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ORIGINAL PAPER

Assessment of the nutritional status of children in the Lodzkie Voivodeship – "Growing Healthy" Project, pilot study

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ABSTRACT

Introduction: Over the past few years, there have been noticeable negative changes in lifestyle, further worsened by the SARS-CoV-2 pandemic. These changes, along with reduced physical activity, limited peer interaction, and stress have all contributed to a positive energy balance in a significant group of children. The "Growing Healthy" project, conducted in collaboration with the Health Department of the Lodzkie Voivodeship Office, was aimed to assess the nutritional status of children in the Lodzkie Voivodeship.
Material and methods: The project included five primary schools selected from the Lodzkie Voivodeship and located in Belchatow, Koluszki, Lodz, Sieradz, and Skierniewice. A total of 2,904 students attending grades 1–8 were registered. Parents of 1,378 children gave informed consent to participation in the study on behalf of their children. The study subjects were measured for height, weight, hip circumference, and waist circumference in accordance with the approved methods. Based on the collected data, the body mass index (BMI), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR) were calculated. All the measurements were plotted on the OLAF and OLA percentile charts. The project was carried out by the staff of the Department of Pediatrics, Neonatal Pathology and Metabolic Bone Diseases, Medical University of Lodz between September and December 2022.
Results: A total of 1,378 subjects aged 6–14 years were examined, which accounted for 47% of all the children attending the schools included in the study. The mean age was 9.3 ±1.78 years. The mean BMI percentile for the whole study population was 52.46 ±30.45. Children with underweight constituted 4.1% (n = 56), those with overweight 13.8% (n = 187), and those with obesity 8.2% (n = 111). Abdominal obesity, assessed based on WHtR, was diagnosed in 11.7% (n = 162) of the children. Android abdominal obesity, identified based on WHR, was found in 5% (n = 331) of the girls and only 1.5% (n = 11) of the boys.
Conclusions: The assessment of excess body weight should be based on several complementary methods of anthropometric measurement as such an approach facilitates the diagnosis. The "Growing Healthy" project keeps evolving and is still being continued in other forms. The study results indicate that obesity and overweight in children in the Lodzkie Voivodeship are a major public health problem/issue, therefore actions in health policy should be taken at the administrative level.

KEY WORDS:
obesity, children, BMI, nutritional.

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INTRODUCTION

Obesity is a lifestyle disease that represents a serious global health issue in the pediatric population. It is a multifactorial, complex, treatable, and chronic condition with periods of exacerbation and remission. Epidemiologically, it involves genetic, physiological, psychosocial, socioeconomic, and environmental factors. Obese children often become obese adolescents and adults. The complications of excess weight in children are similar to those in adults, including hypertension, insulin resistance, dyslipidemia, diabetes, osteoarthritis, cardiovascular diseases, asthma, sleep apnea, cancer, fatty liver, disorders of sexual development (e.g., hyperandrogenism, hirsutism, polycystic ovary syndrome), decreased physical activity, as well as emotional disorders, such as depression and low self-esteem. Furthermore, obesity also contributes to exacerbation of already existing childhood diseases [1]. As a result, obesity leads to a lower quality of life and disability. It also significantly increases the risk of early mortality in adulthood [1].

One of the many challenges related to obesity in children and adolescents is the choice of the most reliable diagnostic method. Among the most commonly used indicators, we can distinguish the body mass index (BMI), the waist-to-hip ratio (WHR), and the waist-to-height ratio (WHtR). According to the latest guidelines on the assessment and treatment of children and adolescents with obesity, the BMI, despite its limitations, is considered the most appropriate clinical tool for detecting excessive fat tissue and establishing the final clinical diagnosis [2].

However, it should be remembered that BMI does not directly measure body composition or fat content and thus may either underestimate or overestimate excess fat tissue. Individuals with high muscle mass (lean tissue) can have a high BMI and, as a result, may be misclassified as overweight or obese [3]. According to Bray, apart from BMI, assessment of an individual patient, should also involve further information, regarding in particular the distribution and amount of fat tissue, which requires additional measurements [2, 4]. On the other hand, Bray emphasizes that currently there is no better tool for tracking population-level changes than BMI. Hampl *et al*. share a similar opinion, however, they also stress that BMI is generally well correlated with direct measurements of fat tissue, including dual-energy X-ray absorptiometry, skinfold thickness measurements, and bioelectrical impedance [4].

