Changes in the Prevalence of Excessive and Deficient Body Weight among Pomeranian Youth in the Years 1979, 1989, and 1999

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Abstract

Background: *The analysis presented in this paper aimed to identify trends in the prevalence of the two extremes of body fat disorders over a period of 20 years (1979–1999) and to form a comparative basis for further studies of physical development of the youth of the Pomerania region.*

Material/Methods: *The study population consisted of 23,854 boys and girls aged 7 to 18 years attending schools in rural and urban areas in the Pomerania administrative region. An overweight and underweight population was identified based on the body mass index (BMI) according to WHO, CDC and the Mother and Child Institute recommendations. The following threshold values were adopted: BMI≤ 5th centile for underweight, BMI between 5th and 15th centile for slimness, between 85th and 95th centile for overweight, and BMI≥ 95th centile for obesity).*

Results: *The highest percentage of boys with a BMI between the 85th and 95th centile was seen in 1999, with figures of 8.7% among younger boys and 7.9% among older boys. This represented respective increases of 3.2 and 2.2 percentage points over 1979 data. The proportion of overweight boys (7 – 18 years) increased from 5.6% in 1979 to 7.4% in 1989 and 8.4% in 1999. The differences between these percentages (among both younger and older boys) in the study period (1979–1999) were statistically significant. Comparing 1989 and 1999, statistically significant differences were only identified among younger boys, and between 1979 and 1989 differences were statistically significant among older boys and for the entire study population.*

Conclusions: *The 20-year period was marked by increasing prevalence of overweight among the boys and girls. Awareness of the consequences of developmental dysharmonies in the form of over- and underweight demands that these trends be further monitored.*

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Background

An increasing number of reports are pointing to an epidemic nature of the prevalence of excessive body weight in most European and global populations (both developed and developing countries). The rapid increase in the prevalence of overweight and obesity in the developmental age population is associated with direct and late heath-related, social and economic consequences [1]. Data on trends in the prevalence of the opposite extreme of body fat disorders also seem alarming [2]. These findings underscore the need of conducting epidemiological analyses and account for their on-going topicality.

Material and methods

The study population was derived from mass studies carried out in 1979, 1989, and 1999 [3] and encompasses a group of 23,854 children and youth aged 7 to 18 attending schools in the Pomerania administrative region. The actual numbers were 11,197 in 1979, 10,241 in 1989, and 3,383 in 1999.

Height and body weight data [3] were used to calculate the Body Mass Index (BMI), also known as the Quetelet II index [4]:

$$BMI = \text{weight (kg)} / \text{height (m}^2\text{)}$$

BMI values were used, according to WHO, CDC and Mother and Child's Research Institute[1] recommendations and the criterion proposed by A. Krzyżaniak [5], to define populations with excessive and deficient body weight. The following threshold values were used for these groups:

- Equal to or less than the 5th centile → underweight
- 85–95 centile → possibly obese in the future (overweight)
- 95 centile and above → obesity

An analysis of the height, weight and BMI data was conducted separately for boys and girls using the Statistica 8.0 software package.

Results

The prevalence of overweight, defined as BMI values between the 85th and 95th centile for the age and gender, among the younger (7–12 years) and older (13–18 years) boys and collectively for all ages analysed in 1979, 1989 and 1999 is shown in Table 1. The highest percentage of boys with the BMI between the 85th and 95th centile was seen in 1999, with figures of 8.7% among younger boys and 7.9% among older boys. This represented respective increases by 3.2 and 2.2 percentage points over 1979 data. The proportion of overweight boys (7–18 years) increased from 5.6% in 1979 to 7.4% in 1989 and 8.4% in 1999. The differences between these percentages (among both younger and older boys) in the study period (1979–1999) were statistically significant. Comparing 1989 and 1999, statistically significant differences were only identified among younger boys, and between 1979 and 1989 the differences were statistically significant among older boys and for the entire study population.

The highest percentage of obese boys was noted in 1999 (1.8% among younger boys and 2.3% among older boys) (Tab. 2). The proportion of younger boys with a BMI above the 95th centile was threefold higher than in 1989, and the figure for older boys was fourfold higher. The

[1] WHO – World Health Organization; CDC – Center for Disease Control and Prevention

differences were statistically significant. The lowest proportion of obese boys was seen in 1989, when the figure was 0.6% for all age groups studied (Tab. 2).

