

Prevalence of overweight and obesity among adolescents in Poland

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ABSTRACT

Objectives: The purpose of the study was to evaluate the prevalence of overweight and obesity among Polish adolescents.

Material and methods: Participants (13–19 years old, $n = 14,044$ students) were recruited from 207 schools, randomly selected from a total of 2058 schools. The stratified two-stage sampling method was used. First the schools were selected, and then the students. The study was conducted from 2013 to 2014. The body weight of students aged 13–18 years was assessed using IOTF criteria. For students aged 19 years old, standard WHO body mass index criteria were applied.

Results: Excessive body weight was observed among 18.2% of all adolescents aged 13–19 years old, 11.6% were found to be overweight, and 6.6% obese. The prevalence of overweight ranged between 9.3% and 11.5% for girls, and 9.4% and 17.0% for boys. The prevalence of obesity ranged between 3.8% and 7.3% for girls, and 4.8% and 9.2% for boys. The obesity rate was higher among younger individuals for both gender groups, and a decreasing prevalence with age was observed.

Conclusions: In Poland overweight was observed in one out of every eight adolescents, and obesity in one out of every 15 adolescents. The weight status was dependent on age and gender of adolescents. The highest prevalence of obesity was noted for the youngest boys (13 years old).

KEY WORDS: obesity, overweight, body weight, body mass index, adolescents/youth.

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INTRODUCTION

Childhood obesity is a public health problem in many countries [1]. During the last decades, obesity rates have increased in Europe, especially in eastern European countries, where the obesity rate was relatively low at the beginning of this century, while in other countries this problem has stabilised [2]. Childhood obesity can cause many health problems; it undermines the social, physical, and psychological well-being, and is a risk factor for other noncommunicable diseases [3]. Childhood obesity determines obesity in adulthood [4].

Moreover, obesity treatment is very expensive, and the results of prevention programs do not always confirm their effectiveness [5]. In Poland, obesity is already diagnosed among toddlers [6]. The prevalence of overweight and obesity among adolescents indicates that the problem of excessive weight concerns at least every fifth teenager, but data vary depending on age and gender [7]. The latest data showed a favourable downward trend, which according to the authors of the Polish report [8], should be associated with observed favourable changes in health behaviours, including improved

physical activity among adolescents. On the other hand, it is worth noting that the data collected in that project are based on self-reported height and weight values. For this reason, the data may be less reliable compared to similar studies, in which participants are accurately measured.

ing anthropometric measurements to assess the nutritional status, as well as evaluation of selected dietary behaviours and parameters related to the physical activity of students. In this article we present the results of weight-related studies only. The WN-HG project diagram is presented in Figure 1.

