Annals of Human Biology

ISSN: 0301-4460 (Print) 1464-5033 (Online) Journal homepage: http://www.tandfonline.com/loi/iahb20

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To cite this article: Eva B. Bodzsar & Annamaria Zsakai (2014) Recent trends in childhood obesity and overweight in the transition countries of Eastern and Central Europe, Annals of Human Biology, 41:3, 263-270

To link to this article: http://dx.doi.org/10.3109/03014460.2013.856473

Published online: 04 Apr 2014.

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Annals of Human Biology
Journal of the Society for the Study of Human Biology

http://informahealthcare.com/ahb
ISSN: 0301-4460 (print), 1464-5033 (electronic)

Ann Hum Biol, 2014; 41(3): 263–270
© 2014 Informa UK Ltd. DOI: 10.3109/03014460.2013.856473

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RESEARCH PAPER

Recent trends in childhood obesity and overweight in the transition countries of Eastern and Central Europe

Eva B. Bodzsar and Annamaria Zsakai

Department of Biological Anthropology, Eotvos Lorand University, 1117 Budapest, Pazmany P. s. 1/c, Hungary

Abstract

Objective: Significant political changes—accompanied by economic changes and social restratification—occurred in Eastern and Central European countries in the 1990s. The main purposes of this study were to assess how prevalence of overweight and obese children changed in Hungary during this transitional period; and to compare the prevalence data of childhood overweight in Central and Eastern European countries, where a similar political and socioeconomic environment existed before the transition and similar changes occurred during the transitional period.
Subjects and methods: Representative samples from the first (1983–1986) and second (2003–2006) Hungarian growth studies were used to assess the prevalence of childhood overweight and obesity in Hungary. The most frequently used indicators of social welfare were used to estimate economic and health status as well as nutritional supply in the transition countries, while data on prevalence of childhood overweight in the studied countries were collected by a search of epidemiological surveys from the region.
Results and conclusion: Frequency of overweight and obese children in Hungary increased between the 1980s and the beginning of the 2000s. Prevalence of childhood overweight was very similar in those Central and Eastern European countries where economic, nutritional or health indicators of general welfare were at a similar level.

Keywords

Children and adolescents, Eastern and Central European countries, nutritional status, obesity and overweight, social welfare

History

Received 13 June 2013
Revised 21 August 2013
Accepted 4 October 2013
Published online 18 March 2014

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Introduction

Nowadays, health organizations must face a growing global public health crisis of obesity (Cawley & Meyerhoefer, 2012; Lobstein et al., 2004; WHO, 2012). Globally, prevalence of overweight and obese adults (aged 20+) has at least doubled in the last 20 years. In 2008 worldwide prevalence of overweight status was 34% in men and 35% in women, while 10% of men and 14% of women were obese (WHO, 2011). The consequences of obesity and obesity-related diseases represent a serious health issue, e.g. elevated blood pressure, stroke, diabetes, infertility, numerous types of cancer, etc. (Ballard-Barbash et al., 2010; Wyatt et al., 2006; WHO, 2011, 2012).

In the 21st century the increasing prevalence of obesity is one of the most important health problems not only in adulthood, but also in the sub-adult age-groups (6% of the world's children were assessed as overweight or obese in 2010 (Lobstein et al., 2004)). Overweight and obese children have a greater risk of suffering from obesity-associated health problems such as respiratory difficulties, cardiovascular problems, musculoskeletal problems, endocrine and metabolic abnormalities and disturbances, as well as psychological problems, social bias, eating disorders, body shape dissatisfaction and negative self-esteem—not only in adulthood, since the relationship between obese nutritional status and these health and psychosocial comorbidities has been evidenced in childhood as well (Baker et al., 2010; Daniels, 2009; Freedman et al., 2007; Kakinami et al., 2012; Taylor et al., 2006).

The formerly socialist countries of Eastern and Central Europe, i.e. the transition countries, experienced a rapidly changing political, social, economic environment at the beginning of the 1990s: an abrupt shift took place from the totalitarian social order (one-party communist system), inhibited social mobility and stratification (with the business elites' capital characterized by nomenclature position, party membership, political access), the centrally planned economy, restriction on individual rights, under-developed and closed financial market towards parliamentary democracy, free elections, restoration of national sovereignty, market economy, free enterprises, state delivery of social welfare services, free social mobility (Philipov & Dorbritz, 2003; Tokes, 1996). The socioeconomic macro-level indicators describe this very complex transition precisely, e.g. gross domestic product (GDP) increased, and rate of unemployment and impoverishment increased in most of the countries right after the transition. However, not only did the political, economic and social structure of the countries change, significant demographic changes could also be observed: e.g. familial structure, indices of fertility, mortality and morbidity changed.

