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Original scientific paper

Trends in Body Mass Index, Prevalence of Overweight and Obesity in Preschool Lithuanian Children, 1986–2006

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A B S T R A C T

The study provides the body mass index (BMI), the prevalence of overweight and obesity in preschool Lithuanian children, 1986–2006. In the 2003–2006 more than 1,000 preschool 3–6 year old children from Vilnius (the capital of Lithuania) were investigated according to the standard anthropometric methods. The prevalence of overweight (OW) and obesity (OB) was estimated according to the cut-off points recommended by the International Obesity Task Force (IOTF). Recent data were compared with the data of preschool children from the 1986 Vilnius study and with the data from the other countries. The BMI of preschool children did not change significantly during the last 20 years, except for the statistically significant BMI increment in 6 years old girls. The prevalence of OB among preschool Lithuanian children was low (0.8%–3.7% in boys, and 0–1.9% in girls) and did not change significantly during 1986–2006. The prevalence of OW was higher in preschool girls (10.7%–18.2%) in comparison with preschool boys (6.5%–12.4%). The significant increment of the prevalence of OW was observed among the 6 years old girls from the 2006 study in comparison with the 1986 study. The possible socio-economic reasons of the defined trend in the BMI and prevalence of OW and OB among preschool Lithuanian children are discussed in the paper.

Key words: *body mass index, overweight, obesity, preschool children, Lithuania, Vilnius*

Introduction

The prevalence of overweight and obesity is growing rapidly not only among the adult population, but also in children worldwide[1,2]. In the past decade, excessive fatness became the primary childhood health problem in developed nations, and, to some degree, in other parts of the world[3–6].

Obesity in childhood is linked to serious health problems and may affect the majority of the organ systems[7]. Excessive fatness may have a significant impact on the emotional and social development of the child as well[8]. For example, teasing, discrimination and victimisation of obese child may have a long lasting negative effect on body image and self-esteem of children[9]. Childhood obesity increases cardiovascular risk and is associated with hypertension[10], dyslipidemia[11], chronic inflammation[12], unfavourable concentrations of haemostatic factors[13], endothelial dysfunction[14], and insulin resistance[15]. The prevalence of diabetes mellitus (type 2) among children and youth often is observed in parallel with obesity [16]. It is well known, that cardiovascular risk factors, diabetes and its complications affect morbidity and mortality of modern populations worldwide. On the other hand, an obese child is at risk of becoming an obese adult with an associated risk of obesity-related morbidity and premature death[17–19].

The ideal health-oriented definition of obesity should be based on the excess of body fat at which the risk for poor health increases[4]. Body weight correlates with body fat, as well as with body height, which is weakly correlated with body fat[20]. Thus, high weight in relation to the height does not necessarily reflect high fat accumulation. Nevertheless, obese individuals often have high weight--for-height indices[21].

The assessment of body fatness in preschool children is especially complicated, because of the natural age-related variety in adiposity and difficulties in distinguishing between what is normal and what is pathological. The majority of the direct methods for determining fat

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accumulation are invasive, complicated, expensive, or, as with the skin fold thickness, hard to interpret and may differ markedly between the observers and among the studies[22,23]. Epidemiological studies require a simple indicator for fatness. Despite the extensive discussions, height and weight are relatively easy to obtain and are not greatly affected by observer's bias. These measurements provide an indirect, but informative assessment of the adiposity.

For a long time the different relational height and weight indices were used to define physique of an individual, for example, weight-for-height, weight/height^3, and weight/height^2. The latter index, – body mass index BMI, or Quetelet index (the weight in kilograms divided by square of the height in meters) became very popular in the last two decades. The cut-off points of the BMI for defining the overweight and obesity in the adults are age and gender independent[22]. However, during the last decade many countries use the BMI for measuring fatness in children[23,24], and many studies examined the validity of BMI in different age and gender groups, and estimated the correlation between BMI and body fat accumulation in children[25–27]. Despite the certain limitations of the BMI[28–30], WHO recommends it as a fatness measure in children for public health screening[31].

The BMI in children has certain age and sex depended dynamics: it increases gradually in the infancy, reaches the maximal values by the end of the first year of age, then diminishes during the preschool age period, and rises again during the adolescence and in adulthood[23]. Moreover, certain gender differences in body fatness, in the timing of puberty, in the growth spurt of height and weight determine the BMI interpretation in the context of age and gender[32]. There are also specific ethnic differences in physique, and it is reasonable to use the national references to assess the BMI in children of a certain population[4]. The local growth standards reflect variety of the body size indicators within the population, and are useful for individual growth monitoring and identifying the risk for health. Otherwise, the reference data for the BMI must come from healthy and adequately nourished populations with a low prevalence of overweight and obesity[33].

Hence, the cut-off points for overweight based on the data of population with the high prevalence of childhood obesity could exceed the »normal« values of the BMI references in comparison with the populations with the low prevalence of overweight. Therefore, it is reasonable to monitor the BMI trends and the prevalence of overweight and obesity according to fixed cut-off points[33,34]. However, many authors use different BMI cut-offs for screening overweight and obesity in children worldwide: the different marginal percentiles (the 85th, 90th, 95th, 97th, and sometimes the 98th, 99th, 99.6th) of the BMI according to age and sex are commonly used to monitor overweight and certain grades of obesity.

Recently the childhood obesity Working Group of the International Obesity Task Force (IOTF) proposed age and gender specific BMI cut-off points for defining overweight and obesity in children. These cut-offs are linked to adult BMI values at 18 years of age: the cut-offs for defining the overweight in children pass the BMI value of 25.0, and the cut-offs for defining the obesity pass the BMI value of 30.0 at the age of 18 years[35]. The international cut-off points are useful for comparison the prevalence of overweight and obesity among the different populations.

The aim of the presented study was to obtain the distribution of the body mass index of preschool Lithuanian children and to reveal the changes in the BMI and prevalence of overweight and obesity during 1986–2006 in the capital city of Vilnius.