Tab. 1. Prevalence of overweight among younger and older boys in 1979, 1989, and 1999

Age groups	Percentage (% of respective age group)			1979-1989	1989-1999	1979-1999
	1979	1989	1999	p-value	p-value	p-value
7-12	5.5	6.6	8.7	0.096	0.029*	0.000*
13-18	5.7	8.1	7.9	0.000*	0.855	0.024*
Total	5.6	7.4	8.4	0.000*	0.186	0.000*

* p≤0.05

Tab. 2. Prevalence of obesity among younger and older boys in 1979, 1989, and 1999

Age groups	Percentage (% of respective age group)			1979-1989	1989-1999	1979-1999
	1979	1989	1999	p-value	p-value	p-value
7-12	1.0	0.6	1.8	0.144	0.001*	0.044*
13-18	0.5	0.6	2.3	0.712	0.000*	0.000*
Total	0.7	0.6	2.0	0.396	0.000*	0.000*

* p≤0.05

Table 3 shows that the highest proportion of underweight boys was seen in 1999 (4.3%) and among older boys in 1979 (3.3%). The lowest percentage of underweight boys was recorded in 1989. The differences were statistically significant for older boys between the years 1989 and 1999.

Tab. 3. Prevalence of underweight among younger and older boys in 1979, 1989, and 1999

Age groups	Percentage (% of respective age group)			1979-1989	1989-1999	1979-1999
	1979	1989	1999	p-value	p-value	p-value
7-12	3.6	3.4	4.3	0.648	0.211	0.356
13-18	3.3	2.3	2.9	0.032*	0.342	0.660
Total	3.4	2.8	3.7	0.068	0.074	0.604

* p≤0.05

Slimness, defined as the BMI between the 5th and 15th centile, was considerably more common among younger boys in all three sampling years (Tab. 4). The highest percentage of slim boys was seen in 1999, and the lowest in 1989. Differences in the percentage of slim boys (aged 7–18 years) between 1979 and 1989 and between 1989 and 1999 were statistically significant. Also, in 1989, younger boys were significantly slimmer than their peers in the last sampling year.

Tab. 4. Slim boys among younger and older boys in 1979, 1989, and 1999

Age groups	Percentage (% of respective age group)			1979-1989	1989-1999	1979-1999
	1979	1989	1999	p-value	p-value	p-value
7-12	10.8	9.7	12.0	0.180	0.043*	0.296
13-18	8.3	6.5	8.4	0.008*	0.074	0.932
Total	9.5	8.0	10.4	0.008*	0.002*	0.236

* p≤0.05

The prevalence of overweight among girls is shown in Table 5. The percentage of overweight older girls was approximately 9% in all three sampling years. A more visible increase in the prevalence of overweight over the 20-year period was observed among younger girls, the percentage rising from 5.7% in 1979 to 8.9% in 1999, which represented a statistically significant difference.

Tab. 5. Prevalence of overweight among younger and older girls in 1979, 1989, and 1999

Age groups	Percentage (% of respective age group)			1979-1989	1989-1999	1979-1999
	1979	1989	1999	p-value	p-value	p-value
7-12	5.7	7.0	8.9	0.059	0.061	0.001*
13-18	9.2	9.3	9.1	0.872	0.860	0.948
Total	7.4	8.2	9.0	0.169	0.277	0.034*

* p≤0.05

Obesity figures did not follow a linear increasing trend over the 20 years (Tab. 6). The proportions of obese girls were the lowest in 1989. These figures were still twice as high as those for younger boys and nearly four times as high as those for older boys. The highest percentages of obese girls, both among younger and older girls and among the entire age range, were noted in the last sampling year. Statistically significant differences were found for the entire group (7–18 years) between 1979 and 1989 and between 1989 and 1999.

Tab. 6. Prevalence of obesity among younger and older girls in 1979, 1989, and 1999

Age groups	Percentage (% of respective age group)			1979-1989	1989-1999	1979-1999
	1979	1989	1999	p-value	p-value	p-value
7-12	1.6	1.2	1.8	0.222	0.140	0.597
13-18	3.2	2.3	3.6	0.070	0.051	0.543
Total	2.4	1.8	2.7	0.031*	0.023*	0.513

* p≤0.05

Underweight was much more commonly diagnosed among younger girls. In this age group, the prevalence of below-normal BMI (not higher than the 5th centile) was just under 6% across all sampling. This figure was nearly twice as high as the rate among boys. The percentages of underweight older girls, especially in the first two sampling years (1979 and 1989), did not exceed 3%. An alarming increase in the prevalence of underweight among older girls was observed in 1999. The difference between the underweight percentages of the two age groups of girls (7–18 and 13–18 years) was statistically significant for the comparison between 1989 and 1999 and for the entire period (Tab. 7).