The measurement of BMI is one of the universal, quick, screening tests which assesses body mass and height. It also allows to monitor changes at subsequent medical appointments or based on measurements taken by the patients themselves at home.

Another type of measurement is the WHR. It is used to determine the distribution of body fat, i.e., to assess the type of abdominal obesity. Two types of obesity are distinguished, namely gynoid (hip-thigh, "pear" shape) and android/central (abdominal, "apple" shape) obesity. It is worth noting that WHR varies depending on age, gender, and ethnic group [3].

Additionally, as a criterion for abdominal obesity, the WHtR is used for both genders. It is the ratio of waist circumference (cm) to height (cm). The threshold value for WHtR is 0.5, which means that abdominal obesity occurs when the waist circumference exceeds half of the height. In children, WHtR > 0.55 increases the risk of cardiometabolic diseases and cardiovascular diseases when WHtR ≥ 0.50 [5, 6]. The aim of the study was to assess the nutritional status of children in the Lodzkie Voivodeship based on measurement of BMI, WHtR and WHR.

MATERIAL AND METHODS

ANTHROPOMETRIC MEASUREMENTS

Hip circumference, waist circumference, body mass and height were measured. Based on the results, BMI, WHR, and WHtR were calculated according to the accepted standards [7].

Hip circumference

Hip circumference was measured with the use of the Seca 201 anthropometric tape. The subject was in the standing position, wearing underwear, with their legs together and weight evenly distributed on both feet. The measurement was taken at the point of the greatest circumference of the hips. The result was given in centimeters.

Waist circumference

Waist circumference was measured with the use of the Seca 201 anthropometric tape. The subject was in the standing position, wearing underwear, with their legs together and weight evenly distributed on both feet. The measurement was taken parallel to the floor, halfway between the lower edge of the last rib and the highest point of the iliac crest. The result was given in centimeters.

Body mass

The measurement was taken with the use of the ADE M318800 column scale. The children were placed on the scale in their underwear and without shoes. The result was recorded in kilograms, with an accuracy of 100 grams.

Height

Height was measured with the use of the Seca 213 stadiometer. Each subject was standing barefoot in an upright position, with their back to the height meter, heels together, feet slightly apart, and arms hanging loosely by their sides. The buttocks, heels, scapulae, and the occiput touched the device's surface. The head was positioned in the Frankfurt plane (the upper edge of the external auditory meatus and the lower edge of the orbit were at the same level – the auditory canal was in line with the cheekbone). Height was measured without shoes or head cover. The result was given in centimeters.

Body mass index

Body mass index was calculated by dividing the subject's weight in kilograms by the square of their height.

The obtained BMI value was then plotted on gender-specific BMI percentile charts for age (to the nearest month). The percentile value was read from the OLA and OLAF percentile grids. Based on the BMI result, the following classification was applied:

- underweight: < 5^{th} percentile,
- normal weight: above 25^{th} and below 85^{th} percentiles,
- overweight: above 85^{th} and below 95^{th} percentiles,
- obesity: ≥ 95^{th} percentile [7].

Waist-to-hip ratio

Based on the anthropometric measurements, waist circumference (cm) and hip circumference (cm), the adopted criteria for abdominal obesity were WHR > 0.8 for females and WHR > 1 for males.

Waist-to-height ratio

This index was calculated by dividing waist circumference (cm) by height (cm). The threshold value for WHtR, independent of gender, is 0.5.

DATA ANALYSIS

During the "Growing Healthy" project, there was no information provided on the age of 22 children, who were excluded from the analysis of percentiles. All the results were first analyzed collectively and then individually for each school included in the project. The measurements were performed by four medical teams, each consisting of at least three doctors, using the same equipment and according to the same procedures. We excluded children with chronic disease who were treated with glucocorticosteroids, for example: asthma, cancer.

STATISTICAL ANALYSIS

The distribution of continuous variables was analyzed using histograms and the Shapiro-Wilk test. Continuous variables were described using the mean and standard deviation. Differences between mean values of continuous variables were tested using the Student's *t*-test and ANOVA with the Sidak *post hoc* test. Pearson's correlation coefficient was used to assess the degree of linear dependence. Linear regression models were built to identify the relationship between age and values of WHR, WHtR, and BMI percentiles. The analysis was conducted using IBM SPSS Statistics ver. 28.0 software (IBM Co., Armonk, NY, USA). A *p*-value of < 0.05 was considered statistically significant.