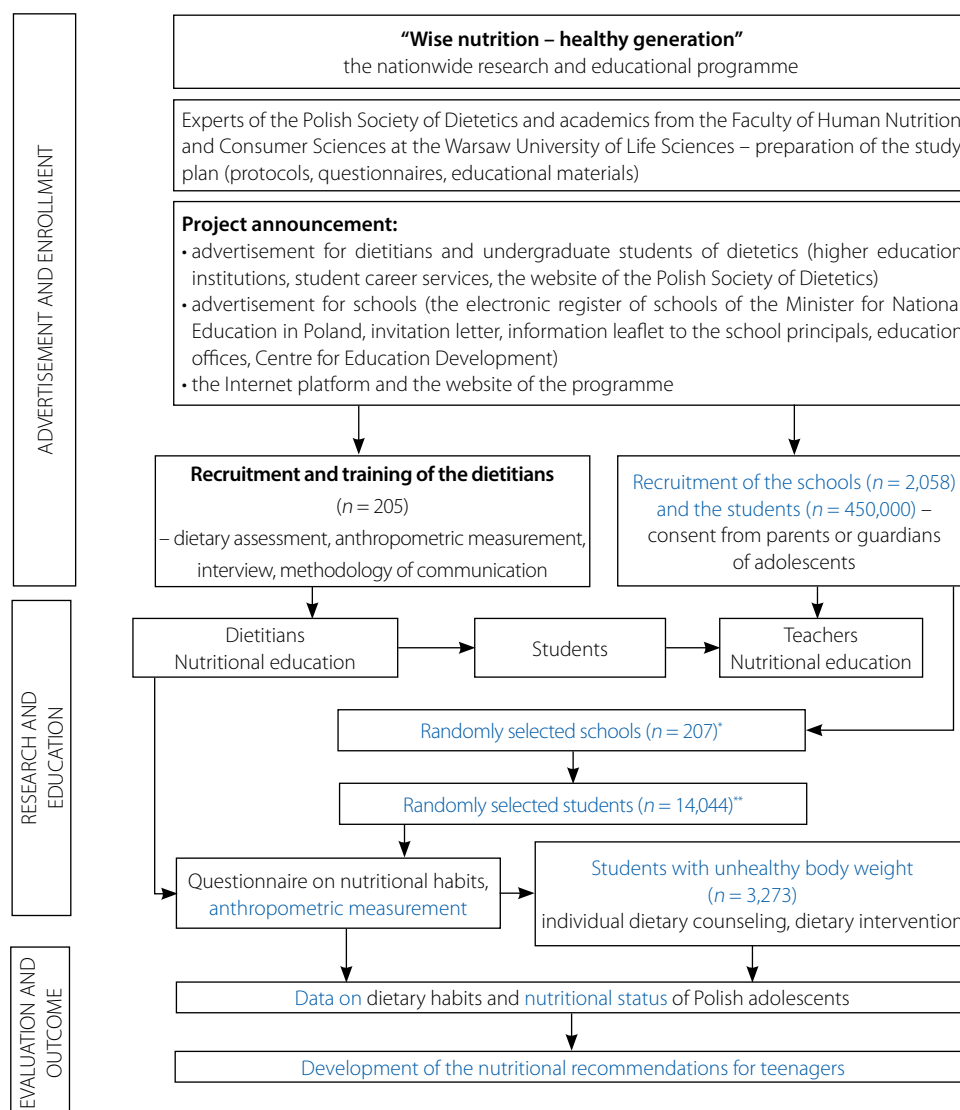
MATERIAL AND METHODS

GENERAL INFORMATION

The study was conducted from October 2013 to March 2014 as part of the research and education program “Wise Nutrition – Healthy Generation” (WN-HG project). The scope of the program included perform-

STUDY PARTICIPANTS

Participants of both genders (13-19 years old, $n = 14,044$ students) were recruited from 207 randomly selected schools. The information about the possibility of joining the program was sent to all schools listed in the electronic register of schools of the Minister for National Education



*exclusion criteria for schools: no application to the WN-HG program lack of consent to participate in the study, **exclusion criteria for students: age < 13 years or age > 19 years, unhealthy adolescents, pregnancy and lactation in girls, persons with posture defect/disability that prevents anthropometric measurements, lack of consent to participate in the study

FIG 1. The “Wise nutrition – healthy generation” project diagram (the part of the program presented in the article is marked in blue)

in Poland (over 14,000 schools). In total 2,058 schools joined the program (10% of all schools in Poland), and 207 schools were randomly selected for the research part of the program. Sampling was stratified by province and location (large, medium, small city) as well as the type of school (secondary and upper secondary). In the next step, students were randomly selected from the class registry. All of the students' data have been fully anonymised. Schools and students included in the research are from all over the country; therefore, the study can be considered as nationwide. The study was conducted among a group of healthy adolescents. Exclusion criteria for students were as follows: age < 13 years old or age > 19 years old, unhealthy adolescents, pregnancy and lactation in girls, persons with posture defect/disability that prevents anthropometric measurements, and lack of consent to participate in the study. Exclusion criteria for schools were as follows: no application to the WH-NH program and lack of consent to participate in the study. Figure 1 presents the WN-HG project diagram, including a scheme for selecting the sample of the study.