Correspondence: Annamaria Zsakai, Department of Biological Anthropology, Eotvos Lorand University, 1117 Budapest, Pazmany P. s. 1/c, Hungary. Tel: +36-1 381-2161. Fax: +36-1 381-2162. Email: zsakaia@elte.hu

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All these socioeconomic changes in the transition countries significantly influenced the lifestyle and health status of the populations.

The main purposes of the paper were (1) to analyse the secular trend in prevalence of overweight and obesity in childhood and adolescence that appeared in Hungary between the 1980s and the beginning of the 2000s; and (2) to describe—in an economic context—the geographic variance in prevalence of overweight and obese nutritional status in children and adolescents in the transition countries of Central and Eastern Europe in the first decade of the 2000s. These two aspects of epidemiological analysis may help us to evaluate the level of childhood overweight in Hungary in the mirror of prevalence data from those European countries which experienced almost the same economic history in the last 20 years and to compare the prevalence of childhood overweight and obesity during a period characterized by significant economic and social change in Eastern and Central Europe.

Materials and methods

The studied Hungarian samples

The Hungarian subjects (aged 3–18 years; Table 1) were examined in the 1st (1983–1986, $n = 39\,158$; Eiben et al., 1991) and the 2nd (2003–2006, $n = 25\,278$; Bodzsar & Zsakai, 2007; Zsakai and Bodzsar, 2012) Hungarian National Growth Studies. Anthropometric measurements were performed using standardized techniques and standard anthropometric measuring devices (IBP recommendations; Weiner & Lourie, 1969).

The children's nutritional status was assessed by Body Mass Index (BMI), subjects were divided into underweight, normal, overweight and obese sub-groups using the international BMI cut-off values adopted by the International Obesity Task Force (Cole et al., 2000, 2007).

Before the examinations, the research objectives and research methodology were controlled and permitted by the Office of the Hungarian Parliamentary Commissioner for Future Generations and the National Human Research Ethics Committee. Since most of the subjects were younger than 18 years of age and the legal age of adulthood is 18 years in Hungary, parents were asked to give informed consent and permission for the examinations (and every child also had to give their oral permission for the examinations).

Samples from the studied transition countries

Data on the prevalence of overweight and obese children in the first decade of the 2000s were available from the following Eastern and Central European countries: Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, Russian Federation, Slovakia, Slovenia and Turkey. With the exception of Turkey these were all European transition countries. Political instability, the huge financial crisis at the turn of the 1990s and the geographic location of Turkey (Gormez & Yigit, 2009) justify the decision to also include this country in the analysis of prevalence of childhood overweight in Eastern and Central European societies.

The studied age interval in childhood and adolescence as well as the year of the studied surveys are summarized in Table 2. All of the surveys were national ones, with the exception of the Russian and Turkish surveys (which were carried out in the Arhangelszk Region in Russia (Godina & Khomyakova, 2013); and in the Ankara region in Turkey, Ankara region represents a special part of Turkey: Ankara is the second largest city in the country and this city is located in Central Turkey (Ozer, 2007)). The children's nutritional status was assessed by BMI in all the national surveys (none of the surveys was based on interviews and self-assessments). The surveys used the same age-dependent BMI cut-off points (Cole et al., 2000) for defining overweight and obese nutritional status.

Methods

Data on health status as well as the nutritional characteristics of the populations were collected from the European Health for all Database (HFA-DB) published by World Health Organization Regional Office for Europe (WHO, 2013) for the year 2007, with the exception of ''total health expenditure

Table 2. The characteristics of the studied samples from Eastern and Central Europe.

Country	Year of the survey	Studied age interval (years)	References
Belarus	2006–2007	7–17	Marfina (2009)
Bosnia and Herzegovina	1995–2002	6–10	WHO (2010)
Bulgaria	1995–2005	3–17	Yordanov (2012)
Croatia	1997	6–18	Zajc Petranovic et al. (2013)
Czech Republic	2005	6–18	Kunesova et al. (2007)
Hungary	2003–2006	3–18	Bodzsar & Zsakai (2012)
Latvia	2008	6–9	Taube (2011)
Lithuania	2000–2002	7–18	Tutkuviene (2007)
Poland	2007–2009	6–19	Kulaga et al. (2011)
Romania	2004	11–18	Radu et al. (2007)
Russian Federation*	2009–2010	7–16	Godina & Khomyakova (2013)
Slovakia	2001	7–17	Novakova (2001)
Slovenia	2006	7–18	Leskosek et al. (2010); Kovac et al. (2008)
Turkey*	2005	6–17	Ozer (2007)

*Not national surveys—these surveys were carried out in Arhangelszk region (Russia) and in Ankara region (Turkey).

