5.5	448	6.6
Overweight + obese	792	21.6	571	18.1	1,363	20

BMI, body mass index.



Color version available online

Fig. 1. Graph age and BMI distribution of boys in percentage. BMI, body mass index.

Results

Table 2 contains the results of the prevalence of overweight and obesity. Out of the 6,824 subjects assessed, 2,881 boys (78.4% of the boys) and 2,580 girls (81.9% of the girls) had normal BMI. Altogether, 14.1% of the boys (n = 518) and 12.6% of the girls (n = 397) were found to be overweight, while 7.5% of the boys (n = 274) and 5.5% of the girls (n = 174) were obese. In the total population studied, the rates of prevalence of overweight and obesity were 13.4% (n = 915) and 6.6% respectively; 20% (n = 1,363) of the studied population were aged 3–18. Table 2 demonstrates that the rate of overweight and obesity is higher in the case of boys, than in the case of girls, since the total prevalence of overweight and obesity was 21.6% (n = 792) in boys and 18.1% (n = 571) in girls; this difference was proven by statistical analysis (chi-square test, $p < 0.005$). Although absolute numbers are remarkable hallmarks of this study, the age and weight distribution of the participants is indicated in percentage in order to ensure more informative data (Fig. 1, 2). The total prevalence of overweight and obesity increases between the ages 3 and 10 in both sexes; however, this increase is not even. The peaks are observed at the age of 10 in both sexes. After puberty, there is a moderate decrease in trend both in boys and girls; however, the decrease is more significant in girls.

Figure 3 represents our findings compared with the data previously measured in IDEFICS and in the study of Antal et al. [6] in Hungary [4]. To ensure the comparability of the data, our data have been determined in accor-

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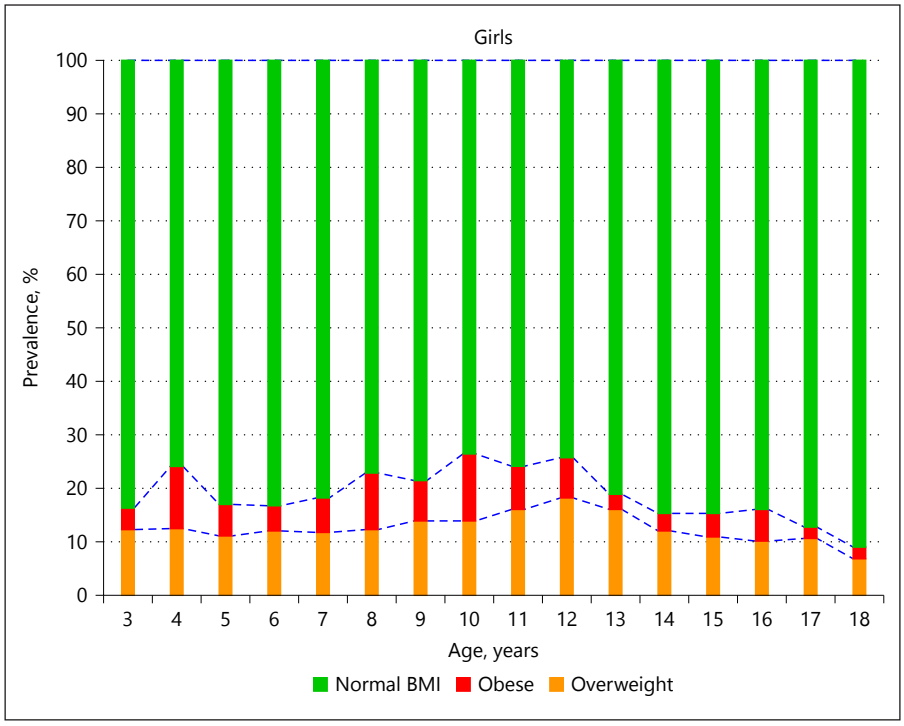