MEASUREMENTS

Anthropometric measurements, such as weight and height, were conducted by trained dietitians. All measurements were carried out with equipment provided by the Polish Society of Dietetics: digital floor scales (TANITA HD-380 BK, Tanita Corporation, Tokyo, Japan) and an elastic measuring tape (0-200 cm). All dietitians conducting the measurements followed the same standardised protocol. All the measurements were done according to the Anthropometry Procedures Manual by the National Health and Nutrition Examination Survey (NHANES) [9]. The weight of the individuals was measured to the nearest 0.1 kilogram twice, and the mean value was recorded. Measurements were made for individuals dressed in basic cloths (e.g. underwear, trousers/skirt and t-shirt) and without shoes. From the final result, 0.5 kg was subtracted (predicted weight of the basic clothes). For the height measurement, individuals stood on a flat surface in an upright position with their back against the wall, their heels together, and toes apart (without shoes and socks). The students were asked to stand as tall as possible with the head in the Frankfort horizontal plane. The height measurement, to the nearest

0.1 cm, was performed twice, and the mean value was recorded.

Body height and weight were measured to calculate the body mass index (BMI). BMI was calculated as body weight in kilograms divided by the square of height in metres. Depending on the age of the students, different criteria for assessing the weight status were used. Body weight of students aged 13-18 years old was assessed using international BMI standards for young people, adopted by the International Obesity Task Force (the IOTF BMI cut-off points) criteria [10]. For students at the age of 19 years, the standard WHO BMI criteria for adults were applied [11]. Separate terms for overweight and obesity were used, whereas the term „excessive weight” included overweight and obesity.

All the dietitians had been trained before the measurement. The program was carried out following the standards required by the Helsinki Declaration and was approved by the Scientific Committee of the Polish Society of Dietetics. All parents received written information describing the program. After study approval from the Society of Dietetics and the Warsaw University of Life Sciences Institutional Review Board, consent was obtained from schools' directors and parents of adolescents.

STATISTICAL METHODS

Statistical data processing was performed using Statistica StatSoft version 13.1. All data were analysed in the total group, as well as in age and gender subgroups. Anthropometric data including weight, height, and BMI were presented as means with standard deviations (SDs). The weight status was presented as the prevalence of underweight, normal weight, overweight, and obesity (expressed as the number of students and percentage of subjects in every age group, among all girls and all boys). A comparison of BMI vs age and gender was made with an analysis of the variance; qualitative variables were determined using Pearson's χ^2 test. Additionally, the contingency coefficient or Cramér's V was used to indicate the strength of association between categorical variables. The differences were considered significant at $p < 0.05$.

RESULTS

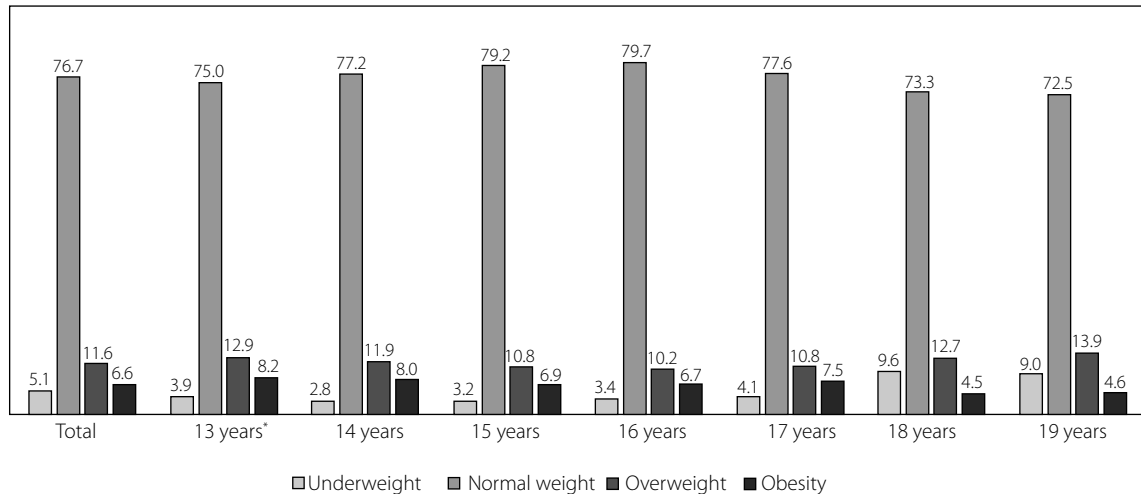
The total sample group consisted of 14,044 students, including 7,553 girls and 6,491 boys. Anthropometric characteristics of Polish adolescents divided by gender (all girls vs all boys) are presented in Table 1. The differences in BMI depending on gender are also indicated in Table 1. The weight status of Polish adolescents in total and divided by age is presented in Figure 2.

