

Body Mass and Body Fat in Hungarian Schoolboys: Differences between 1980–2005

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Abstract The prevalence of juvenile excess weight keeps growing in the more developed world (WHO, 1998). The aim of the study was to compare the prevalence of overweight and obesity in Hungarian schoolboys in 1980 and 2005.

Two independent representative data collections were performed in volunteer boys aged between 6.51 and 18.50 years in the same 90 settlements of the country in 1980 (n=13,061) and 2005 (n=13,060). Height, body mass, and five skinfolds were measured by the same investigators in both instances. Overweight and obesity were estimated by using BMI (Cole et al., 2000), respectively skinfold thicknesses (Parízková, 1961).

The pair-wise differences between height means were consistently significant in the 12 age groups studied. Body mass differences were not exactly proportionate with height. The boys of 2005 had significantly more relative body fat than those of 1980. The prevalence of overweight and obesity was remarkably higher in 2005.

Taller height and a part of the heavier body mass in 2005 was attributed to a positive secular growth trend. The increases in BMI and fat content are negative consequences of a markedly changed lifestyle associated with inactivity and dietary habits. Because of its public health importance the trends of childhood obesity should be closely monitored. *J Physiol Anthropol* 27(5): 241–245, 2008 <http://www.jstage.jst.go.jp/browse/jpa2>
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Introduction

Recent data from almost all the countries of the industrialised world and also from the developing areas have revealed that a growing proportion of children, adolescents, and young adults is overweight or definitely obese (WHO, 1998). The increase in the prevalence of overweight and

obesity can be related above all to a marked reduction of energy expended for daily activity (including a lower level of habitual physical activity) and to absolute or relative overnutrition (Weinsier, 1998). A consistently positive energy balance over time leads to an unavoidable increase in body mass, most of which consists of depot fat. The fraction of children and adolescents exposed to health risks would therefore increase more or less year by year (Maffeis et al., 1997; Toriano et al., 1995).

As one of the consequences of a markedly changed lifestyle, the world-wide epidemic of inactivity reached Hungary during the past two decades and resulted among others in a significant decrease in the physical and physiological performance capacity of the school-age generations (Frenkl and Mészáros, 2002; Tatár, 2004). The secular trend of body fat content by using two independent nationwide representative samples has not yet been studied in Hungary. So the aim of the study was to compare the prevalence of overweight and obesity in Hungarian schoolboys in 1980 and 2005.

Material and Methods

Two representative anthropometric data collections were carried out in volunteer non-athletic, apparently healthy schoolboys of Caucasian origin, aged between 6.51 and 18.50 years and attending curricular physical education classes at school, in the same 90 settlements of the country in 1980 (n=13,061) and 2005 (n=13,060). The effective units of sampling were the schools. The possible settlements of the respective geographical regions, the required subject numbers within a given age group size and types of settlements (industrial, agricultural, or mixed) for creating nationwide representative samples were chosen using demographic criteria by the Hungarian Central Office of Statistics (Központi Statisztikai Hivatal, KSH). Distribution of subjects by calendar age and investigation can be seen in Table 1. Age groups were formed around full year midpoints [(x-1.0).51...x.50] using decimal age.

The protocol for the research project had been approved of

Table 1 Differences between height and body mass means

Age	Height (cm)						Body mass (kg)			
	1980			2005			1980		2005	
	n	Mean	SD	n	Mean	SD	Mean	SD	Mean	SD
7	1103	122.55	5.38	1094	125.41*	4.63	23.71	3.73	25.29*	4.73
8	1118	127.70	5.32	1099	130.74*	5.66	26.08	4.15	28.69*	6.21
9	1094	133.79	5.57	1089	136.07*	6.30	29.64	5.12	32.17*	7.48
10	1062	128.25	6.02	1083	140.42*	6.59	32.89	5.99	35.28*	8.45
11	1061	143.61	6.38	1080	145.97*	6.46	36.79	6.94	39.38*	9.24
12	1082	148.81	7.45	1087	151.37*	7.70	40.39	8.19	42.91*	10.33
13	1074	156.01	8.31	1085	158.84*	8.92	45.59	9.30	49.09*	11.19
14	1055	163.03	8.44	1090	164.83*	7.69	52.43	9.83	54.19*	11.22
15	1118	169.05	7.94	1096	170.55*	7.24	58.51	10.98	61.89*	12.48
16	1118	172.00	7.00	1094	174.24*	6.43	61.69	9.27	65.90*	12.30
17	1102	174.20	6.54	1083	175.68*	5.47	64.70	9.14	70.12*	12.01
18	1074	175.02	6.36	1080	177.31*	5.99	67.34	8.01	71.89*	11.72

*=difference of the means between 1980 and 2005 is significant at the 5% level of random error.

by the Scientific Ethical Committee of the university. According to the respective prescriptions of the Declaration of Helsinki, the parents of our subjects received detailed information about the aim of the study and also the technical procedures. In this we also declared our intention to consistently preserve the subjects' anonymity. A written agreement of at least one of the parents was collected.