Material and Methods

The data from a cross-sectional study, carried out in 2003–2006 in the kindergartens of Vilnius are presented in this paper. In total the authors investigated more than 1,500 preschool Lithuanian children, but the present analysis uses only the data of 1,087 healthy individuals aged 30–78 months and of Lithuanian origin. The standard anthropometric methods and standard anthropometric instruments were used[36]. The height was measured using the metal anthropometer (Siber Hegner, Swiss) with the accuracy of 0.1 cm; the weight was taken using the portable electronic scale with the accuracy of 0.05 kg (children were in underwear clothing and without shoes). The BMI was calculated as the weight in kilograms divided by the square of the height in meters.

The recent data were compared with the data of preschool Vilnius children from the 1986 study. The latter data were collected by one of the authors (J.Tutkuviene). Statistical analysis of the data was performed using the standard statistical programme (SPSS, EXCEL for Windows). The main percentiles of the BMI were calculated, and the Student's t test was used to test for significance of the differences between the data from the 1986 and the 2006 studies and for gender differences.

The estimation of the prevalence of overweight and obesity was based on the cut-off points as recommended by the IOTF[35]. The comparison of the marginal BMI percentiles of preschool Lithuanian children and children from the other countries with the international cut-off points was performed. The reference data on the BMI of preschool children from the following countries were used: The Netherlands[37], France[38], UK[39], China[40], Sweden[41], Estonia[42], Flanders (Belgium)[43], Germany[44], Italy[45], US[46], Czechia[47], Iran[48].

Results

Height, weight and BMI of preschool Lithuanian children, 2003–2006

The mean values of body weight and height according to gender and age of preschool Vilnius children from the 1986 and the 2006 studies are shown in Table 1. During the investigated period the mean height in Lithuanian boys increased from the value of 98.2 cm up to 119.3 cm, and in girls – from 96.7 cm up to 118.2 cm.

TABLE 1
BODY HEIGHT AND WEIGHT OF PRESCHOOL LITHUANIAN CHILDREN, 1986–2006

Age (years)	N 1986	N 2006	Height (cm) 1986		Height (cm) 2006		Weight (kg) 1986		Weight (kg) 2006	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD
Boys										
3	91	105	96.7*	5.0	98.2*	3.8	15.2*	1.9	15.8*	1.9
4	90	123	104.4	4.9	104.6	4.4	16.9	1.9	17.5	2.0
5	110	133	110.6*	5.1	112.1*	4.8	19.1*	2.5	19.9*	3.0
6	110	171	118.5	5.8	119.3	5.3	22.5	4.5	22.5	3.2
Girls										
3	103	104	96.0	4.9	96.7	4.2	14.8	2.1	15.2	1.8
4	115	122	103.7	4.8	103.5	4.7	17.0	2.7	17.0	2.1
5	107	131	111.8	4.7	111.0	5.0	19.3	2.8	19.3	2.5
6	109	198	117.4	5.2	118.1	5.2	21.3*	3.8	22.2*	3.2

* statistically significant difference between the 1986 and the 2006 studies ($p<0.05$)

TABLE 2
BMI OF PRESCHOOL LITHUANIAN CHILDREN, 2006

Age (years)	Mean	SD	Percentiles									
			3	5	10	25	50	75	85	90	95	97
Boys												
3	16.39	1.31	14.26	14.54	14.71	15.41	16.41	17.25	17.58	18.08	18.31	19.13
4	15.98	1.24	14.25	13.37	14.58	15.13	15.92	16.68	17.05	17.21	18.11	18.28
5	15.79	1.52	13.27	13.65	13.99	14.97	15.64	16.55	17.09	17.46	18.21	18.92
6	15.74	1.39	13.88	14.00	14.14	14.72	15.50	16.55	17.10	17.81	18.46	18.70
Girls												
3	16.19	1.23	14.24	14.32	14.77	15.29	16.19	16.83	17.31	17.74	18.20	18.72
4	15.83	1.25	13.72	13.92	14.12	14.92	15.77	16.61	16.89	17.46	18.03	18.33
5	15.64	1.13	13.87	14.04	14.33	14.88	15.54	16.24	16.81	17.17	17.66	17.98
6	15.83	1.55	13.31	13.78	14.12	14.75	15.58	16.94	17.60	17.96	18.33	18.61

The gender differences in height and weight were significant at the age of 3 years and declined at the age of 4–6 year. The age dynamic of mean, standard deviation, and the main percentiles of BMI of Vilnius preschool children are presented in the Table 2. The BMI of preschool Lithuanian boys decreased from the value of 16.39 at the age of 3 years to 15.74 at age of 6 years. Hence, the adiposity rebound was not detected in preschool Lithuanian boys. The BMI in girls reached the lowest value (15.64) at the age of 5 years, and consequently, the adiposity rebound was obtained between the 5 and 6years of age. Though the mean values and the main percentiles did not show any significant gender differences in this age period, the distribution of the marginal percentiles differed in both sexes. The slimmest girls (the 3rd BMI percentile) were relatively lighter, than peer boys, particularly at the age of the 4–6 year. The 97th BMI percentile in boys was higher during all investigated period; hence, the corpulent boys were relatively heavier than girls of the same BMI percentile. Gender differences in physique of preschool Lithuanian children were evident among individuals with the marginal BMI values. The analysis of body composition of preschool children would help to reveal the body mass component.

The changes of BMI in preschool Lithuanian children during the 1986–2006

In comparison with the 1986 data, some tendency for increment of body height and weight in boys from the 2006 study was observed, particularly in the children of 3 and 5 years of age. Mean values of height and weight in girls did not change during the last 20 years, except the statistically significant increment of body weight in 6 years old girls (Table 1).

The comparison of the data from the 2006 study with the data from the 1986 study did not reveal statistically significant differences in the BMI of boys and girls, except the statistically significant ($p<0.05$) increment of the BMI in the 6 years old girls from the 2006 study. It

could be assumed, that the adiposity rebound in girls from the 1986 study started after the age of 6 years, i.e. later, than in the 2006 study.