Tab. 7. Prevalence of underweight among younger and older girls in 1979, 1989, and, 1999

Age groups	Percentage (% of respective age group)			1979-1989	1989-1999	1979-1999
	1979	1989	1999	p-value	p-value	p-value
7-12	5.7	5.9	5.7	0.700	0.800	0.977
13-18	2.8	2.2	5.2	0.189	0.000*	0.001*
Total	4.3	4.1	5.5	0.660	0.016*	0.035*

* p≤0.05

The percentage of those girls classified as slim was much higher among younger girls in all sampling years. The lowest percentages of slim girls, both among younger and older girls, were recorded in 1989 (Tab. 8), and the highest in 1999. The percentage of girls with a BMI between the 5th and 15th centiles in 1999 was significantly higher than in 1989 and 1979.

Tab. 8. Percentage of slim girls among younger and older girls in 1979, 1989, and 1999

Age groups	Percentage (% of respective age group)			1979-1989	1989-1999	1979-1999
	1979	1989	1999	p-value	p-value	p-value
7-12	10.3	9.5	12.0	0.349	0.151	0.458
13-18	6.2	6.1	8.4	0.879	0.006*	0.007*
Total	8.3	7.8	10.4	0.387	0.003*	0.017*

* p≤0.05

The three sampling occasions, spanning a period of twenty years, thus show an increase in the prevalence of overweight among developing girls and boys (7–18 years). The lowest percentages of obese, slim and underweight children were recorded in 1989. The rapid growth in obesity rates among boys between 1989 and the last sampling year appears alarming. The increments among girls were similar, but the respective percentages between 1989 and 1999 were lower. Equally alarming is the finding of high percentages of children whose BMIs did not exceed the 5th centile.

Discussion

An analysis of trends in the prevalence of body fat disorders among the developmental age population (Fig. 1) and among the adult population shows that WHO's view that overweight, which typically leads to obesity, is the epidemic of the 21st century [6], and that it is one of the most important and costliest challenges to present-day public health [7,8,9,10,11] seems very much justified.

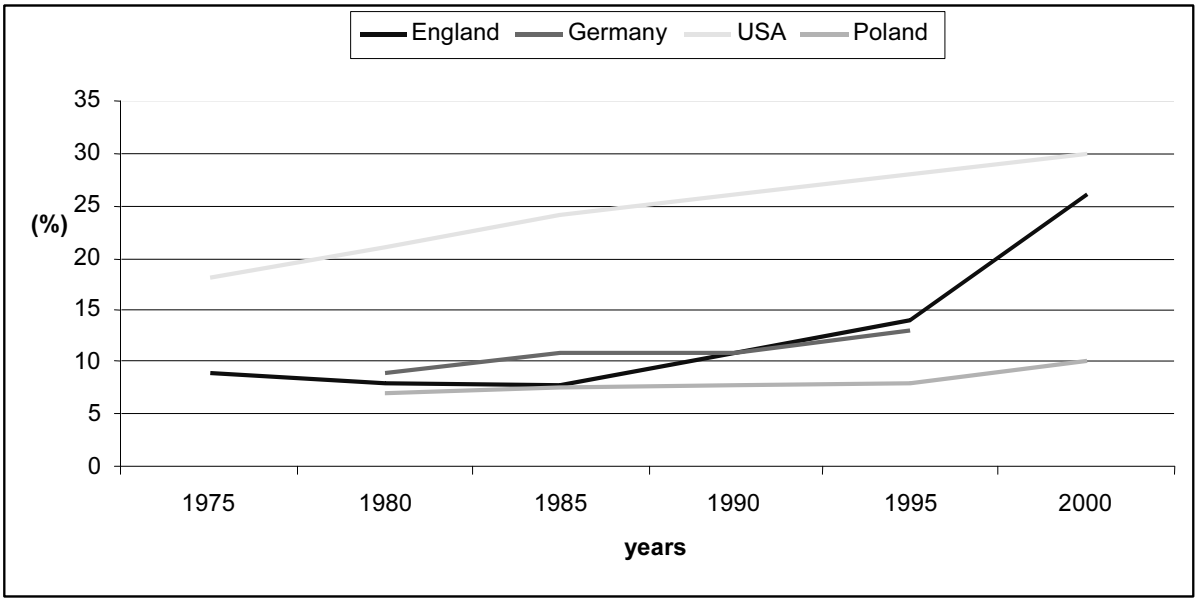

Fig.1. Trends in the prevalence of obesity in children from selected regions of the world
Source [12]