More than 3/4 of the study population had normal weight (76.7%), 5.1% of the subjects were under-

TABLE 1. Anthropometric characteristic of Polish adolescents divided by gender

| Gender | n | Height (cm) Mean (SD) | Weight (kg) Mean (SD) | BMI* (kg/m ²) Mean (SD) |
|--------|-------|--------------------------|--------------------------|--|
| Girls | 7,553 | 164.2 (6.2) | 56.6 (10.1) | 20.9 (3.3) |
| Boys | 6,491 | 174.9 (8.8) | 66.8 (14.0) | 21.7 (3.7) |

SD – standard deviation, * significant differences BMI vs gender (all girls vs all boys, $p = 0.0000$)



*significant differences weight status vs age ($p = 0.0000$)

FIG. 2. Weight status of Polish adolescents in total and divided by age (% of subjects)

weight, and excessive weight was observed in 18.2% of adolescents (overweight in 11.6% and obesity in 6.6%). Significant correlations were found between the weight status of the students and their age

($p = 0.0000$). However, the value of the Cramér coefficient (0.07) indicated a small influence of age on the weight status in the total group. There was an increase in the prevalence of underweight with age, while the

TABLE 2. Weight status of Polish adolescents including prevalence of overweight and obesity divided by gender and age

| Gender/Age (years) | Underweight ¹ | | Normal weight ² | | Overweight ³ | | Obesity | |
|--|--------------------------|-------|----------------------------|-------|-------------------------|-------|----------|------|
| | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % |
| Girls ^a (<i>n</i> = 7,553) | | | | | | | | |
| 13 ^b | 19 | 2.84 | 536 | 80.00 | 66 | 9.85 | 49 | 7.31 |
| 14 | 26 | 2.59 | 791 | 78.79 | 115 | 11.45 | 72 | 7.17 |
| 15 ^b | 40 | 3.85 | 836 | 80.38 | 109 | 10.48 | 55 | 5.29 |
| 16 | 50 | 3.98 | 994 | 79.08 | 137 | 10.90 | 76 | 6.04 |
| 17 ^b | 83 | 5.40 | 1,194 | 77.63 | 149 | 9.69 | 112 | 7.28 |
| 18 ^b | 178 | 12.40 | 1,070 | 74.51 | 133 | 9.26 | 55 | 3.83 |
| 19 ^b | 64 | 10.53 | 449 | 73.85 | 68 | 11.18 | 27 | 4.44 |
| All girls ^c | 460 | 6.09 | 5,870 | 77.72 | 777 | 10.29 | 446 | 5.90 |
| Boys (<i>n</i> = 6,491) | | | | | | | | |
| 13 | 30 | 5.00 | 417 | 69.50 | 98 | 16.33 | 55 | 9.17 |
| 14 | 26 | 2.98 | 658 | 75.46 | 109 | 12.50 | 79 | 9.06 |
| 15 | 24 | 2.47 | 756 | 77.86 | 108 | 11.12 | 83 | 8.55 |
| 16 | 32 | 2.83 | 907 | 80.34 | 106 | 9.39 | 84 | 7.44 |
| 17 | 31 | 2.49 | 965 | 77.64 | 150 | 12.07 | 97 | 7.80 |
| 18 | 67 | 6.01 | 799 | 71.66 | 190 | 17.04 | 59 | 5.29 |
| 19 | 41 | 7.31 | 399 | 71.12 | 94 | 16.76 | 27 | 4.81 |
| All boys | 251 | 3.87 | 4,901 | 75.50 | 855 | 13.17 | 484 | 7.46 |
| <i>p</i> | 0.0000 | | 0.0241 | | 0.0019 | | NS | |