Table 1. Distribution of the sample in the 2nd Hungarian National Growth Study (2003–2006) by age and gender.

	Age (years)																
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Boys	334	595	733	757	741	864	893	861	869	904	818	748	950	975	886	890	12 818
Girls	353	566	682	745	756	906	891	877	922	931	835	718	839	812	772	855	12 460

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in the percentage of gross domestic product (GDP)'', which was collected for the year 2006 from the World Health Statistics 2009 of WHO (2010).

The ''total pharmaceutical expenditure as a percentage of total health expenditure'' (%), the ''total health expenditure in the percentage of GDP'' (%), the prevalence of ''circulatory system diseases per 100 000 inhabitants'' and the prevalence of ''diabetes per 100 000 inhabitants'' were the selected indicators of the general health status of the populations.

The ''average number of calories available per person per day (kcal)'', the ''percentage of total energy available from fat'' (%), the ''average amount of cereal available per person per year'' (kg) and the ''average amount of fruits and vegetables available per person per year'' (kg) were chosen to assess the nutrition (nutrient and energy supply, nutritional behaviours, etc.) of the studied societies.

The economic status of the countries was assessed by the GDP per capita (USD; estimated for the year of 2007; WHO, 2013). Since income inequalities through the increased psychosocial stress of living in more hierarchical societies were found to be associated with higher prevalence of obesity in developed countries (Pickett et al., 2005), the Gini index (varies between 0 = equality and 100 = maximum inequality) was used to assess how the distribution of income or consumption expenditure among individuals or households within the countries deviates from a perfectly equal distribution (Wilkinson & Pickett, 2011).

A Nutritional Index (NI) was created from the four nutritional indicators by using the rank orders of the countries for all the indicators: (1) in the case of cereal and fruit/vegetable consumption the reverse order of the countries was used, since fat and consumption of these foods are at the two edges of a ''healthy scale'' of foods; (2) if the estimated value of a studied indicator were missing, the NI value was calculated by using the extrapolated median value of the existing indicators. The same procedure was used for building a Health Index (HI) from the selected health indicators. The scales of these new indices were directed to achieve the following inter-relation: the higher the index value, the better general health status or the better general nutritional supply in a population could be presumed.

Hypotheses were tested at the 5% level of random error. χ^2 test was used for testing homogeneity of the sub-groups' distribution, while Spearman's rank correlation was used to analyse the relationship between the discrete variables of well-being in the studied countries. Hierarchical cluster analysis was used to identify homogeneous groups of countries by considering the economic, nutritional and health characteristics of the studied transition countries.

Results

The prevalence of overweight and obese children in Hungary

Considering the prevalence of overweight (without obese) children in the beginning of the 2000s in Hungary it can be stated that the prevalence of overweight children (1) was the lowest in the youngest age-group (3 years, 4.7% in the boys, 6.0% in the girls), (2) showed an increase by age until 10–11 years (reached 17.5% in the boys, 17.1% in the girls) and (3) this increase was followed by a decrease until 15 years in both genders (12.5% in the boys, 9.4% in the girls; Figures 1 and 2). From 15 years of age a significant sexual dimorphism (Table 3) was observed in the prevalence of overweight children, i.e. a decrease in prevalence of overweight girls continued until the end of the studied age interval (7.4%), while prevalence of overweight boys increased again from the age of 16 years and reached 15.7% in 18-year-old boys.

The prevalence of obese children (studied between 2003–2006) showed a similar pattern by age to prevalence of overweight children, with the exception of a decreasing prevalence of obese boys at the end of the studied age interval, i.e. obese children's prevalence increased until the age of 8–9 years (5.8% in the boys, 5.7% in the girls), then showed a remarkable decrease at the end of the studied age interval in both genders (reaching 4.5% in the boys and 2.4% in the girls at 18 years of age), revealing a significant sexual dimorphism from 17 years of age (Figures 1 and 2).

By comparing the prevalence of Hungarian children's nutritional status categories studied in 1983–1986 and 2003–2006 it was evidenced that prevalence of overweight and obese children changed significantly in the studied 20 years (Figures 1 and 2). The prevalence of these undesirable nutritional status categories became much higher in all age-groups in both genders up to an age of 15 years by the time of the recent study. Prevalence of overweight children at age 3 and 16 years in the boys and from the age of 15 years in the girls was almost the same in the two studies.