Fig. 2. Graph age and BMI distribution of girls in percentage. BMI, body mass index.

dance with the age groups applied in the previous studies (3–9 years, 7–14 years). Since prevalence rates are available only as percentages in the HELENA and ENERGY studies, and since absolute numbers regarding Hungary are not published therein, a proper statistical analysis could not be carried out in these cases. Statistically, compared to the previous Hungarian data, there has been no changes in any of the sexes in any respect (Fisher's exact test, overweight $p = 0.055$ and obesity $p = 0.66$) in the youngest age group (3–9 years). However, a slight decrease is observed in the prevalence, since the p value of the overweight is really close to the level of significance. In contrast, a significant decrease is presented in the older age group (7–14 years) in both sexes with respect to overweight: the total prevalence has decreased from 20 to 15.3% ($p < 0.005$), while in this age group, the prevalence of normal BMI increased from 72.7 to 76.4% ($p < 0.001$), and no difference is presented in the case of obesity ($p = 0.2$).

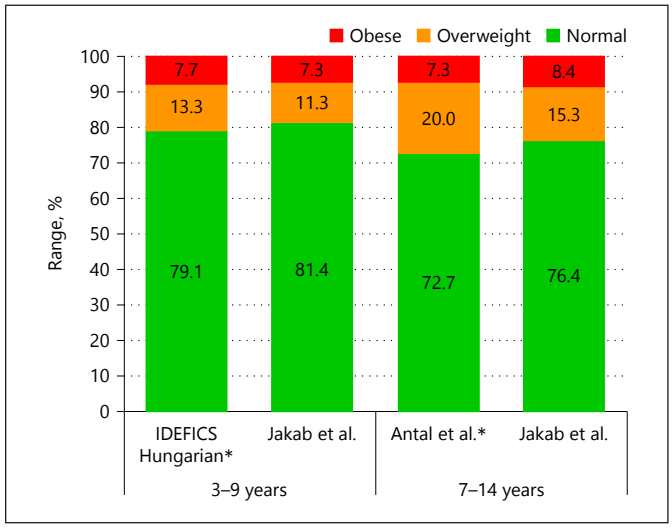


Fig. 3. Graph comparison of normal weight, overweight, and obesity prevalence between European data, latest Hungarian data, and results from this study. * Data from IDEFICS, Antal et al. [4, 6].

Discussion

The prevalence of overweight and obesity is constantly increasing in children, adolescents, and adults, in developed and developing countries, as well [1]. This condition – besides several other serious consequences – raises the risk of cardiovascular mortality, and thus, on the one hand substantially shortens life expectancy for persons, while on the other hand, imposes a burden on health care and social welfare systems.

Studies have suggested that there is a strong correlation between elevated BMI and geographical location, local habits and traditions, and socio-economic culture, consid-

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ering eating habits as well as physical activity patterns [12, 13]. Changes in environmental factors, lifestyle, eating habits, and in physical activity may affect the prevalence of overweight and obesity in a negative or positive way. Such changes and the geo-economical differences justify the repeat of large population studies in order to follow up potential changes in the frequency of overweight and obesity.

For this purpose, several studies have been carried out in Europe involving more than 10 European countries, including Hungary. Adolescents (aged 12.5–17.5 years) were assessed in the "HELENA" study [5] between 2002 and 2006; Children in the age group 2–9 years were assessed in the "IDEFICS" [4] study between 2006 and 2012; and children aged 10–12 were assessed in the "ENERGY" study [3] between 2010 and 2013. These three projects cover a remarkable period of time (>11 years). Antal et al. [6] conducted their study in the first semester of the academic year 2005/2006 [6].

Our research lasted for 3 years, and the 3–18 year old population was basically assessed simultaneously. Due to such circumstances, our findings may give a more accurate picture of the condition of a well-balanced, young generation with a significant number (n = 6,824) of participants.