^a significant differences weight status in gender subgroups ($p = 0.0000$), ^b significant differences weight status in age subgroups (13 years old $p = 0.0001$, 15 years old $p = 0.0096$, 17 years old $p = 0.0001$, 18 years old $p = 0.0000$, 19 years old $p = 0.0162$), ^c significant differences weight status vs gender ($p = 0.0000$), ^{1,2,3} significant differences in weight status subgroups (overweight not included obesity), *p* – level of significance, NS – statistically not significant

prevalence of obesity declined with age. Normal body weight was the most common among 16-year-olds, and this age category included the fewest overweight students. The occurrence of overweight was most frequent among border age groups, i.e. 13- and 19-year-olds. Obesity was most common among 13-year-olds.

The weight status of the individuals, including prevalence of overweight and obesity (separately) divided by age and gender, is presented in Table 2.

Analysis of the weight status in the gender subgroups (girls and boys separately) also showed a significant relationship with age ($p = 0.0000$ in both groups). However, the strength of these effects was small (V Cramér = 0.09 in girls and 0.08 in boys). Among the girls, the prevalence of underweight increased with age from 2.84% for 13-year-olds to 10.53 for 19-year-olds. The highest rate of underweight (12.4%) was found among 18-year-old girls. Among the boys, underweight was most commonly observed in the oldest age group, while it was the least common among 15-year-olds. The highest proportion of adolescents with a normal weight was found among 15-year-old girls and 16-year-old boys. The prevalence of overweight among girls was similar in all age groups, whereas the difference in boys was noticeable: 9.39% for the 16-year-old group and 17.04% for the 18-year-old group. The obesity rate was higher for younger individuals in both gender groups, and a decreasing prevalence with age was observed. The highest percentage of obesity was noted for the group of the youngest boys (13 years old).

DISCUSSION

Adequate growth and normal body weight of children are the basic indicators of their general health. In daily practice, basic anthropometric tests, such as the assessment of length/height and weight, are the most important tools for physicians to evaluate the growth status of the child. Incorrect weight status might be a sign of some diseases and nutrition-related problems. Early detection of such abnormalities allows for early intervention. On the other hand, the monitoring of anthropometric data is a public health tool to summarise and compare data in time and among groups of children. Nevertheless, comparing data is often problematic due to the different methodologies used. In recent years, there have been several international studies in which data were collected according to the same protocol of study, but in some other studies the data were self-reported. The data presented in this article were obtained during measurements conducted by trained specialists; therefore, it should be considered as reliable. The data concerning anthropometric measurements such as height, weight, and BMI showed diversity according to age and gender. Similar values for growth, body weight, and the mean

values of BMI were found in previous Polish studies among a group of children and adolescents in 2007-2009 [12, 13], but we found a lower proportion of overweight children, and a higher proportion of children with obesity compared to previous studies [12]. Another Polish study [14], which examined the prevalence of overweight and obesity among adolescents aged 13-15 years in 2005, reported a lower percentage of adolescents with overweight and obesity in both genders. The two studies mentioned above present the results of research conducted in the last decade, which was a time of economic transformation in Poland. The international report from the Health Behaviour in School-aged Children (HBSC) study showed that from 2002 to 2010, in Poland, there was a rapid increase in the number of adolescents with excessive body weight [15]. At that time, the number of children with excessive body weight doubled. The rate of weight gain has been characterised as one of the highest in the studied groups of countries. A similar increase in the number of overweight children was also noted in other countries (e.g. Ukraine, Russia, Latvia, and Estonia), but in these cases the prevalence of excessive weight in 2010 was not as high as in Poland [16]. The authors of that study noted that the overweight prevalence increased significantly in at least half of the surveyed countries, and they showed that in 2010 the prevalence of overweight was highest in the USA (about 29% of adolescents) and lowest in Ukraine (about 10% of adolescents). A relatively high prevalence of overweight in 2010 among adolescents was noted in Greece and Canada, but in both cases the prevalence of overweight was also high in 2002 [16].