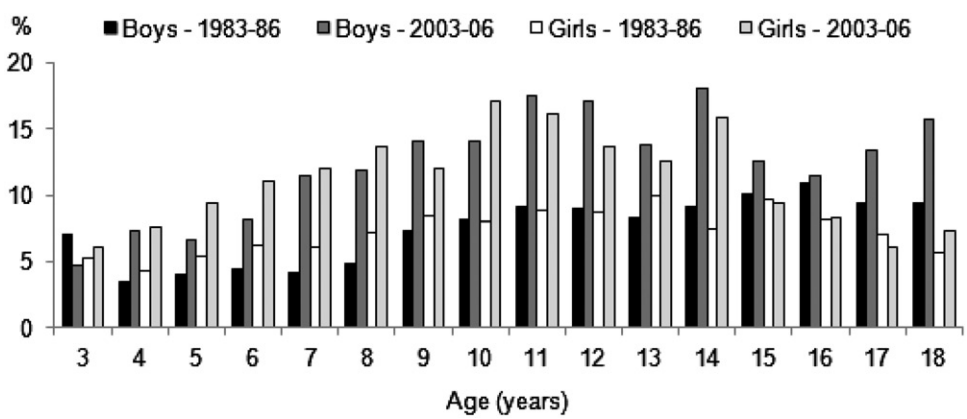

Figure 1. The frequency (%) of overweight Hungarian children between 3–18 years in 1983–1986 and 2003–2006.

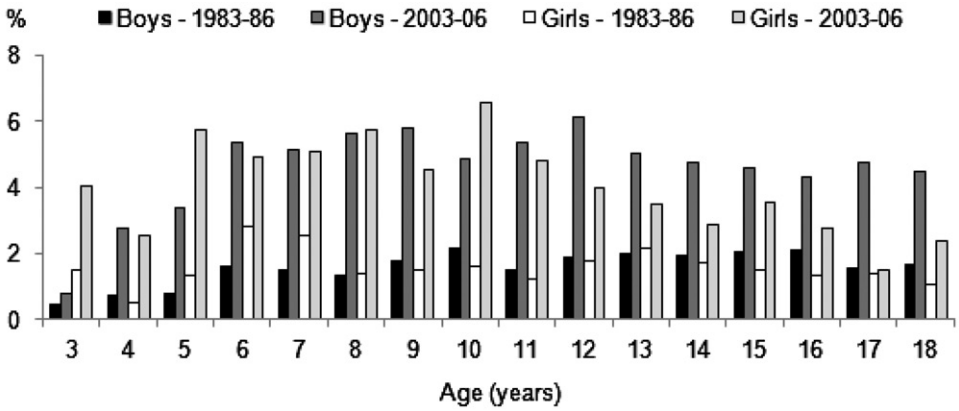

Figure 2. The frequency (%) of obese Hungarian children between 3–18 years in 1983–1986 and 2003–2006.

Table 3. Significance levels of χ^2 tests in comparison of the prevalence of overweight as well as obese children between boys and girls in 2003–2006 and between 1983–1986 and 2003–2006.

			Secular changes between 1983–1986 and 2003–2006			
	Sexual dimorphism in 2003–2006		Overweight		Obese	
Age (years)	Overweight	Obese	Boys	Girls	Boys	Girls
3	0.431	*0.006*	0.398	0.749	0.650	0.117
4	0.825	0.807	*0.002*	*0.013*	*0.003*	*0.001*
5	*0.050*	*0.033*	*0.020*	*0.004*	*<0.001*	*<0.001*
6	*0.049*	0.687	*0.002*	*<0.001*	*<0.001*	*0.019*
7	0.764	0.951	*<0.001*	*<0.001*	*<0.001*	*0.006*
8	0.259	0.914	*<0.001*	*<0.001*	*<0.001*	*<0.001*
9	0.189	0.237	*<0.001*	*0.015*	*<0.001*	*<0.001*
10	0.075	0.128	*<0.001*	*<0.001*	*0.001*	*<0.001*
11	0.429	0.590	*<0.001*	*<0.001*	*<0.001*	*<0.001*
12	*0.038*	*0.037*	*<0.001*	*0.001*	*<0.001*	*0.002*
13	0.471	0.118	*<0.001*	0.082	*<0.001*	0.068
14	0.264	0.066	*<0.001*	*<0.001*	*<0.001*	0.096
15	*0.036*	0.264	0.096	0.819	*<0.001*	*0.002*
16	*0.026*	0.082	0.664	0.917	*0.002*	*0.019*
17	*<0.001*	*<0.001*	*0.007*	0.416	*<0.001*	0.853
18	*<0.001*	*0.017*	*0.002*	0.283	*0.003*	0.077

p Values in italics represent significant differences.