The main percentiles of the BMI of preschool children from both studies were compared in Figures 1 and 2. The 50th BMI percentile in boys was almost identical in the 1986 and the 2006 studies, whereas the marginal percentiles had certain differences. The 3rd BMI percentile in the 2006 study showed the tendency to increase in comparison with the 1986 study. The 90th BMI percentile demonstrated almost the identical values in the 1986 and the 2006 studies, whereas the course of the 97th BMI percentile indicated that the corpulent 3–5 year old boys from the 2006 study became relatively, but insignificantly heavier.

The 50th BMI percentile of preschool girls from the 2006 study was slightly, but insignificantly ($p>0.05$) higher in comparison with the BMI data from the 1986 study. Concerning the 3rd BMI percentile in girl, the same tendency for the increase was observed. The 90th percentile of BMI was very similar in the 1986 and the 2006 studies, whereas the 97th percentile was slightly lower during the preschool age period. The 75th and the 85th BMI percentiles were significantly lower in the 1986 study. Some similar findings were observed in the other studies as well[49].

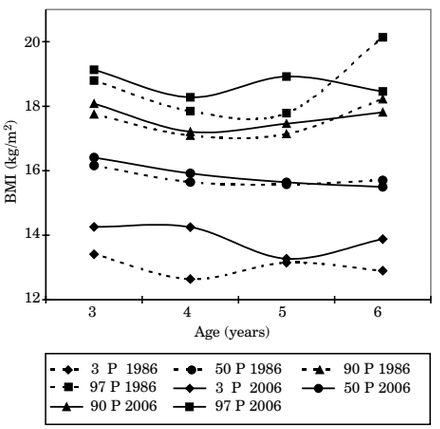

Fig. 1. The 3rd, 50th, 90th and the 97th BMI percentiles (P) of preschool Lithuanian boys, 1986–2006.

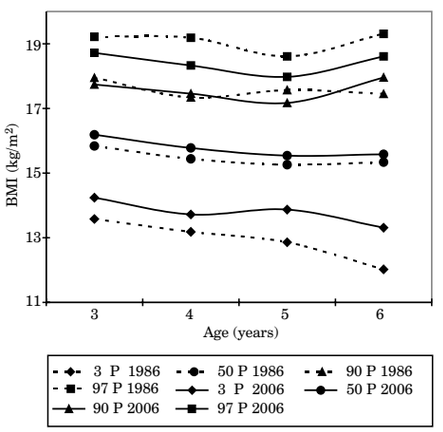

Fig. 2. The 3rd, 50th, 90th and the 97th BMI percentiles (P) of preschool Lithuanian girls, 1986–2006.

The prevalence of overweight and obesity in preschool Lithuanian children, 2003–2006

The prevalence of overweight and obesity in preschool Lithuanian children are presented in Figure 3 and 4. In generally, the prevalence of obesity in the 2003–2006 study was low and varied from 0.8% up to 3.7% in boys, and from 0% up to 1.9% in girls. The low prevalence of obesity among older children was obtained in the 2000–2002 study of Lithuanian schoolchildren as well[50]. Nevertheless, the prevalence of overweight in preschool Lithuanian children was higher in comparison with the school children from the 2000–2002 study, and varied from 6.5% up to 12.4% in boys and from 10.7% up to 18.2% in preschool girls. Moreover, the prevalence of overweight in preschool Lithuanian girls was slightly higher than in peer boys (the differences were especially evident at the age of 6 years), while the prevalence of overweight among adolescent girls was lower in comparison with the older boys, especially at the end of adolescence[50].

The changes in prevalence of overweight and obesity in preschool Lithuanian children during the 1986–2006

The prevalence of obesity among preschool Lithuanian children was low and did not change significantly between the 1986 and the 2006 studies (Figure 3 and 4). The certain BMI differences were statistically significant ($p<0.01$): in 2006 the prevalence of obesity increased in 5 years old, and decreased in 6 years old boys. However, total number of obese children was too small to reveal the statistically significant differences between the groups with the right marginal BMI percentiles.

The comparison of the recent results with the 1986 data showed the following changes in the prevalence of overweight. The statistically insignificant ($p<0.05$) trends of BMI were estimated in two age groups of preschool boys. The prevalence of overweight increased among 3 years old boys from the 2006 study, but decreased among the 6 years old boys in comparison with the 1986 data.

The prevalence of overweight among 3–5 years old girls was very similar in the 1986 and the 2006 studies, but it almost doubled among the 6 years old girls ($p< 0.05$). However, the prevalence of overweight among the older Lithuanian girls from the 2000–2002 study was evidently lower in comparison with the preschool girls both – from the 1986 and the 2003–2006 studies[50].

Summing up, the prevalence of obesity among preschool Lithuanian children was low and did not change significantly between the 1986 and the 2006 studies. The significant increment of the prevalence of overweight was observed only among the 6 years old girls from the 2006 study.

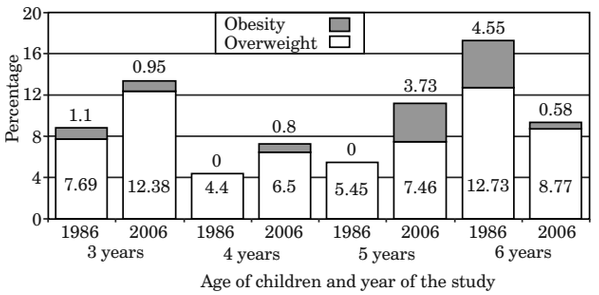

Fig. 3. The prevalence (%) of overweight and obesity in preschool Lithuanian boys, 1986–2006.

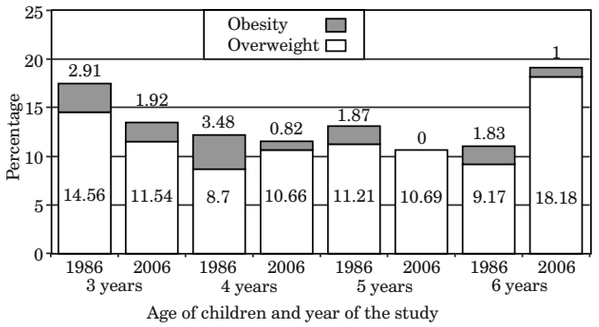

Fig. 4. The prevalence (%) of overweight and obesity in preschool Lithuanian girls, 1986–2006.

