

Overweight and obesity among adolescents in Poland: gender and regional differences

Maria Jodkowska*, Anna Oblacinska and Izabela Tabak

Department of Child and Adolescent Health, Unit of School Medicine, Research Institute of Mother and Child, ul. Kasprzaka 17 A, Warsaw, Poland

Submitted February 2009; Accepted May 2010

Abstract

Objective: To examine the prevalence of overweight and obesity in Polish adolescents in 2005 using both the International Obesity Task Force (IOTF) cut-offs and a national reference; to compare this to data collected in 1995; and to assess whether there were differences in overweight or obesity by gender and place of residence in 1995–2005.

Design: BMI was calculated from measured height and weight, collected in a cross-sectional study in five regions of Poland in 2005. Adolescents were categorised as normal, overweight or obese based on IOTF cut-off values, and by national weight for stature tables, where the 90th and 97th percentiles were used as cut-off values for overweight and obesity.

Setting: Population-based study set in Poland.

Subjects: A two-stage sampling method was used to recruit 8065 pupils (3980 boys and 4085 girls) aged 13–15 years.

Results: The prevalence of overweight and obesity was 12.5% and 1.9%, respectively. No significant gender differences were found, either in overweight or obesity. The prevalence of overweight and obesity in 2005 had increased 2% compared to 1995. Overweight and obesity among adolescents were not related to urban–rural residence, but there were significant regional differences.

Conclusions: Monitoring trends in overweight and obesity among adolescents in all regions of Poland using the same reference criteria is important. Since regional differences in overweight and obesity rates among adolescents were observed both in 1995 and 2005, future research should investigate the potential causes of these differences.

Keywords
Obesity
Overweight
Adolescents
Gender
Regional differences

Puberty constitutes a critical period of life when adolescents are particularly prone to development of obesity^(1,2). Several studies have suggested that up to 80% of overweight adolescents will become obese adults^(3,4). Thus, the incidence of overweight and obesity among adolescents is of public health concern and should be closely monitored.

A study carried out in Poland in 1995 on a population of two million schoolchildren and adolescents aged 6–17 years in almost all regions of Poland revealed gender and regional differences⁽⁵⁾. The present study population was divided into five age groups: 6–7, 9–10, 14–15 and 16–17 years. There were 439 262 adolescents in the age group of 14–15 years. School nurses measured their height and weight. The national charts of weight for stature for boys and girls were used. Pupils above the 90th percentile were identified as overweight and those above the 97th percentile as obese⁽⁵⁾.

In the age group of 14–15 years, the prevalence of overweight (including obesity) was 8.9% for the whole sample, 7.8% for boys and 9.9% for girls ($P < 0.001$). The prevalence of obesity was 3.8%; 3.5% for boys and 4.1% for

girls ($P < 0.001$). The prevalence of overweight and obesity in the whole study population (all age groups) was higher in urban (9.4%) than in rural areas (7.1%; $P < 0.001$). The highest overweight rate was reported in the Podlaskie region and the lowest overweight rate was reported in the Kujawy region (11.0% and 7.7%, respectively).

The aim of the present study was 3-fold. First, to assess the prevalence of overweight and obesity among adolescents (13–15 years) in five regions of Poland based on both the International Obesity Task Force (IOTF) cut-offs and national references. Second, to compare these data to the data from the 1995 study (14–15-year-olds). Finally, to assess whether there were differences in overweight and obesity by gender and place of residence in the 2005 study.

Subjects and methods

The study design and participants

A cross-sectional study was carried out in the autumn of 2005. A two-stage sampling method was used. In the first

*Corresponding author: Email maria.jodkowska@imid.med.pl

stage, five regions from an overall sixteen regions in Poland were chosen. These regions were selected in a judgement sampling because of the results of the previous study from 1995. One region with the highest overweight rate in 1995 (Podlaskie), one with the lowest rate (Kujawsko-Pomorskie) and three regions with an average rate (Malopolskie, Lubuskie and Pomorskie) were selected.

The theoretical sample size was planned to be 10 000 subjects at the age of 13, 14 and 15 years (the pupils of grades I, II and III of lower secondary schools). The class size was assumed to be about thirty pupils, and the number of classes to be drawn was calculated [$10\,000: (3 \times 30) \approx 112$] based on this.