The prevalence of overweight and obese children in Eastern and Central European countries

Prior to comparing the prevalence of overweight (including obese) children in the transition countries, it is worth comparing the economic and nutritional characteristics, as well as the health status of the analysed Eastern and Central European countries during the studied period (2006–2007; Table 4). The societies in the studied region showed a tendency to have a better nutritional index the higher their GDP, with the exception of the countries that had the highest GDPs, namely the better economic conditions in Slovakia and Slovenia were not reflected in healthier food consumption (the correlation between GDP and nutritional index was positive and significant; Figure 3). The health index did not show this increasing tendency with increasing GDP in the transition countries (the correlation between GDP and health index was not significant; Figure 3), i.e. health status (estimated on the basis of the studied health statistics) was (1) best in Belarus and Bulgaria, (2) worst in Bosnia and Herzegovina, Turkey and Hungary and (3) similar in the other countries studied from the region.

The relationship between all the studied well-being (economic, nutritional and health) characteristics of the societies and the prevalence of overweight adults is shown by many epidemiological surveys (Dierk et al., 2006; Finkelstein et al., 2005; Reidpath et al., 2002). To check this relationship in childhood and adolescence, a hierarchical cluster analysis was carried out to identify homogeneous groups of countries on the basis of the economic, nutritional and health characteristics in the studied populations (Figure 4). A dendogram of the transition countries by well-being characteristics revealed three similarity groups among the countries: a group (Group A) was formed by Belarus, Romania, Bulgaria and Turkey, and Bosnia and Herzegovina was very close to this group; Lithuania, Hungary, Latvia, Croatia, Poland and the Russian Federation were divided into another group (Group B); the group including Slovakia and the Czech Republic (Group C) was very close to this group; while Slovenia was a bit distinct from all of these groups (Figure 5).

Our hypothesis, i.e. the similarities or dissimilarities in the well-being characteristics would be reflected in the similarities/dissimilarities in the prevalence of overweight children, may be partly confirmed by our analysis (Figure 6), i.e. prevalence of overweight children in the studied transition countries was very similar within two well-being groups (only Turkey and Latvia had different levels of childhood overweight compared to the other members of their well-being groups, i.e. the prevalence of overweight children in Turkey was closer to Slovenia than the Group A countries; while the prevalence of overweight in Latvian boys was higher than in the other countries of Group B), while only small differences were found between these two groups, and the prevalence of overweight children in the countries of Group C was different. The prevalence of overweight children was highest in Turkey and Slovenia.

Discussion

The political, economic, social and demographic changes, which started at the beginning of the 2000s, in the Eastern and Central European transition countries, could influence the

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Table 4. The estimated values (WHO 2009, European Health for all Database of WHO, World Bank 2011) of health and economic status indicators and nutritional characteristics of the studied populations.

Countries	TPE	THE	DCS	DIAB	CAL	TEF	CER	FRU	GDPc	Gini	% Boys	% Girls
Belarus	11.0	6.4	590.6	3.8	3150	33.3	119.2	206.0	10 740	27.2[d]	14.4	11.8
Bosnia Herz.	NDA	9.5	NDA	NDA	3068	22.1	169.0	289.6	7 700	36.2[c]	14.2	15.7
Bulgaria	NDA	7.2	645.7	18.0	2775	31.7	140.9	119.4	11 180	28.2[c]	13.9	13.2
Croatia	NDA	8.2	417.7	19.9	3094	35.2	123.4	190.6	15 050	33.7[d]	17.0	14.2
Czech Rep.	21.5	6.9	370.7	17.1	3244	36.9	120.6	143.5	22 020	26.0[b]	23.5	14.9
Hungary	30.6	8.3	449.9	20.8	3491	39.5	120.0	199.1	17 210	31.2[c]	17.6	15.6
Latvia	23.5	6.6	566.0	11.4	2949	36.1	111.5	165.2	16 890	36.6[d]	23.8	18.3
Lithuania	26.6	6.2	550.4	6.9	3487	27.3	152.9	173.8	17 180	37.6[d]	16.1	16.2
Poland	24.8	6.2	365.5	13.5	3389	30.1	148.6	173.7	15 330	34.1[e]	18.7	14.2
Romania	NDA	4.5	578.1	8.5	3442	28.2	178.9	209.5	10 980	30.0[e]	15.0	15.0
Russian Fed.	NDA	5.3	737.3	6.0	3377	25.2	152.5	186.7	14 400	40.1[e]	17.4	14.8
Slovakia	27.9	7.1	484.4	10.7	2838	33.3	125.9	151.3	19 340	26.0[e]	17.5	16.2
Slovenia	19.7	8.4	259.1	9.1	3221	33.9	140.4	203.5	26 640	31.2[a]	24.9	23.2
Turkey	NDA	4.8	NDA	NDA	3679	27.5	231.7	348.7	12 350	39.0[d]	19.2	17.6