Many authors showed that the prevalence of overweight and obesity in adolescents worldwide is high and varies according to age, as well as gender (higher among boys [17]). In the Polish study [13], authors evaluating a 10-year trend (from 1998 to 2008) showed a trend toward stabilisation of the prevalence of overweight and obesity among school children. Some differences have been shown after age and gender adjustment. The authors noted a declining obesity prevalence among girls (from 10.1% to 7.7%) and increased prevalence of overweight among boys (from 10.5% to 14.2%). The same authors indicated that the proportion of overweight boys in 2008 was significantly higher than in 1998 due to a significant increase in the prevalence of overweight among seven- and eight-year-olds. The results of our study also confirmed the higher prevalence of obesity in the group of younger boys compared to other specific age groups and the all-ages group of girls. Similar observations were recorded in the last two editions of the Polish HBSC study [8, 15]. A significant correlation between age and gender was observed in the Russia study [16]. The above results indicate an increasing

trend of prevalence of excessive body weight among younger boys (11-year-olds) compared to the oldest (15-year-olds). Higher rates of obesity among boys aged 3-17 years old compared to girls have been noted in the three latest decades in the United States, England, and France [1]. Other authors estimating trends in the prevalence of overweight and obesity in the US among children and adolescents showed significant differences according to age and gender [18]. The same authors noted that between 2011 and 2014 in US, for children and adolescents aged 2-19 years old, the prevalence of only obesity was 17%, and extreme obesity 5.8%. In England, childhood overweight and obesity prevalence noted in 2013/2014 ranged from 22.5% to 33.5%, and varied according to age, gender, and other factors [19]. In the case of France, the obesity rate was lower than in other countries and results showed a general stabilisation. The authors explained that the stabilisation of prevalence of overweight and obesity in France is caused by the introduction of obesity prevention programs focused on children [20]. The effectiveness of educational programs on obesity prevention among children implemented in different countries has been demonstrated in many studies [19, 21-23], but there were programs with limited success in improving healthy eating behaviours and physical activity among students [24]. Some authors indicate that in the prevention of obesity among children, we need to develop a new concept of a community-based incentive [25]. In the last decade, several obesity prevention programs were also implemented in Poland, some of which were dedicated to the youngest age group [26]. A number of authors point out that due to these programs, there is a relative stabilisation in weight-gain trends among children in Poland [8].

In recent years, no research on such a scale has been conducted in Poland, and what is more all data presented in our study were obtained from measurements. The previously published research, despite its national character, was based on students' self-reported data on height and weight. The authors of these studies pointed out that self-reported data generally lead to an underestimation of BMI, especially among girls and among overweight and obese adolescents. Because BMI does not measure body fat tissue directly, its use as a diagnostic tool is limited, but it might be considered as an appropriate screening tool.

CONCLUSIONS

In conclusion, the prevalence of overweight and obesity among adolescents in Poland is on an average level for Europe but is still relatively high compared to other countries. The prevalence of obesity among children in Poland is not a problem only of the last decade, although the highest rate in the growth of this

condition among adolescents was recorded in that time. To counteract this phenomenon in Poland, in 2007 a National Program was introduced for the prevention of overweight, obesity, and chronic non-infectious diseases through improved nutrition and physical activity for 2007-2011 [27] based on the WHO strategy [28]. Obesity prevention programs implemented in Poland focus on different age groups, including adolescents. Such activities incorporate education on healthy lifestyle, as well as improvement of physical activity. However, the effects of these activities are not always evaluated. Anthropometric measurements are important elements of the efficacy evaluation. In order to be reliable and comparable to data from other countries, anthropometric measurements should be made using international standards, and the results should refer to them.

In order to create effective preventive programs to limit the increase in childhood obesity, special emphasis should be placed on screening for abnormal weight and unhealthy lifestyle, including eating habits. Such activities should be carried out in children from the youngest age groups. All children diagnosed and classified as at risk should be covered by special medical assistance and individual dietary counselling. If necessary, the intervention should also include the help of a physiotherapist or psychologist. The child's parents should also participate in the implementation of such activities.

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DISCLOSURE

The authors report no conflict of interest. The founding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; and in the decision to publish the results.

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AUTHORS' CONTRIBUTIONS

AH and JMR wrote the article. AH, JMR, DG, LW prepared the research concept and design, collected data and finally approved it. AH and DG revised the article.