Discussion

The comparison of the 90th and the 97th BMI percentiles of preschool Lithuanian children and the children from the other countries

The right marginal percentiles of the BMI of preschool Lithuanian children were compared with the data from the other countries: The Netherlands[37], France[38], UK[39], China[40], Sweden[41], Estonia[42], Flanders (Belgium)[43], Germany[44], Italy[45], US[46], Czechia[47], Iran[48] (Figures 5, 6, 7 and 8). The IOTF cut-off points for overweight and obesity served as a datum-lines for the comparison of the 90th and the 97th percentiles from various references.

The 97th percentile for preschool Lithuanian boys was lower than international cut-off points for obesity, and it was similar to the analogous BMI percentile of preschool boys from many other European countries (Figure 5). The 97th BMI percentiles in preschool Czech, Swedish and German boys were similar to the data of preschool Lithuanian boys. Overall, among the references only the 97th BMI percentile of 3–5 years old Iran boys exceeded the international cut-off points for obesity. The 90th BMI percentile of preschool Lithuanian boys, as well as the same BMI percentile of boys from the other European countries, was close to the international cut-off points for overweight (Figure 6).

The trajectory of the 97th percentile in preschool Lithuanian girls was very similar to peer boys: it is lower than international cut-off points for obesity, and was very similar to the analogous data of preschool girls from the other European countries, whereas the 90th BMI percentile was slightly higher than international cut-off point for overweight (Figure 7 and 8). The 90th percentile of 6 years old Lithuanian girls was approximately the same as that from countries (Italy, Germany) with the highest values of the 90th BMI percentile in girls (Figure 8). Nevertheless, the 90th and the 97th BMI percentiles of adolescent Lithuanian girls from the 2000–2002 study were evidently lower than the international cut-offs, and in comparison with the analogous BMI percentiles of older adolescent girls from the other countries[50]. Hence, the BMI of preschool Lithuanian girls was more similar to the BMI of girls from the other countries, while older adolescent Lithuanian girls were demonstrably slimmer in comparison with the peer girls from many other countries.

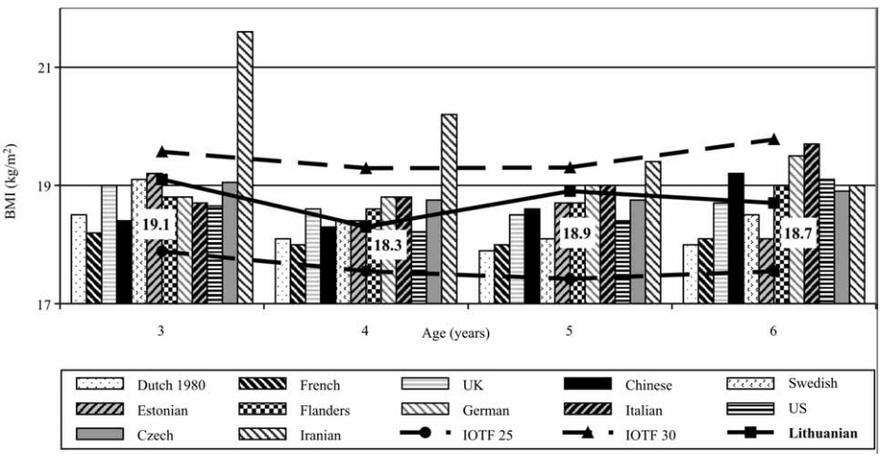

Fig. 5. The International Cut-off points for overweight (dashed lower line), obesity (dashed upper line) and the 97th percentile (solid line, labels are shown) of BMI in preschool Lithuanian boys and preschool boys from the other countries (different columns).

Finally, it should be mentioned, that some differences in the BMI between certain populations could not be explained only by the influence of specific regional factors. The year of the study in the references varied widely – from the 1980 (the studies of Dutch, French, English, Swedish children) to the beginning of the 21st century

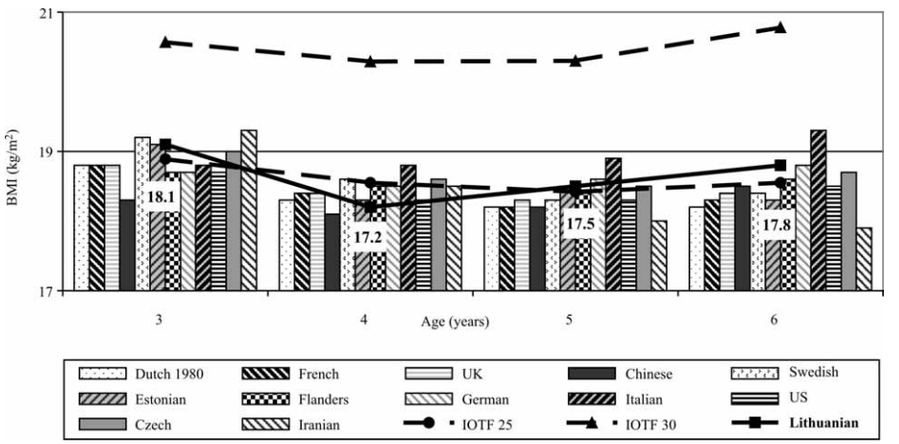

Fig. 6. The International Cut-off points for overweight (dashed lower line), obesity (dashed upper line) and the 90th percentile (solid line, labels are shown) of BMI in preschool Lithuanian boys and preschool boys from the other countries (different columns).