TPE, Total pharmaceutical expenditure as a percentage of total health expenditure (2007); THE, Total health expenditure in the percentage of GDP (%, 2006); DCS, Diseases of circulatory system, all ages per 100 000 inhabitants (2007); DIAB, Diabetes, all ages, per 100 000 inhabitants; CAL, Average number of calories available per person per day (kcal); TEF, percentage of total energy available from fat; CER, Average amount of cereal available per person per year (kg); FRU, Average amount of fruits and vegetables available per person per year (kg); GDPc, GDP per capita (USD, 2007); Gini, Gini index (data from [a]2004, [b]2005, [c]2007, [d]2008, [e]2009); NDA, no data available; % Boys and % Girls, Prevalence of overweight (including obese) children (%) in boys and girls; Bosnia Herz., Bosnia and Herzegovina; Russian Fed., the Russian Federation.

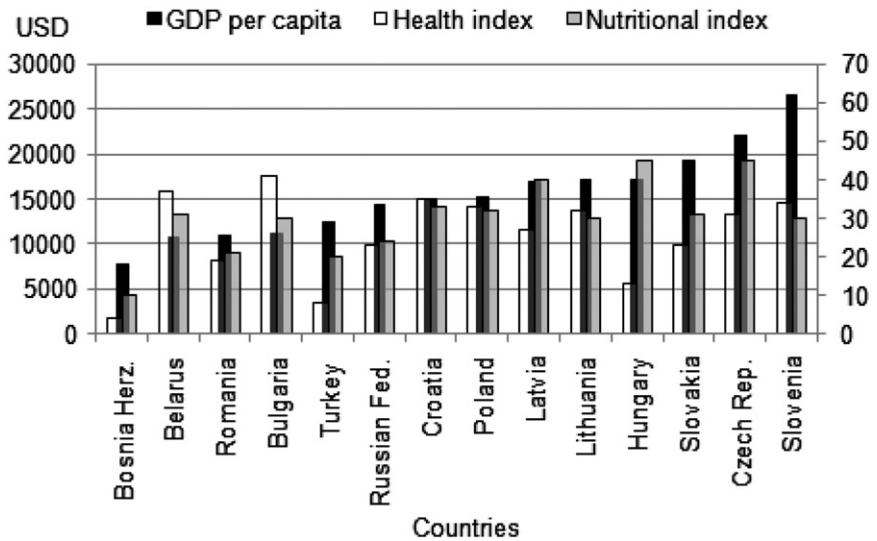

Figure 3. GDP per capita (USD, 2007), health (2006–2007) and nutritional index (2007; index values are represented on the second *y*-axis) in the studied Eastern end Central European countries (Spearman's rho: GDP-HI: 0.108, not significant correlation, $p = 0.714$; GDP-NI: 0.586, significant correlation, $p = 0.028$; HI-NI: 0.342, not significant correlation, $p = 0.231$).

lifestyle of children in a society and through lifestyle factors, indirectly, their health and nutritional status. Our hypothesis, i.e. that these complex changes in the transition countries' societies in the Eastern and Central region of Europe at the beginning of the 1990s would be reflected in the nutritional status of children growing up in this transitional period, may be confirmed by our comparison. The prevalence of overweight children was similar in those countries in the studied region whose societies experienced a similar level of economic, nutritional or health indicators: the prevalence of overweight (including obese) children was 12–14% in the group of Belarus, Romania, Bulgaria, Bosnia and Herzegovina; 15–17% in the group of Lithuania, Hungary, Latvia, Croatia, Poland, Russian Federation; 17–23% in the group of Slovakia and Czech Republic; 23–24% in Slovenia (which was a bit distinct from all of these groups not only by considering the prevalence of childhood overweight, but also by regarding the economic, health and nutritional factors); and 24–28% in Turkey. As a summary we can state that the prevalence of overweight children was the highest (1) in Slovenia, the country which was the most distinct country from the other countries in the well-being comparison; and (2) in Turkey, where the nutritional indices were the healthiest in this comparison, but the cultural attitude toward obesity still exists and fights against this nutritional preference.