In the second stage, a sample of 112 schools, out of all the secondary schools from the selected regions, was drawn. The number of schools drawn from each region was proportional to the total number of pupils in the region. The final sample consisted of 8065 pupils. The sample was smaller than planned because the average number of pupils in the class was lower (about twenty-five pupils) than expected. Out of 8384 pupils attending the selected classes, 319 did not participate due to their absence from school on the day of measurement. The study was approved by the Bioethics Committee of Research Institute of Mother and Child in Warsaw (Opinion no. 24/2004).

The measurement and definition of overweight and obesity

Trained school nurses conducted anthropometric measurements: height and weight of all the participating pupils. Weight was recorded to the nearest 0.1 kg using a mechanical column scale with participants standing without shoes in the minimum clothing possible. Height was measured to the nearest 0.5 cm using non-stretch tape fixed to a flat wall.

BMI was calculated. The definition of overweight and obesity used in the present study was based on the age- and gender-specific cut-off points corresponding to a BMI of 25 and 30 kg/m² at 18 years of age (the IOTF cut-offs)⁽⁶⁾. Adolescents were categorised as normal weight, overweight or obese according to these cut-off values.

To accommodate a direct comparison of the current results with the ones published from the 1995 study, the data from the present study were also analysed using the methodology of the 1995 study⁽⁵⁾. Pupils' weight and height from the 2005 study were applied to the weight-for-stature tables used in the 1995 study⁽⁷⁾. The 90th and 97th percentiles were cut-off values defining overweight and obesity, respectively. Only the 14- and 15-year-old participants from the 2005 study were included for comparison with the respective population from the 1995 study.

Statistical methods

The Statistical Package for Social Sciences statistical software package version 14.0 (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses. The statistical significance

of differences between boys and girls and differences in the prevalence rates of overweight and obesity between urban and rural areas and between regions were examined with the χ^2 test. Percentage agreement was calculated and the McNemar test was used to test agreement between the two methods of defining overweight and obesity.

Logistic regression was used to examine the association of region of residence with overweight and obesity. The regression analyses were conducted for the whole sample, and also stratified by gender. The cut-off point for statistical significance was $P < 0.05$.

Results

The sample included 8065 lower secondary-school students: 3980 boys and 4085 girls, aged 13–15 years. The mean age was 14.3 (SD 0.9) years. Of the entire sample 61% ($n\ 4958$) of the students lived in rural areas and 39% ($n\ 3107$) lived in urban areas. These pupils lived in five regions of Poland (selected regions and number of participants are shown in Fig. 1).

Using IOTF cut-offs, the overall prevalence of overweight (including obesity) was 12.5% and the prevalence of obesity was 1.9%. No significant age or gender differences were found for overweight or obesity in this sample (Table 1).

The results of the analyses for adolescents aged 14–15 years only using the national reference used in the 1995 study are shown in Table 2. The prevalence of overweight (including obesity) and obesity was 11.1% and 5.5%, respectively. Significant gender differences were found. The prevalence of overweight and obesity in the analysed age group increased by 2.2% and 1.7%, respectively, between 1995 and 2005. The overall percentage agreement

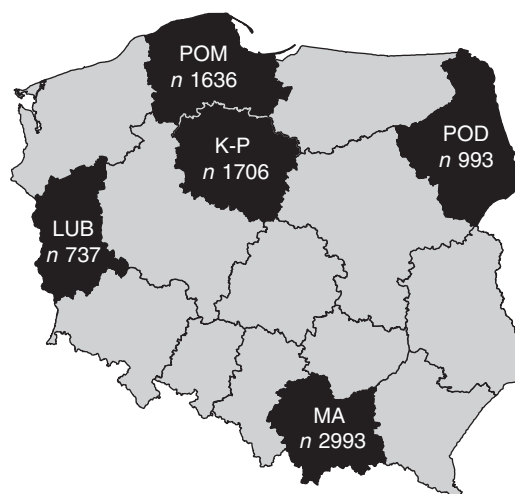


Fig. 1 Selected regions and number of students examined in each region (POM, Pomorskie; K-P, Kujawsko-Pomorskie; POD, Podlaskie; MA, Malopolskie; LUB, Lubuskie)

Table 1 Prevalence of overweight and obesity among adolescents aged 13–15 years in Poland stratified by gender and age, using IOTF cut-offs

| Age (years) | Total | | | Boys | | | Girls | | |
|-------------|----------|----------------|-------------|----------|----------------|-------------|----------|----------------|-------------|
| | <i>n</i> | Overweight (%) | Obesity (%) | <i>n</i> | Overweight (%) | Obesity (%) | <i>n</i> | Overweight (%) | Obesity (%) |
| 13 | 1718 | 13.8 | 2.7 | 818 | 14.2 | 2.8 | 900 | 13.0 | 2.2 |
| 14 | 2652 | 13.5 | 2.3 | 1308 | 14.1 | 1.9 | 1344 | 12.5 | 2.2 |
| 15 | 2782 | 11.8 | 1.6 | 1426 | 11.9 | 1.9 | 1356 | 11.9 | 1.4 |
| ≥15 | 913 | 10.1 | 1.4 | 428 | 10.5 | 1.4 | 485 | 9.6 | 1.4 |
| Total | 8065 | 12.5 | 1.9 | 3980 | 12.9 | 2.0 | 4085 | 12.0 | 1.8 |

IOTF, International Obesity Task Force.