The results of the present study are not different from those shown in Figure 1. In the study population of Pomeranian children, the rates of obesity in boys and girls increased over the 20 years of study. However, it is difficult to identify clear-cut trends in the prevalence of obesity and the other extreme of body fat disorders, i.e. underweight, since the lowest proportions of children with these types of developmental dysharmony were recorded in 1989. The later data testify to a rapid increase in the percentage of obese boys. A similar, though less evident, correlation was found among girls. The trends in the prevalence of obesity in children from the Pomerania region correspond with findings from other populations, both in Poland [e.g. 13,14] and abroad [1,15,16,17,18]. In 1999, the prevalence of obesity among boys in the Pomerania administrative region[2] was more than 2% lower than in boys from Cracow (2000 data), about 10% than in boys from Warsaw (1999–2000 data), 8% lower than in boys from Poznań (2004–2005 data), 7% lower than in boys from eastern Poland (2005-2006 data) and 7% lower than in boys from Łódź (2005-2006 data). The differences were small in girls, with approximately 10% of girls from every population analysed having excessive body weight (girls from Łódź were an exception with a rate of 13.2%) [14,16,19,20,21]. The present study, which showed nearly identical percentages of obese girls and boys (8.4% of boys and 9% of girls were obese according to Polish criteria), did not confirm the purported trend of a higher prevalence of obesity among boys than girls. Nevertheless, obesity has been more commonly observed among boys, also in all other studies. Our results show that the prevalence of obesity in the group of younger children in the Pomerania administrative region in the last sampling year (1999), for which the largest body of comparative data is available, was similar to figures from such countries as Russia, Slovakia, or the Netherlands [12]. The prevalence of obesity in our study was lower than that recorded in most European countries [1].

As with overweight and obesity, trends in the prevalence of underweight in this study are not unequivocal. The lowest percentage of underweight children was recorded in 1989, and the highest in 1999. Accordingly, it may be supposed that the economic and political transformations taking place in the Pomerania administrative region over the 20-year period spanning the three sampling years indirectly influenced the direction and magnitude of changes in the prevalence of body fat disorders. The 1989 data reveal the lowest percentage of children with abnormal (above or below reference range) body weight. As with overweight and obesity, underweight data show wide variation between populations and regions [2,22,23,24]. Y.S.S. Wang et al. [25] analysed trends in the prevalence of body fat disorders in Chinese, Brazilian and American children and indicated that the percentage of children suffering from these disorders has been decreasing. The present study demonstrated the opposite trend. Additionally, in each sampling year, the proportion of underweight and slim children was significantly higher among younger children. Similar findings have been reported by E. Rychlik [26] and L. Szponar and M. Ołtarzewski [22] in their nation-wide studies of Polish children. Reports show that underweight, through its psychosomatic sequelae, not only lowers the quality of life but also affects life expectancy [27]. Thus, similar to excessive body weight, deficient body weight is a significant public health problem. It ought to be noted that our analysis does not continue beyond 1999, thus failing to encompass the most recent decade[3]. Other papers have indicated that the last ten years have been a period of key importance for increases in overweight and obese populations [29].

[2] The international criterion of IOTF was used for comparisons between populations in this study [28].

[3] Information from R. Przewęda and J. Dobosz (2003), the authors of populational surveys, indicates that their research will be continued in 2009.

Conclusion

The results of the present study are not consistent with a world-wide trend towards a rapid increase in the prevalence of overweight and obesity. However, these comforting data may later prove to be *"calm before a storm"* in the population of Pomeranian children. Awareness of the sequelae of the chronic metabolic disorder that obesity is underscores the necessity of continued research. The increasing prevalence of underweight in this group of children and adolescents demands alertness in the face of a new threat to positive health.

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