Although the relationship between the studied macro- and micro-environmental factors was confirmed in this analysis, it also revealed that this relationship is not as simple as; the better the economic status of a society, the better the nutritional supply and the better the health status of the inhabitants that can be achieved. The prevalence of childhood overweight showed a grading considering the groups of countries (made on the basis of economic, health and nutritional factors), i.e. the prevalence was the lowest in those countries where the GDP, health status and nutritional supply were in general at the worst level, and was the highest

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in Slovenia, which was the country of the region which had the highest GDP per capita, but surprisingly has only a medium level (compared to the other studied countries) of nutritional supply and health status.

Epidemiological surveys of Western European societies show that prevalence of overweight and obese children has not increased since the second part of the first decade of the 21st century (2008–2010; e.g. in France, Peneau et al., 2009; Salanave et al., 2009; Sweden, Sjoberg et al., 2008; Switzerland, Aeberli et al., 2010). The joint prevalence of overweight and obese children increased in general by 4–10% in Hungary between the 1980s and the beginning of the 2000s. This trend is in concordance with epidemiological results from other Central European countries: the continuously increasing trend in prevalence of childhood overweight and obesity was also observed in the first decade of the 21st century in the Czech Republic and Poland (Chrzanowska et al., 2007; Poplawska et al., 2006; Vignerova et al., 2008).

Two special trends could be observed in the prevalence of overweight children and adolescents by considering sexual dimorphism: (1) beyond the age of 15 the prevalence of overweight and obese children in boys was higher than in girls; (2) the secular change in prevalence of overweight and obese girls was negligible compared to the secular change in prevalence of overweight and obese boys from the age of 15. These two observations may be explained by the recent trend for more conscious body shape control in adolescent girls.

In recent decades prevalence of obesity has reached an alarming rate in our societies due to modern lifestyle factors

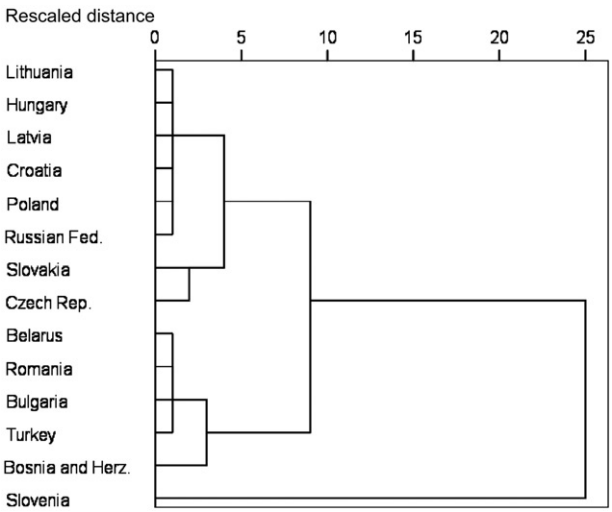


Figure 4. Dendogram using average linkage (based on the economic: GDP per capita and Gini index, as well as nutritional and health indices) among the studied Eastern and Central European countries.