RESULTS

The mean age of the children included in the study was 9.3 ±1.78 years. A majority of the study participants (52.2%) were boys. Table 1 presents the characteristics of the patients by gender. Table 2 shows the results for each specific location where the study was performed, while Table 3 provides data on the demographics of these

TABLE 1. Characteristics of the studied children by gender

Parameters	Sex (N = 1378)		Statistical significance (p > 0.05)
	Boys, n = 719 (52.2%)	Girls, n = 659 (47.8%)	
Age (years) (min 9.3 ±1.78)	9.3 ±1.76	9.3 ±1.80	$p > 0.05$
Waist circumference > 95^{th} percentile, N = 110 (8.0%)	61 (8.6)	49 (7.6)	$p > 0.05$
Hip circumference > 95^{th} percentile, N = 146 (10.6%)	84 (11.8)	62 (9.6)	$p > 0.05$
BMI [percentile] (min 52.5 ±30.45)	53.2 ±30.36	51.6 ±30.53	$p > 0.05$
Underweight, N = 31 (2.3%)	14 (1.9)	17 (2.6)	$p > 0.05$
Overweight, N = 187 (13.6%)	104 (14.5)	83 (12.6)	$p > 0.05$
Obesity, N = 111 (8.1%)	59 (8.2)	52 (7.9)	$p > 0.05$
WHR (min 0.82 ±0.06)	0.84 ±0.06	0.81 ±0.06	$p < 0.001$
WHtR (min 0.44 ±0.05)	0.45 ±0.05	0.43 ±0.05	$p < 0.001$

BMI – body mass index, WHR – waist-to-hip ratio, WHtR – waist-to-height ratio

TABLE 2. Characteristics of the studied children by the school they attended ($N = 1378$)

Parameters	Skierniewice (1)	Lodz– private school (2)	Koluszki (3)	Sieradz (4)	Belchatow (5)	Lodz – state school (6)	Statistical significance
Age (years) (min 9.3 ±1.78), n (%)	77 (5.6) 9.9 ±2.16	128 (9.3) 9.9 ±1.91	155 (11.2) 9.9 ±1.85	292 (21.2) 8.7 ±1.5	368 (26.7) 9.5 ±1.76	358 (26.0) 9.2 ±1.68	$p < 0.001$ $p < 0.001$
Waist circumference > 95th percentile, $N = 110$ (80%)	8 (10.4)	7 (6.5)	21 (13.5)	25 (8.6)	31 (8.4)	18 (5.0)	$p < 0.05$
Hip circumference > 95th percentile, $N = 146$ (10.6%)	10 (13)	8 (7.4)	23 (14.8)	28 (9.6)	53 (14.4)	24 (6.7)	$p < 0.01$
BMI [percentile] (min 52.5 ±30.45)	58.2 ±29.86	47.8 ±30.41	54.1 ±29.51	49.7 ±31.00	57.11 ±30.48	47.3 ±29.30	pANOVA < 0.001 3 vs. 4 $p < 0.05$ 3 vs. 6 $p = 0.001$ 4 vs. 5 $p < 0.05$ 5 vs. 6 $p < 0.001$
Underweight, $n = 31$ (2.3%)	1 (1.3)	3 (2.3)	2 (1.3)	10 (3.4)	4 (1.1)	11 (3.1)	$p > 0.05$
Overweight, $n = 187$ (13.6%)	10 (13.0)	10 (7.8)	24 (15.5)	40 (13.7)	66 (17.9)	37 (10.3)	$p < 0.05$
Obesity, $n = 111$ (8.1%)	9 (11.7)	7 (5.5)	19 (12.3)	22 (7.5)	37 (10.1)	17 (4.7)	$p < 0.05$
WHR (min 0.82 ±0.06)	0.84 ±0.06	0.84 ±0.07	0.81 ±0.06	0.82 ±0.05	0.82 ±0.05	0.83 ± 0.07	pANOVA < 0.001 1 vs. 3 $p < 0.05$ 2 vs. 3 $p < 0.05$ 3 vs. 6 $p < 0.05$
WHtR (min 0.44 ±0.05)	0.45 ±0.05	0.44 ±0.05	0.45 ±0.06	0.43 ±0.05	0.44 ±0.05	0.43 ±0.05	pANOVA < 0.001 3 vs. 4 $p < 0.05$ 3 vs. 6 $p < 0.01$ 5 vs. 6 $p < 0.05$