Table 2 Comparison of the prevalence of overweight and obesity among adolescents aged 14–15 years in Poland, in 1995 (*n* 439 262) and 2005 (*n* 5434), using weight for stature tables

| Year of study | Overweight (%) | | | | Obesity (%) | | | |
|---------------|----------------|------|-------|----------------|-------------|------|-------|----------------|
| | Total | Boys | Girls | <i>P</i> value | Total | Boys | Girls | <i>P</i> value |
| 1995 | 8.9 | 7.8 | 9.9 | <0.001 | 3.8 | 3.5 | 4.1 | <0.001 |
| 2005 | 11.1 | 10.2 | 11.9 | 0.05 | 5.5 | 4.9 | 6.2 | 0.030 |

The 90th and 97th percentiles were cut-off values defining overweight and obesity.

between the two methods (IOTF and national reference) was 97% for overweight (McNemar's test, $P < 0.001$), 98% for girls ($P = 0.80$), 97% for boys ($P < 0.001$) and 96% for obesity (McNemar's test, $P < 0.001$), 95% for girls ($P < 0.001$), 96% for boys ($P < 0.001$).

Only smaller, non-significant differences in the prevalence of overweight and obesity rates was observed for adolescents 13–15 years residing in urban and rural areas (Table 3).

A significant regional difference in the prevalence of overweight was seen among Polish adolescents ($P = 0.003$), but when analysing separately for gender, the difference was significant only for girls ($P = 0.002$). The highest percentage of overweight pupils was seen in the sample from the Podlaskie region, and the lowest from Kujawsko-Pomorskie (Table 3).

Similarly, a significant regional difference in the prevalence of obesity was seen ($P = 0.012$), and as for overweight, the difference was significant for girls only ($P = 0.023$). The highest percentages of obese adolescents were in the Lubuskie and Podlaskie regions, and the lowest in Kujawsko-Pomorskie (Table 3).

The above results were confirmed by logistic regression analyses adjusted for gender and age, revealing that adolescents in the Podlaskie region were more likely to be overweight than adolescents in Kujawsko-Pomorskie (OR = 1.30, 95% CI 1.03, 1.66). Furthermore, pupils in the Lubuskie and Podlaskie regions were more likely to be obese than their peers in the Kujawsko-Pomorskie region (OR = 2.23, 95% CI 1.24, 4.01 and OR = 2.11, 95% CI 1.21, 3.69, respectively).

After stratification for gender, no association between regional residence and incidence of overweight was found for boys (Table 3), but the girls in Pomorskie and

Table 3 Prevalence of overweight and obesity among adolescents stratified by urban–rural area and regions in adolescents aged 13–15 years in Poland using IOTF cut-offs (*n* 8065)

| | Overweight (%) | | | Obesity (%) | | |
|---------------------|----------------|------|--------|-------------|------|--------|
| | Total | Boys | Girls† | Total | Boys | Girls‡ |
| Place of residence* | | | | | | |
| Urban area | 13.3 | 13.4 | 13.0 | 1.9 | 1.6 | 2.1 |
| Rural area | 12.0 | 12.6 | 11.5 | 2.0 | 2.3 | 1.7 |
| Region§ | | | | | | |
| Kujawsko-Pomorskie | 10.7 | 12.0 | 9.5 | 1.4 | 1.6 | 1.3 |
| Lubuskie | 11.1 | 12.2 | 10.1 | 3.0 | 2.5 | 3.5 |
| Malopolskie | 12.7 | 12.8 | 12.6 | 1.6 | 1.9 | 1.3 |
| Podlaskie | 13.9 | 14.5 | 13.3 | 2.8 | 3.1 | 2.6 |
| Pomorskie | 13.7 | 13.4 | 13.9 | 2.1 | 2.0 | 2.2 |

IOTF, International Obesity Task Force.

*Urban–rural differences are statistically not significant.