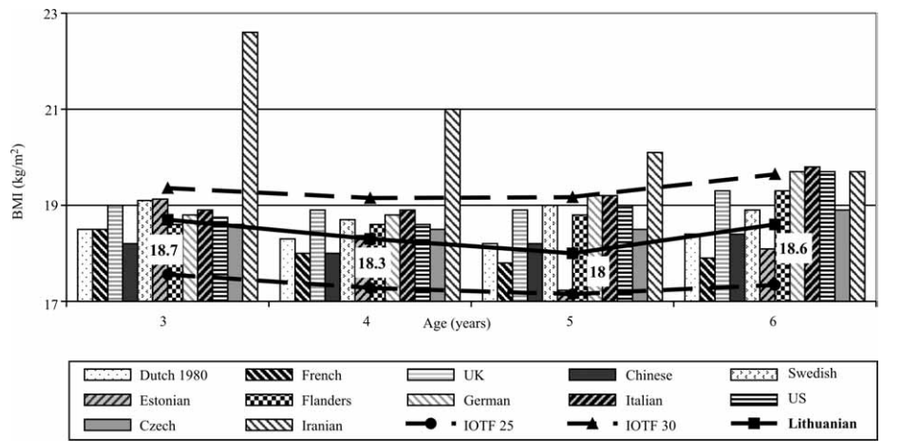

Fig. 7. The International Cut-off points for overweight (dashed lower line), obesity (dashed upper line) and the 97th percentile (solid lines labels are shown) of BMI in preschool Lithuanian girls and preschool girls from the other countries (different columns).

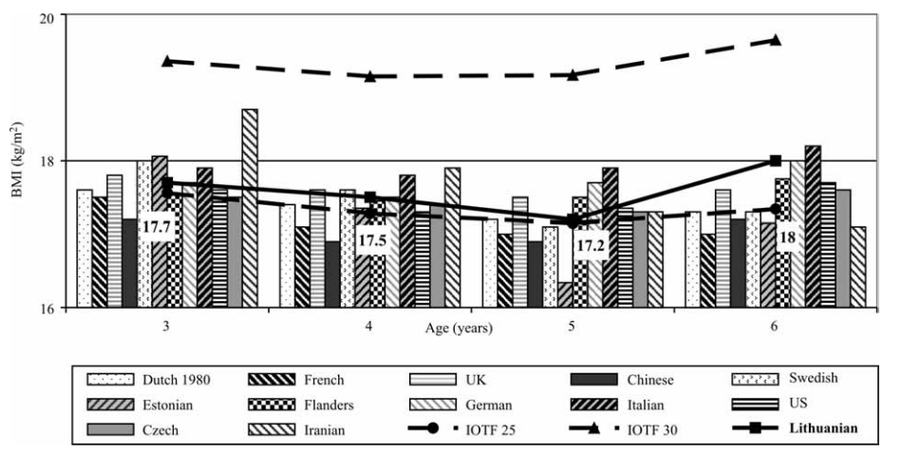

Fig. 8. The International Cut-off points for overweight (dashed lower line), obesity (dashed upper line) and the 90th percentile (solid line, labels are shown) of BMI in preschool Lithuanian girls and girls from the other countries (different columns).

(Lithuanian children). Obviously, the 90th and the 97th BMI percentiles were lower in children, who were investigated 20–30 years ago (Figures 5, 6, 7 and 8).

The comparison of the prevalence of overweight and obesity in preschool Lithuanian children with the children from the other countries

The comparison of the prevalence of overweight and obesity among preschool children worldwide is problematic because of the lack of publications or methodological differences in defining the overweight and obesity. The prevalence of overweight and obesity according to gender and age by year was presented only in a few studies, but the majority of the references reported the prevalence of overweight and obesity in preschool children for certain age periods, for example, for 0–5 y., 1–6 y., 4–6 y., 3–6 y., etc. Moreover, some data were presented irrespective of the gender, the overweight and obesity was defined using the different cut-offs. Hence, certain difficulties arose while comparing the data from the different countries. Nevertheless, despite the methodological differences in the defining overweight and obesity, few recent reviews summarised the data on the prevalence of overweight and obesity in preschool children from the developing countries[5], Europe[3] and the other parts of the world[5,6].

In generally, the prevalence of overweight among preschool children in most regions of the world increased from the 1970 to the late 1990, and the highest rise was noticed during the last decade[6]. This trend was particularly obvious among the younger children in comparison with the adolescents (with the exception of the US, England and Scotland[2,52]). Overweight was higher among preschool girls in comparison with the boys of the same age in the majority of the studies. Hence, the present study of preschool Lithuanian children was in the line with the data from the other countries: the prevalence of overweight in preschool Lithuanian children was higher in comparison with schoolchildren, and among preschool Lithuanian girls it was higher in comparison with the peer boys.

Recently, the prevalence of overweight and obesity in preschool children from many countries was defined according to the international cut-off points[51–61]. The summary of these references is given in the Table 3. Obviously, the prevalence of obesity among preschool Lithuanian children was low. To reveal the tendencies in the prevalence of overweight was difficult because of the different years of the studies and certain dissimilarities in the grouping of the children's ages. The prevalence of overweight in preschool Lithuanian children was lower than in South Africa, Chile, Spain and Switzerland, and similar to the prevalence of overweight in Germany and Australia. Nevertheless, the latter data were collected more than 10 years ago and could not reflect the recent situation exactly. For example, the data from UK (England, Scotland, South Wales[52,53]) showed the regional differences in BMI of preschool children in the country, and the increasing prevalence of overweight and obesity during the last decades.

The parallels between the overweight and health status of the child, and prediction of the future trends

The obesity is influenced by the complex interaction between genetic and environmental factors, especially by nutrition and physical activity. These factors could affect the child at distinct age periods. The studies of preschool children from the families with a high risk of obesity (for example, the mother or both parent were overweight), revealed an increased body weight of the child in comparison with the body size of peers without obesity risk[62]. The longitudinal study of 2–8 year old children revealed that early adiposity rebound, and the high BMI at the age of 2 years were associated with the high BMI at the age of 8 years[63].

The age between 4 and 8 years in children is related to adiposity rebound and is considered to be critical for the development of obesity and its complications[64,65]. The longitudinal observations showed the relationship between the time of increase in body corpulence of preschool child and fatness later in adulthood. Each BMI percentile has its own age of rebound: the higher the percentile, the earlier the rebound. An early adiposity rebound is a risk factor for the latter fatness, because it identifies children, whose BMI percentile is high and/or moving upward. These children are likely to have increased BMI later in childhood and adulthood. However, some scepticism about the validity of the adiposity rebound defining corpulence status has appeared lately. T. Cole in his recent paper assigned the relationship between the early adiposity rebound and the later fatness rather to the statistical phenomenon and less to physiological appearance[66].