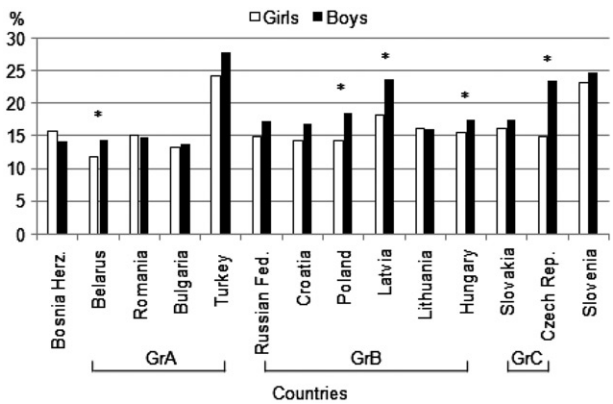
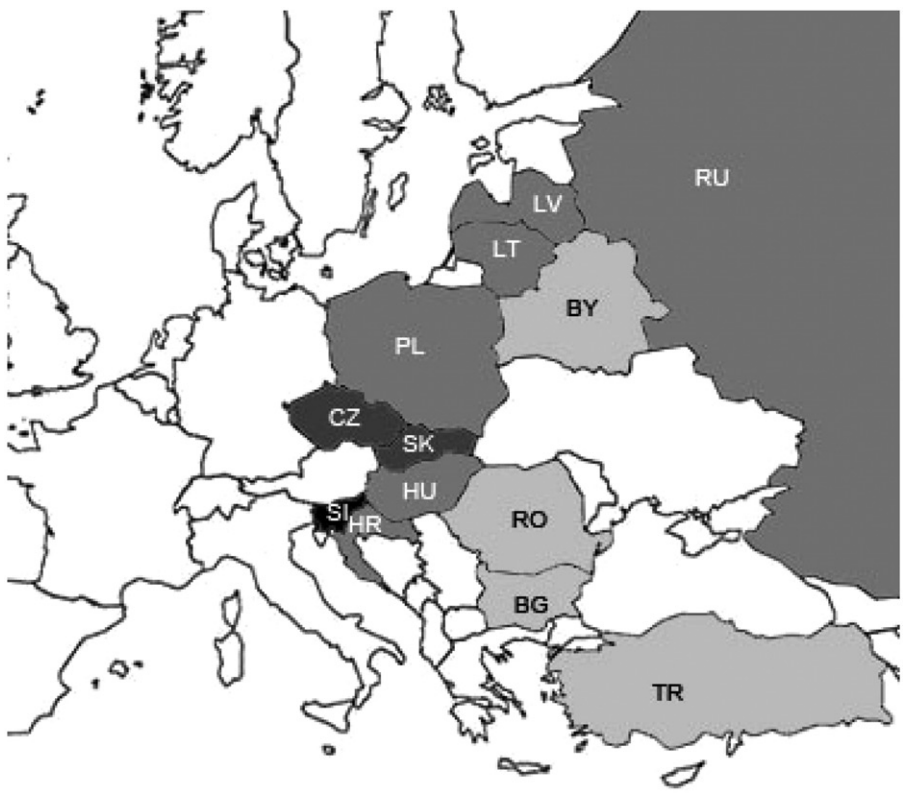


Figure 6. Prevalence of overweight (including obese) children in the studied Eastern and Central European countries. (*significant sexual dimorphism; GrA, Group A; GrB, Group B; GrC, Group C).

Figure 5. The groups of the studied transition countries in Europe by the well-being characteristics of the societies (Group A: Belarus (BY), Romania (RO), Bulgaria (BG) and Turkey (TR); Group B: Lithuania (LT), Hungary (HU), Latvia (LV), Croatia (HR), Poland (PL) and the Russian Federation (RU); Group C: Slovakia (SK) and Czech Republic (CZ)). Slovenia (SI) showed the greatest detachment from these countries in the studied well-being characteristics.



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(lack of physical activity and increased food consumption). Obesity, the excessive accumulation of fat, is not only a cosmetic or aesthetic problem that could result in body shape dissatisfaction, but it also has other serious possible clinical and public health consequences (Reilly et al., 2003). Unfortunately, it is not widely known that overweight, the minor form of body mass excess caused usually by fat mass excess, may also lead to several health problems due to carrying extra mass. Contrary to the obese, overweight patients could usually lose weight by themselves (without the help of clinical experts and medication) and could fight against this abnormality of nutritional status.

The components of the economic costs of overweight and obesity include direct costs resulting from the treatment of obese nutritional status and its co-morbidities, and indirect costs caused by lost productivity due to work days lost and premature mortality of obese people, e.g. the direct costs of inactivity and obesity accounted for almost 10% of national healthcare expenditure in the US in 1999 (Colditz, 1999). The serious health consequences of being overweight and obese and increasing obesity-related medical expenditure should warn both governments and individuals, and the deterioration of the general health status of modern populations should draw more attention to this epidemic, especially if the majority of this basic illness could be prevented (Finkelstein et al., 2005).

Before the final conclusions it must be emphasized that the comparison of prevalence of overweight children in the Eastern and Central region of Europe was based on the results of auxological surveys that studied different age intervals (usually covering the interval between 7–16 years) and two surveys were not national ones. Therefore, our results and conclusions can be considered only in the light of these limitations of the analysis. Our results confirmed the main principle of epidemiological auxology, i.e. epidemiological surveys, by assessing the biological status of populations, can provide indirect but very precise information on the actual socioeconomic status of the populations. Our results have revealed that not only the social, economic, nutritional and health characteristics of societies or social strata should be considered in analyses of the relationship between biological and socioeconomic status, but also cultural attitudes toward special types of body shape.

Acknowledgements

The Hungarian growth studies were supported by the Hungarian National Foundation for Science (OTKA grants 47073 and 76849).

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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