Height, body mass, and five skinfolds (biceps, triceps, subscapular, suprailiac, and calf) were measured (using a Lange skinfold calliper) by the same investigators in both data collections. In taking body dimensions, prescriptions of the International Biological Program (Weiner and Lourie, 1969) were considered. Individual BMI and also relative body fat content were calculated. Parízková's original tabular (1961) method transformed into linear regression formulas by Szmodis et al. (1976) was used to estimate fat percentage.

The categories of overweight and obesity were determined by using the suggestions of Cole et al. (2000), namely, subjects were assigned to the relevant category after interpolating their decimal age between the respective half-year cut points.

Differences between the age group means were analysed by *t*-tests for independent samples at the 5% level of random error. Statistica for Windows software (version 7.1, StatSoft Inc., Tulsa, OK 74104, USA, 2006) was used.

Results

All the differences between the height means (Table 1) were significant in all the 12 age groups studied while no remarkable intergroup variability could be observed. The mean differences ranging between 2 and 3 cm are the consequences of positively changed environmental conditions; in summary they could be related to a positive secular growth change among the existing ones (Tóth and Eiben, 2004).

The boys investigated in 2005 were significantly heavier

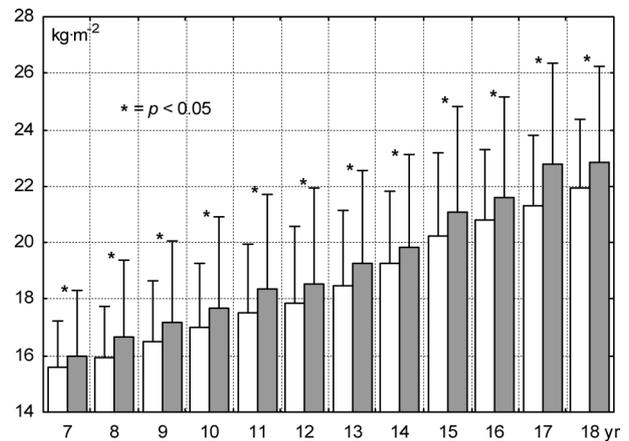


Fig. 1 Differences between BMI means (open bars=1980, shaded bars=2005; the measure of variability is standard deviation; *=difference of the means between 1980 and 2005 is significant at the 5% level of random error).

than their peers in 1980 (Table 1), but the significantly heavier body mass means were more than proportionate to the taller stature. The boys of the second investigation had therefore significantly higher BMI means (Fig. 1). Corresponding to the larger intragroup variability of body mass also the standard deviations around the BMI means were larger at the time of the second data collection.

Figure 2 contains the summary of descriptive and comparative statistics for estimated body fat content expressed as a percentage of body mass (F%). The boys of the second investigation had significantly more relative body fat than their peers studied in 1980, and also the variability of body fat content was broader in 2005. We have to note that while the directions of the differences in BMI and F% were the same, the relative differences in peer-age means of body fat content (estimates of 2005 expressed as percentages of 1980) were

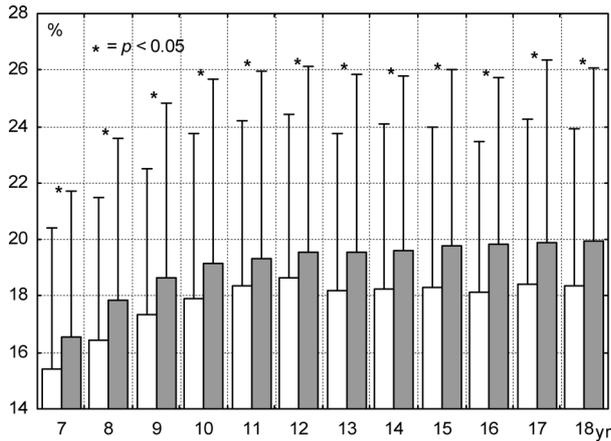


Fig. 2 Differences between weight-related body fat contents (open bars=1980, shaded bars=2005; the measure of variability is standard deviation; *=difference of the means between 1980 and 2005 is significant at the 5% level of random error).

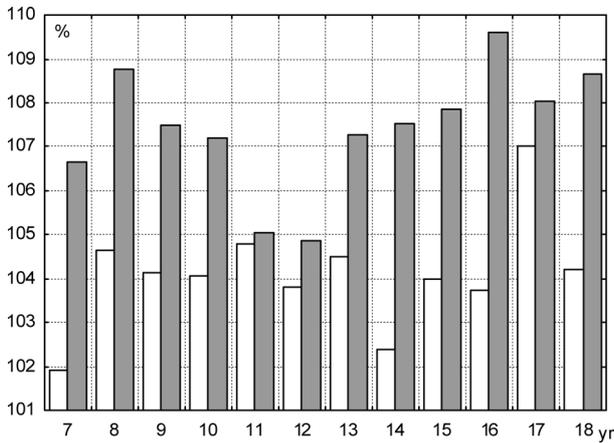


Fig. 3 Means of body mass index (open bars) and fat percentage (shaded bars) of the 2005 boys expressed as percentages of 1980.

larger than those in BMI (Fig. 3).