The viewpoint on the adiposity of preschool child is also controversial. Historically, the corpulent child meant a healthy child, one who was likely to survive the rigors of malnutrition and infections. It was noticed, that the majority of the mothers of overweight preschool children did not perceive their children as different from their peers[67]. Moreover, it is not definitely proved that the overweight preschool child would be the obese adolescent or adult person. Hence, defining childhood obesity, the criteria and cut-off points for overweight in children must be verified and interpreted very accurately.

Our recent study in comparison with the 1986 study revealed the evident and statistically significant increase of the BMI and the prevalence of overweight only among the 6 years old preschool girls. Partially it could be explained by the sampling influence. Nevertheless, A. Fredriks et al. compared the BMI of Dutch children in the 1997 and the 1980 studies, and also found maximal differences at the age of 6 years[49]: in the 1997 more than 20% of the investigated children exceeded the 90th BMI percentile and more than 60% exceeded the 50th BMI percentile in children from the 1980 study.

Meanwhile, the 2000–2002 study of Lithuanian schoolchildren showed the diminished BMI and the decreased prevalence of overweight in older adolescent girls, while

TABLE 3
THE PREVALENCE OF OVERWEIGHT AND OBESITY IN PRESCHOOL CHILDREN WORLDWIDE
(ACCORDING TO THE IOTF CUT-OFF POINTS)

Country	Year of study	Age and gender group		Prevalence (%) of overweight	Prevalence (%) of obesity	References
Lithuania	1986→2003/6	3–4-y.	F	11.5→11.1	3.2→1.3	Present study
		5–6-y.	F	10.2→15.2	1.9→0.6	
		3–4-y.	M	6.1→9.2	0.6→0.9	
		5–6-y.	M	9.1→ 9.9	2.3→0.3	
Chile	1987→2000	6–y.	F	11.6→19.6	2.1→7.5	51
		6–y.	M	10.6→18.8	1.8→7.2	
UK	1984→1994					52
English		4–6-y.	F	4.6→ 5.4	1.3→2.6	
		4–6-y.	M	7.5→10.9	0.6→1.7	
Scottish		4–6-y.	F	9.3→11.9	0.9→2.1	
		4–6-y.	M	5.7→ 7.6	1.8→3.2	
UK South Wales	1986/7→2001/2	5–y.	F	13.5→19.5	3.6→6.9	53
		5–y.	M	11.3→13.7	2.5→4.6	
Australia	1995 (Cross sectional)	2–3-y.	F	16.5	6.1	54
		4–6-y.	F	15.3	4.2	
		2–3-y.	M	14.6	2.4	
		4–6-y.	M	10.4	3.0	
Australia	1982–1992 (Longitudinal)	3–y.	F	12.4	1.6	55
		6–y.	F	14.2	3.7	
		3–y.	M	12.5	1.0	
		6–y.	M	8.6	4.0	
Germany (East)	1998/9	5–7-y.	F	17.8	4.8	56
		5–7-y.	M	11.1	2.7	
Germany (Bavaria)	1982→1997	5–6-y.	F	9.5→13.6	2.1→2.8	57
		5–6-y.	M	7.6→11.0	1.5→2.8	
Switzerland	1999	6–y.	F	18.4	7.9	58
		6–y.	M	20.0	5.0	
Spain (Aragon)	1985→1995	6–7-y.	F	15.0→18.3	10.0→17.7	59
		6–7-y.	M	14.5→19.8	6.5→14.2	
Spain (Madrid)	1999/2002	6–12-y.	F	25.9	5.9	60
		6–12-y.	M	21.6	6.0	
South Africa (KwaZulu-Natal)	1994	2–5-y.	F+M	26.7	6.3	61

bodies of adolescent Lithuanian boys underwent only minor slenderising in comparison with the 1985 study[50]. On the other hand, after the political changes since 1990 in Lithuania during the first years of independence the living standards, on average, decreased, and economic indicators have improved markedly only during 2000–2005[68]: Gross Domestic Product increased more than 70%, the inflation rate and unemployment decreased, the income per capita grew up, particularly in Vilnius (the preschool Vilnius children study was carried out at this time).

Today the improved quality of life influences the lifestyle in Lithuania with an accelerating tempo. The consumption of fast and ready to cook food increases; the traditions of cooking at home are declining; the sedentary lifestyle is prevailing; the number of cars, TV sets, mobile phones and PC's increased enormously in households[68,69]. Considering these facts, it might be assumed, that the physique of the investigated preschool girls was affected by the changes in lifestyle and, perhaps, in nutrition. It was revealed, that the larger gain either in BMI, or in height during childhood induces earlier onset of puberty and accelerated growth, as well as more truncal fat accumulation, especially in girls[28,32,70]. Sometimes BMI classifies taller children as the overweight without the excess adiposity[29]. For example, the analysis of 3 years old children in Wirral (England) revealed more evident BMI increase in tall children than in short peers during the 1988–2003 period[71].

Summing up the results of the prevalence of overweight and obesity in preschool Lithuanian children, only minor changes in body corpulence of both genders occured during 1986–2006, and the singular increase of

overweight among the 6 years old girls could be related to the sampling. Certain changes in the socio-economic situation since the 2000 should be considered as well when interpreting the findings. Hence, further investigations of the growing population could help to reveal future trends. The interrelationship between the BMI and the relative amount of body fat, age and sex related changes of different skin folds, as well as the influence of social factors on the physique of preschool Lithuanian children will be investigated in subsequent analyses.