†Regional differences overall; $P = 0.003$ and 0.012 for overweight and obesity, respectively.

‡Regional differences for overweight in girls ($P = 0.002$).

§Regional differences for obesity in girls ($P = 0.023$).

Podlaskie had a greater probability of being overweight than girls in Kujawsko-Pomorskie (OR = 1.53, 95% CI 1.13, 2.06 and OR = 1.42, 95% CI 1.01, 2.01, respectively). Boys in Podlaskie and girls in Lubuskie had higher odds of being obese than their peers in Kujawsko-Pomorskie (OR = 2.23, 95% CI 1.04, 4.79 and 2.79, 95% CI 1.23, 6.30, respectively).

Discussion

The present study provides the baseline to study future trends in overweight and obesity among adolescents using IOTF cut-off values in Poland. The prevalence of overweight and obesity was 12.5% and 1.9%, respectively.

Comparison of anthropometric criteria for assessing overweight and obesity has shown significant differences between the two methods (IOTF and Polish national references). It seems that the application of IOTF's cut-off values may result in the underestimation of obesity.

These results are in agreement with those of the WHO Health Behaviour in School-aged Children (HBSC) study, conducted in Poland in early 2006, despite the different methods of data collection (self-reported in the HBSC study and measured in the present study). Based on self-reported data on height and weight, the prevalence of overweight and obesity among 13–15-year-olds was 12% and 1.7%, respectively⁽⁸⁾. When comparing overweight and obesity rates across countries, it seems that overweight and obesity rates among adolescents in Poland are relatively low^(9–11).

The results of the present study indicate that an urban–rural place of residence was not a risk factor for overweight and obesity in the study sample. The study from 1995 did find a rural–urban difference; overweight and obesity rates were significantly higher in urban areas⁽⁵⁾. Obesity has been more commonly observed in children and adolescents in urban areas in developed countries before 1980⁽¹²⁾. However, studies from the USA and developed European countries indicate a reversal of the situation in which overweight and obesity in children and adolescents appear to be worse in rural areas^(13–15). There is evidence that rural life presents special cultural and structural challenges in maintaining a healthy weight (higher dietary fat and energy consumption, lower level of physical activity, lack of sport facilities or further distance from them)^(15,16). It is highly probable, therefore, that a similar trend has been occurring currently in Poland. At the beginning of the 21st century, significant differences between urban and rural areas have not been observed, but one may expect a shift towards higher overweight and obesity prevalence in rural areas in the near future. It is necessary to closely monitor this trend.

The study shows regional differences in overweight and obesity among adolescents in Poland. The three independent studies carried out in Poland in the past decade (1995⁽⁵⁾, 2005 and 2006⁽⁸⁾) have shown that regional differences in overweight and obesity rates among adolescents aged 13–15 years still persist. No differences were found in food habits (fruit and vegetable consumption, soft drinks and breakfast skipping), physical activity and sedentary behaviours among adolescents in these regions⁽⁸⁾. Thus, further investigations are called for in order to explain these differences.

Researchers from other countries have also reported on regional differences in overweight and obesity among adolescents, and it has been observed both in large⁽¹⁷⁾ and smaller countries⁽¹⁸⁾. Today's challenge is to find the causes of these regional differences, especially in countries where minority ethnic groups only account for a small proportion of the total population.

In the present study, the observations were limited to only five regions. It is important to monitor the incidence of overweight in all sixteen regions of Poland. We believe that to be more effective, obesity prevention programmes should take into account these regional differences.

The main strength of the present study is that it represents the first Polish report of measured height and weight among adolescent school pupils applying the IOTF cut-off points for overweight and obesity. This allows for direct comparisons with similar measured data for the same age group from other parts of Europe. A limitation of the study, however, is that pupils from only five regions were included, making the comparison to the 1995 study complicated as that study included most regions of Poland. Furthermore, the statistically significant regional differences observed in the present study might be exaggerated, as we did not adjust for the school-level cluster effect (thus reducing the error term). Finally, data on socio-economic status and other background factors that might help explain the observed differences were not available from the present data set.

In conclusion, the observed prevalence of overweight and obesity among 13–15-year-old adolescents in Poland was seen as relatively low compared to that of other European countries. While no significant gender or urban–rural differences were seen, regional differences consistent with those observed a decade earlier were found. A modest increase in the prevalence rates of overweight and obesity (about 2%) among 14–15-year-olds was seen from 1995 to 2005. It is recommended that overweight and obesity among adolescents in all regions of Poland be continued to be monitored using the IOTF reference criteria, and that further research be conducted in order to investigate the potential causes of the observed regional differences.