In our study, the prevalence of overweight and obesity was significantly higher in boys than in girls. Our findings essentially correspond to the global prevalence published by Ng et al. [1].

According to our results, the prevalence of overweight and obesity was significantly higher in boys than in girls.

BMI differences between the sexes have long been recognized [14]. Such differences may arise from biological, sociological, and cultural differences or perhaps from the combined effects of these differences [15, 16]. There is a close correlation between the total energy expenditure and body weight [17]. Goran et al. [18] found in their longitudinal study, that between the age of 5 and 10, the total energy expenditure continuously increases in the case of boys; however, in the case of girls, this marker rises from 1,400 kcal at age 5 to 1,800 kcal at age 6 and falls to 1,600 kcal at age 9. This significant decrease is due to the fact that the girls' physical activity decreases by 50% between the age 6 and 9 years. Studies have found that adolescent girls are more likely to pay more attention to healthy nutrition, while boys are more prone to consume fast food and other less nutritious food items. These differences may stem from the Western societies' perception of the ideal body figure and from the fact that certain foods are preferred based on genders. For example, power and virility is symbolized by meat, and therefore men eat more meat than women, while fat and carbohydrate-rich foods are more often consumed by women in accordance with their menstrual cycle [19].

The above-described reasons may explain the age-related increase in prevalence of overweight and obesity, namely, that it increases between the age of 3 and 10 in both sexes, and afterwards shows a gradual decrease in both sexes; however, such decrease is more significant in the case of girls.

One of the most important observations of this study is that compared to the previous Hungarian data, mild decrease occurred in the youngest age group (3–9 years) in both sexes, in terms of overweight. Furthermore, the prevalence of overweight significantly decreased, while the prevalence of normal BMI significantly increased in the older age group (7–14 years).

The interesting fact that the total prevalence of overweight and obesity has not significantly changed in the age group 3–9 years compared to the previous Hungarian researches, may be explained by several factors. The lower supply of protein from human milk (9 and 10 g/day at ages 3 and 6 months) as compared with formula (14 and 18 g/day, respectively) [20] might attenuate both early weight gain and later obesity [21]. One of the best predictors of later obesity risk is weight gain during the first year of life [22–24]. Recent studies have pointed out that increased protein intake (+6–8 g daily) during the first year of life could lead to 2.43 times higher risk for obesity at the age of 6 [25]. Moreover, the daily rhythm of nutrition of this age group is not well balanced; some meals are often omitted, which may also increase the risk of obesity [26]. Since parents have the greatest influence on nutrition at this age, they may have a key role at eliminating these anomalies. Consequently, education of parents in the field of nutrition is crucial, since they are the ones who are mostly responsible for the daily eating routine of their children.

Recognizing these factors, several acts have been adopted in Hungary aimed to prevent obesity in childhood (daily physical education, regulation of the products offered at the school canteen, maximized the level of trans-fatty acids in products).

When examining the prevalence of these conditions in other European countries, we have found that in Switzerland, the total prevalence of overweight and obesity shows a significant decline due to the school-based promotion of physical activity and healthy nutrition. In France and Sweden, data demonstrate that the raising trend has stopped, similar to the situation in the United Kingdom, where it has reached its peak in 2005 (26.4%) and no significant change was observed until 2008 [27].

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Detailed interview questionnaires (physical activity patterns and nutritional habits) that are required to assess the progress examined, and measurement of hip and waist circumference, and upper arm skinfold thickness are planned in the future. These can give us more informative results, which could help in understanding the changes in the prevalence of increased BMI.

Based on their BMI, nearly two-third of the Hungarian adults (65% in men, 60% in women) were found to be overweight or obese [28]. Such abnormal conditions are rooted in childhood and adolescence. Results from this study suggest that overweight and obesity are present in 20% of the 3–18 year old population. This fact draws attention to the importance of prevention, healthy nutrition, and regular physical activity.

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Disclosure Statement

The authors declare that they have no conflicts of interests to disclose.

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