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REFERENCES

1. WHO, Obesity: Preventing and managing the global epidemic (WHO Technical Report Series, Geneva, 2000). — 2. DECKELBAUM RJ, WILLIAMS CL, Obes Res, 9 (suppl.4) (2001) 239. — 3. LOBSTEIN T, FRELUT M-L, Obes Rev, 4 (2003) 195. — 4. LIVINGSTONE B, Eur J Pediatr, 159 (2000) 14. — 5. DE ONIS M, BLOSSNER M, Am J Clin Nutr, 72 (2000) 1032. — 6. WANG Y, LOBSTEIN T, Int J Pediatr Obes, 1 (2006) 11. — 7. DANIELS SR, ARNETT DK, ECKEL RH, GRIDDING SS, HAYMEN LL, KUMANYIKA S, ROBINSON TN, SCOTT BJ, JEOR SS, WILLAMS CL, Circulation 111 (2005) 1999. — 8. STRAUSS RJ, Pediatrics, 2000 (105) 1. — 9. STORCH EA, LEDLEY DR, Clin Pediatr, 44 (2005) 29. — 10. FREEDMAN DS, DIETZ WH, SRINIVASAN SR, BERENSON GS, Pediatrics, 103 (1999) 1175. — 11. TEXEIRA PJ, SARDINHA LB, GOING SB, LOHMAN TG, Obes Res, 9 (2001) 433. — 12. FORD ES, GALUSKA DA, GILLESPIE C, WILL JC, GILES WH, DIETZ WH, J Pediatr, 138 (2004) 486. — 13. FERGUSON MA, GUTIN B, OWENS S, LITAKER M, TRACY RP, ALLISON J, Am J Clin Nutr, 67 (1998) 1136. — 14. TOUNIAN P, AGGOUN Y, DUBERN B, VARILLE V, GUY-GRAND B, SIDI D, GIRARDET JP, BONNET D, Lancet, 358 (2001) 1400. — 15. SRINIVASAN SR, MYERS L, BERENSON GS, Diabetes, 5 (2002) 204. — 16. HANNON TS, RAO G, ARSLANIAN SA, Pediatrics, 116 (2005) 473. — 17. POWER C, LAKE JK, COLE TJ, Int J Obes, 21 (1997) 507. — 18. FREEDMAN DS, KHAN LK, SERDULA MK, DIETZ WH, SRINIVASAN SR, BERENSON GS, Pediatrics, 115 (2005) 22. — 19. DIETZ WH, J Nutr, 128 (suppl.) (1998) 411. — 20. BELLIZZI MC, DIETZ WH, Am J Clin Nutr, 70 (suppl.) (1999) 173. — 21. SJÖRSTRÖM L, Impacts of body weight, body composition, and adipose tissue distribution on morbidity and mortality. In: STUNKARD AJ, WADDEN TA (Eds.), Obesity: Theory and Therapy (2nd ed., Raven press, NY, 1993). — 22. WHO, Physical status: the use and interpretation of anthropometry (WHO Technical Report Series, 1995). — 23. ROLLAND-CACHERA MF, SEMPÉ M, GUILLOUD-BATAILLE M, PATOIS E, PÉQUIGNOT-GUGGENBUHL F, FAUTRAD V, Am J Clin Nutr, 36 (1982) 178. — 24. GUILLAUME M, Am J Clin Nutr, 70 (suppl.) (1999) 126. — 25. MEI Z, GRUMMER-STRAWN LM, PIETROBELLI A, GUOLDING A, GORAN MI, DIETZ WH, Am J Clin Nutr, 75 (2002) 978. — 26. ETO C, KOMIYA S, KIKKAWA K, J Physiol Anthropol Appl Human Sci, 23 (2004) 25. — 27. FIELD AE, LAIRD N, STEINBERG E, FALLON E, SEMEGA-JANNEH M, YANOVSKI JA, Obes Res, 11 (2003) 1345. — 28. FREEDMAN DS, THORNTON JC, MEI Z, WANG J, DIETZ WH, PIERSON RN, HORLICK M, Obes Res, 12 (2004) 846. — 29. FREEDMAN DS, WANG J, MAYNARD LM, THORNTON JC, MEI Z, PIERSON JR RN, DIETZ WH, HORLICK M, Int J Obes, 29 (2005) 1. — 30. FRANKLIN MF, Am J Clin Nutr, 70 Suppl (1999) S157. — 31. DE ONIS M, Int J Obes, 28 (suppl.) (2004) 81. — 32. HE Q, KARLBERG J, Pediatr Res, 49 (2001) 244. — 33. POSKITT EME, Acta Paediatr, 89 (2000) 507. — 34. HALL DMB, COLE TJ, Arch Dis Child, 91 (2006) 283. — 35. COLE TJ, BELLIZZI MC, FLEGAL KM, DIETZ WH, BMJ, 320 (2000) 1240. — 36. MARTIN S, SALLER K, Lehrbuch der Anthropologie I (Fischer Verlag, Stuttgart, 1957). — 37. COLE TJ, ROEDE MJ, Ann Hum Biol, 26 (1999) 303. — 38. ROLLAND-CACHERA MF, COLE TJ, SEMPE M, TICHET J, ROSSIGNOL C, CHARRAUD A, Eur J Clin Nutr, 45 (1991) 13. — 39. COLE TJ, FREEMAN JV, PREECE MA, Arch Dis Child, 73 (1995) 25. — 40. LEUNG SS, COLE TJ, TSE LY, LAU JT, Ann Hum Biol, 25 (1998) 169. — 41. HE Q, ALBERTSSON-WIKLAND K, KARLBERG J, Acta Paediatr, 350 (2000) 215. — 42. GRÜNBERG H, ADOJAAN B, THETLOFF M, Growth and growth disorders: Methodological instructions for evaluation children's physical development (In Estonian) (Tartu, 1998). — 43. ROELANTS M, HAUSPIE R, Flemish Growth Charts 2–20 years: Use and interpretation, VUB 2004, Available from: http://www.vub.ac.be/groeicurven, accessed April 9, 2006. — 44. KROMEYER-HAUSCHILD K, WABITSCH M, KUNZE D, GELLER F, GEIß HC, HESSE V, VON HIPPEL A, JÄGER U, JOHNSEN D, KORTE W, MENNER K, MÜLLER G, MÜLLER JM, NIEMANN-PILATUS A, REMER T, SCHÄFER F, WITTCHEN HU, ZABRANSKY S, ZELLNER K, ZIEGLER A, HEBEBRAND J, Monatsschr Kinderheilkd, 149 (2001) 807. — 45. LUCIANO A, BRESSAN F, ZOPPI G, Eur J Clin Nutr, 51 (1997) 6. — 46. KUCZMARSKI RJ, OGDEN CL, GRUMMER-STRAWN LM, FLEGAL KM, GUO SS, WEI R, CURTIN LR, ROCHE AF, JOHNSON CL, CDC Growth Charts: United States, Adv Data 2000, Available from: http://www.cdc.gov/growthcharts, accessed April 9, 2006. — 47. BLÁHA P, VIGNEROVÁ J, RIEDLOVA J, KOBZOVA J, KREJČOVSKÝ L, BRABEC M, Nationwide anthropological survey of Czech children and adolescents 2001, Czech Republic (In Czech) (SZU, Praha, 2005). — 48. HOSSEINI M, CARPENTER RG, MOHAMMAD K, Ann Hum Biol, 26 (1999) 527. — 49. FREDRIKS AM, VAN BUUREN S, WIT JM, VERLOOVE-VANHORICK SP, Arch Dis Child, 82 (2000) 107. — 50. TUTKUVIENE J, Coll Antropol, 1 (2007), in press. — 51. KAIN J, UAUY R, VIO F, ALBALA C, Eur J Clin Nutr, 56 (2002) 200. — 52. CHINN S, RONA RJ, BMJ, 322 (2001) 24. — 53. JONES SE, JAMES-ELLISON M, YOUNG S, GRAVENOR MB, WILLIAMS R, Arch Dis Child, 90 (2005) 464. — 54. MARGAREY AM, DANIELS LA, BOULTON TJC, Med J Aust, 174 (2001) 561. — 55. BURKE V, BEILIN LJ, SIMMER K, ODDY WH, BLAKE KV, DOHERTY D, KENDALL GE, NEWNHAM JP, LANDAU LI, STANLEY FJ, Int J Obes, 29 (2005) 15. — 56. FRYE C, HEINRICH J, Int J Obes, 27 (2003) 963. — 57. KALIES H, LENZ J, VON KRIES R, Int J Obes, 26 (2002) 1211. — 58. ZIMMERMANN MB, GUBELI C, PUNTENER C, MOLINARI L, Swiss Med Wkly, 134 (2004) 523. — 59. MORENO LA, SARRIA A, POPKIN BM, Eur J Clin Nutr, 56 (2002) 992. — 60. MARRODAN S, MESA S, ALBA D, AMBROSIO S, BARRIO C, DRAK H, GALLARDO Y, LERMO C, ROSA R, GONZALEZ-MONTERO M, An Pediatr (Barc), 65 (2006) 5. — 61. JINABHAI CC, TAYLOR M, SULLIVAN KR, Ann Tropic Pediatr, 25 (2005) 3. — 62. BERKOWITZ RI, STALLINGS VA, MAISLIN G, STUNKARD AJ, Am J Clin Nutr, 81 (2005) 140. — 63. SKINNER JD, BOUNDS W, CARRUTH BR, MORRIS M, ZIEGLER P, Int J Obes, 28 (2004) 476. — 64. CAMERON N, DEMERATH EW, Yearb Phys Anthropol, 45 (2002) 159. — 65. ROLLAND-CACHERA MF, DEHEEGER M, BELLISLE F, SEMPÉ M, GUILLOUD-BATAILLE M, PATOIS E, Am J Clin Nutr, 39 (1984) 129. — 66. COLE TJ, BMC Pediatrics, 4 (2004) 1. — 67. CAMPBELL MWC, WILLIAMS J, HAMPTON A, WAKE M, Med J Aust, 184 (2006) 274. — 68. Statistical yearbook of Lithuania 2005 (Statistics Lithuania, Vilnius, 2006). — 69. Information technologies in Lithuania 2006 (Statistics Lithuania, Vilnius, 2006). — 70. HEUDE B, KETTANEH A, DE LAUZON GUILLAIN B, LOMMEZ A, BORYS J-M, DUCIMETIERE P, CHARLES M-A, FLEURBAIX LAVENTIE VILLE SANTE GROUP, Eur J Clin Nutr, advance online publication, Available from: http://www. nature.com/ejcn/journal/vaop/ncurrent/abs/1602474a.html, accessed November 8, 2006. — 71. BUCHAN IE, BUNDRED PE, KITCHINER DJ, COLE TJ, Int J Obes, 31 (2006) 23.