The prevalence of overweight and obese subjects was remarkably higher in 2005 (Fig. 4). The relative frequency increase of obese children and adolescents exceeded that of overweight ones. We have to note that these fractions were already unfavourably high in 1980. The relative changes in F% were consistently larger.

Discussion

The growth change in height and body mass largely agrees with the recent overview of Hungarian secular trend observations (Tóth and Eiben, 2004). The unchanged rates over the longer period of 25 years of our study makes one wonder how great the still existing lag might be from the biological potential of the Hungarian population.

From the marked increases in BMI and depot fat content as well as from the responses to an independent survey of ours concerning knowledge about soundness of diet and actual

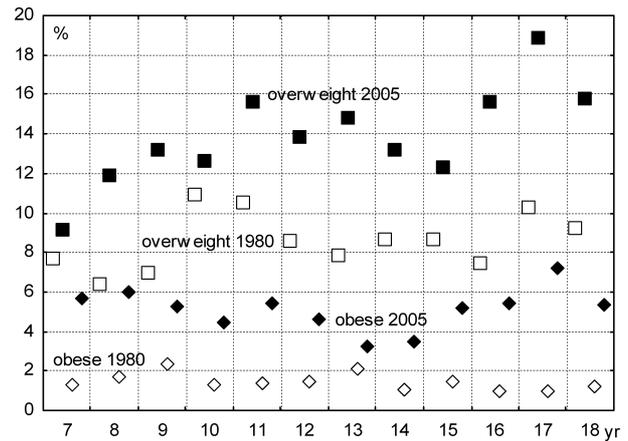


Fig. 4 Prevalence of overweight and obesity in percentage of age-group sample sizes.

dietary practice (Uvacsek et al., 2006), we have to infer a fundamental change in Hungarian lifestyle (Table 2) and dietary habits. This survey showed that there was a striking contrast between knowledge and practice in that schoolboys knew exactly which kinds of food were labelled as healthy yet a month later they gave evidence to prefer fast food menus to the former. The most likely factors of this change thus appear to be a progressive lack of habitual physical activity and an imbalance between energy output and dietary calorie intake. The number of fast-food restaurants and their variety has shown an appalling growth during the observation period. Since the majority of our subjects was non-athletic in both studies, it is not an unfounded statement to say that the active mass of the 2005 children and adolescents has fallen dramatically compared to the fraction found in 1980.

Although the respective estimates of the Hungarian Central Office of Statistics (Sághi et al., 2002; Table 2, included here as corroborative evidence compiled by us to conform to the objectives of this study) cover only a shorter (13-year) period, the effects of a general and progressive inactivity (Frenkl and Mészáros, 2002) cannot be neglected.

The significant trend of increasing BMI and/or relative body fat content is not only characteristic of Hungarian youngsters (Bodzsár and Susanne, 1998; Neovius et al., 2004; Ogden et al., 2004). One cannot take much comfort from this fact since the recent observations of Kopp et al. (2004) are frightening: the prevalence of chronic child diseases has shown an increase of more than 20% during the past 15 years. These independent results obviously indicate that the increased prevalence of overweight and obesity has had serious health consequences within a relatively short time. Stimulating more exercise and habitual physical activity may be one of the solutions. One has to be aware, however, that with its very limited number of weekly classes, physical education at school cannot be effective alone. We cannot help but stress the responsibility of adult society. Since the average life standard of the Hungarian families is low (approximately 50% of the EU average), the problem needs a radical change in community and health

Table 2 Changes in challenges and lifestyle characteristics in Hungary between 1987 and 2000 (Sághi et al., 2002)

Factor	1987	2005
Watching TV	35–45 min per day	69–84 min per day
TV channels available	2	25 on average
Availability of computer facilities	n.a.	55–60% of the families, and 95% at school
Computer and video games	n.a.	35–55 min day
Regular meals per day	4–5	2–3
PE classes in a week	3–5	2
Percentage of athletic children	31%	8–8.5%
Clubs and youth departments of sports (in percentage of the 1987 conditions)	100	42–44
Weekly physical activity out of school	3–3.8 hr	1–1.5 hr

n.a. = not applicable, because it did not exist at the time.

policy (cf. Thorkild and Sørensen, 1997). Because of their public health importance, the trends of childhood overweight and obesity should be closely monitored.

Anyway, the marked differences in BMI and fat content that has occurred during these 25 years are indirect evidence for how severely the average physical condition had declined (Mészáros et al., 2001; Frenkl and Mészáros 2002; Othman et al., 2002), and how the health risks of the respective middle socio-economic layers of children have increased. If one relies on Bouchard's norms (2000), the Hungarian children's classification concerning excess weight combined with their only fair level of cardio-respiratory performance points to a higher cardiovascular risk than the simple arithmetic sum of two risky states. Dollman and associates (1999) have also inferred that in the first decades of intense economic development, the physical activity and cardio-respiratory performance of children usually decreases, and habitual physical activity is largely replaced by electronic and screen-based entertainment. After a general improvement of economic conditions, this trend used to come to be reversed in most countries, at least in respect of physical activity. In view of the observed changes in body fat and physical performance, respectively, of the associated higher risks one can but wonder how long it will take until this trend will be reversed in Hungary.

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