Acknowledgements

Source of funding: The present study was supported by the Nutricia Poland Research Foundation Grant no. 1/2005, and has been facilitated by the EU-funded HOPE project: 'Health promotion through Obesity Prevention across Europe (the Commission of the European Communities, SP5A-CT-2006-044128)'. The study does not necessarily reflect the Commission's views and in no way anticipates the Commission's future policy in this area. *Conflict of interest declaration:* None of the authors has any conflicts of interest. *Authorship responsibilities:* M.J. was responsible for the study concept, and did the data analyses and manuscript preparation. A.O. was the director of the study and critically reviewed the analyses and the manuscript. I.T. participated in the study, provided expert advice on data interpretation and contributed to the editing of the paper. *Acknowledgement:* The authors thank Knut-Inge Klepp and Nanna Lien for valuable comments and support in the preparation of the manuscript.

References

1. Dietz WH (1994) Critical periods in childhood for development of obesity. *Am J Clin Nutr* **59**, 955–999.
2. Dietz WH (2004) Overweight in childhood and adolescence. *N Engl J Med* **350**, 855–857.
3. Whitaker RC, Wright JA, Pepe MS *et al.* (1997) Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med* **337**, 869–873.
4. Daniels AR (2006) Critical periods for abnormal weight gain in children and adolescents. In *Handbook of Pediatric Obesity*, pp. 67–78 [MI Goran and MS Sothern, editors]. New York: Taylor & Francis.
5. Oblacinska A, Wroclawska M & Woynarowska B (1997) Prevalence of overweight and obesity in the school-age population in Poland and health care for pupils with these disorders. *Pediatr Pol* **72**, 241–245.
6. Cole TJ, Bellizzi MC, Flegal KM *et al.* (2000) Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* **320**, 1240–1243.
7. Kurniewicz-Witczakowa R, Niedzwiecka Z & Pietrzak M (1995) Siatki skorelowane proporcji masy do wysokosci ciala (Polish). In *Otylosc. Jak Leczyc i Wspierac Dzieci i Mlodziez*, pp. 25–26 [A Oblacinska and B Woynarowska, editors]. Warsaw: Institute of Mother and Child.
8. Mazur J, Woynarowska B & Kololo H (2007) *Subjective Health, Life Style and Psychosocial Environment of School-Children in Poland. Report from HBSC Study 2006*. Warsaw: Institute of Mother and Child.
9. Lissau I, Overpeck MD, Ruan WJ *et al.* (2004) Body mass index and overweight in adolescents in 13 European countries, Israel and United States. *Arch Pediatr Adolesc Med* **158**, 27–33.
10. Jebb SA, Rennie KL & Cole TJ (2003) Prevalence of overweight and obesity among young people in Great Britain. *Public Health Nutr* **7**, 461–465.
11. Wang Y & Beydoun MA (2007) The obesity epidemic in the United States – gender, age, socioeconomic racial/ethnic, and geographic characteristics: a systemic review and meta-regression analyses. *Epidemiol Rev* **29**, 6–28.
12. Dietz WH & Gortmaker SL (1984) Factors with the physical environment associated with childhood obesity. *Am J Clin Nutr* **39**, 619–624.
13. Levin S, Mayer-Davis EJ, Ainsworth BE *et al.* (2001) Racial/ethnic health disparities in South Carolina and the role of rural locality and educational attainment. *South Med J* **94**, 711–718.
14. Joens-Matre RR, Welk GJ, Calbro MA *et al.* (2008) Rural–urban differences in physical activity, physical fitness, and overweight prevalence in children. *J Rural Health* **24**, 49–54.
15. Ekblom O, Oddsson K & Ekblom B (2004) Prevalence and regional differences in overweight in 2001 and trends of distribution in Swedish children 1987–2001. *Scan J Public Health* **32**, 257–263.
16. Woynarowska B, Jodkowska M & Oblacinska A (2000) Self-estimation of physical fitness and physical activity during leisure-time in school children in 1990–1998. *Pediatr Pol* **75**, 35–41.
17. Shields M & Tjepkema M (2006) Regional differences in obesity. In *Health Reports*, issue no. 7, 61–67, Catalogue no. 82-0031. Ottawa: Statistics Canada.
18. Schober E, Rami B, Kirchengast S *et al.* (2007) Recent trend in overweight and obesity in male adolescents in Austria: a population-based study. *Eur J Pediatr* **166**, 709–714.