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TRENDOVI PROMJENE INDEKSA TJELESNE MASE, PREVALENCIJE PREKOMJERNE TEŽINE I PRETILOSTI KOD PREDŠKOLSKE DJECE U LITVI, 1986.–2006.

S A Ž E T A K

Istraživanje donosi usporedbu indeksa tjelesne mase, prevalencije prekomjerne težine i pretilosti kod predškolske djece u Litvi u razdoblju od 1986. do 2006.g. U razdoblju od 2003.–2006.g. preko 1000 predškolske djece u dobi od 3–6 godina iz Vilniusa (glavni grad Litve), izjereno je u skladu sa standardnim antropometrijskim metodama. Prevalencija prekomjerne težine (OW) i pretilosti (OB) procijenjena je korištenjem graničnih vrijednosti IOTF-a (International Obesity Task Force). Novi podaci o predškolskoj djeci uspoređeni su sa podacima iz 1986.g. iz Vilniusa i podacima iz drugih zemalja. Vrijednosti BMI-a predškolske djece nisu se značajno promijenile u posljednjih 20 godina, izuzev statistički značajnog porasta BMI-a u šestogodišnjih djevojčica. Prevalencija pretilosti među predškolskom djecom u Litvi bila je niska (0,8%–3,7% kod dječaka i 0–1,9% kod djevojčica) i nije se značajno promijenila od 1986.–2006.g. Prevalencija prekomjerne tjelesne težine bila je viša kod predškolskih djevojčica (10,7%–18,2%), nego kod predškolskih dječaka (6,5%–12,4%). Značajni porast prevalencije prekomjerne tjelesne težine opažen je među šestogodišnjim djevojčicama iz istraživanja provedenom 2006.g. u usporedbi s onim iz 1986.g. U radu se raspravlja o mogućim socio-ekonomskim čimbenicima utvrđenog trenda porasta BMI-a i prevalencije prekomjerne težine i pretilosti kod predškolske litvanske djece.