BMI – body mass index, WHR – waist-to-hip ratio, WHtR – waist-to-height ratio

TABLE 3. Demographics

City/town	Population	Number of children aged 7–15 years	Number of children studied	Percentage of children studied (%)
Belchatow	53 964	5201	368	7
Koluszki	22 485	2215	155	7
Lodz	664 860	50 031	486	1
Sieradz	39 351	3344	292	9
Skierniewice	45 268	4428	77	2

TABLE 4. Linear interrelationships/relationships between the variables of body mass index percentile, waist-to-hip ratio, waist-to-height ratio and age

Parameters	BMI [percentile]	WHR	WHtR	Age
BMI [percentile]	–	0.143	0.705	0.107
WHR	0.143	–	0.552	– 0.264
WHtR	0.705	0.552	–	– 0.099
Age	0.107	– 0.264	– 0.099	–

BMI – body mass index, WHR – waist-to-hip ratio, WHtR – waist-to-height ratio
The table presents Pearson's correlation (r) index values. All the above results are statistically significant (p < 0.001).
Correlations between the BMI centile and WHR and WHtR were r = 0.143, r = 0.705, respectively (p < 0.001).

TABLE 5. Analysis of linear regression models. Independent variable: age

Parameters	B	95% CI for B	Standard error
BMI [percentile]	1.834	0.926–2.741	0.463
WHR	–0.009	–0.011 to 0.007	0.001
WHtR	–0.003	–0.004 to –0.001	0.001

BMI – body mass index, WHR – waist-to-hip ratio, WHtR – waist-to-height ratio

locations (data sourced from the Central Statistical Office – results from the 2021 National Census of Population and Housing, available at https://stat.gov.pl).

BODY MASS INDEX

The mean BMI percentile in the whole study population was 52.46 ±30.45 (Table 1). Children with underweight accounted for 2.3% (n = 31) of the study population, 13.8% (n = 187) were overweight, and 8.2% (n = 111) obese. In total, 24.3% (n = 329) of the children had abnormal body weight, and 22% (n = 298) had excessive body weight. No statistically significant difference was found in the number of children with abnormal body weight depending on gender. Body mass index percentile positively correlated with the age of the children, $r = 0.107$ ($p < 0.001$). With each subsequent year of life, the BMI percentile in the children increased by an average of 1.834 (95% CI: 0.926–2.741) (Tables 4, 5). The highest percentage of underweight children was recorded in the school in Sieradz, and the lowest in Belchatow (3.4% vs. 1.1%). The differences in the percentage of underweight children between schools were not statistically significant ($p > 0.05$). The highest percentage of overweight children was found in Belchatow, and the lowest in the private school in Lodz (17.9% vs. 7.8%). The highest percentage of obese children was recorded in Koluszki, and the lowest in the state school in Lodz (12.3% vs. 4.7%). These results were statistically significant ($p < 0.05$) (Table 2).

HIP AND WAIST CIRCUMFERENCE

The mean waist circumference was 61.81 ±8.95 cm, with the results of 60.41 ±8.36 cm in the group of girls and 63.09 ±9.27 cm among the boys. The mean hip circumference was 75.07 ±10.46 cm, with 74.73 ±10.58 cm in the group of girls and 75.39 ±10.35 cm in the group of boys (Table 2).

Values above the 95^{th} percentile for waist and hip circumference were observed in 8.0% and 10.6% of children, respectively. No statistically significant differences were found in the percentage rates of children reaching the above-mentioned percentile values depending on gender. The highest percentage of children with both waist and hip circumference above the 95^{th} percentile was recorded in Koluszki, while the lowest was found in the state school in Lodz (13.5% vs. 5% for waist circumference and 14.8% vs. 6.7% for hip circumference). These differences were statistically significant ($p < 0.05$ and $p < 0.01$, respectively).

WAIST-TO-HIP RATIO

The mean WHR in the whole study population was 0.82 ±0.06. The values found in the group of boys were approximately 0.03 higher than in the group of girls (0.84 ±0.06 vs. 0.81 ±0.06) (Table 3). The difference was statistically significant ($p < 0.001$).

The highest mean WHR value was recorded in the school in Skierniewice, whereas the lowest in the school in Koluszki (0.84 ±0.06 vs. 0.81 ±0.06). The difference was statistically significant ($p < 0.001$). The waist-to-hip ratio value negatively correlated with the children's age, $r = –0.264$ ($p < 0.001$).

The waist-to-hip ratio value in the children included in the analysis decreased by an average of 0.009 (95% CI: –0.11 to –0.007) with each subsequent year of life (Tables 4, 5). The difference between the highest and lowest mean WHR values in the analyzed schools was 0.03 ($p < 0.05$).

WAIST-TO-HEIGHT RATIO

The mean WHtR value in the whole study population was 0.44 ±0.05. The values found in the group of boys were approximately 0.02 higher than in the group of girls (0.45 ±0.05 vs. 0.43 ±0.05), and the difference was statistically significant ($p < 0.001$). In 162 children (11.7%), WHtR > 0.5 was observed.

The highest mean WHtR value was recorded in the school in Skierniewice, while the lowest was found in the state school in Lodz (0.45 ±0.05 vs. 0.43 ±0.05). The difference was statistically significant ($p < 0.001$).

The waist-to-height ratio value showed a weak negative correlation with the children's age, $r = –0.099$ ($p < 0.001$). The waist-to-height ratio value in the children included in the analysis decreased by an average of 0.003 (95% CI: –0.04 to –0.001) with each subsequent year of life (Tables 4, 5). The difference between the highest and lowest mean WHtR values in the schools attended by the children was 0.02 ($p < 0.01$).

DISCUSSION

The conducted study estimated the prevalence of overweight and obesity in the population of children residing in the Lodzkie Voivodeship. It may serve as a starting point for implementing changes in health policy at the administrative level. According to the Polish Society for the Treatment of Obesity, in Poland overweight or obesity occurs in 12.2% of preschool boys and 10% of preschool girls, and in 18.5% of school-age boys and 14.3% of school-age girls. This study provides new information on the epidemiology of overweight and obesity among school-age children in the Lodzkie Voivodeship. According to the BMI classification, one in five children (13.8%; $n = 187$) had/was overweight, and 8.2% ($n = 111$) were obese. Similar results were obtained by Kobylińska *et al*. in a study conducted in late 2019/early 2020 among 181 children (96 girls and 85 boys) aged 6–15 years, attending primary schools in the Mazowieckie Voivodeship, where the prevalence of overweight and obesity was found to be 21.5% ($n = 39$) [8]. The findings obtained by Chabowska *et al*. are also alarming. A cross-sectional study of 195 children aged 11–18 years (mean age 14.04 ±1.67 years) in Kudowa Zdrój showed the prevalence of obesity at 23.08%, with the 97th percentile BMI as the cutoff point (BMI standard deviation score = 2) [3]. In 2020, a study of 690 students aged 15–17 years (366 girls and 324 boys) in the Mazowieckie Voivodeship revealed that 23.6% of secondary school students had an abnormal body mass, with 11.3% and 12.3% suffering from obesity and overweight, respectively [9].

Interestingly, in previous studies of 2015–2016 in the Swietokrzyskie Voivodeship (Maslow and Gorno municipalities), 486 children aged 7–10 years were examined. In the study group, 14.81% were overweight and 1.02% obese [10]. Grajda *et al*. (2007–2009) found that 16.4% of Polish students ($n = 17,573$, age 7–18, 52.2% girls) had overweight or obesity/were overweight or obese (18.7% of boys and 14.3% of girls) [11]. These examples from the cited studies confirm that the number of children with obesity and overweight in the pediatric population in Poland has been increasing over the years. Similar conclusions were drawn by Kryst *et al*., who studied 17,407 individuals (8,650 girls and 8,757 boys) aged 3–18 years in Cracow. In 1983, 2000, 2010 and 2020, they conducted four cross-sectional studies. The obtained results showed an increase in body weight and BMI between 2000 and 2010, which was probably related to the significant socio-economic progress in Poland [12]. Similarly, in the United States, the percentage of children and adolescents with obesity increased more than threefold, from 5% in 1963–1965 to 19% in 2017–2018 [4].

On the other hand, compared to our findings, studies conducted in other countries have shown higher obesity rates. For example, in the United Arab Emirates, the obesity rate was 39% among children aged 13–19 years ($n = 932$), in Cameroon, it was 38.4% (Sub-Saharan Africa, 771 children in private schools, mean age 16), and in Colombia, 18% of children aged 3–10 years were obese ($n = 321$) [6, 13–15].

We identified a higher percentage of boys with excessive body weight. This observation has also been highlighted in studies by other authors [10, 11, 16]. However, similarly to Kobylińska *et al*., in our study we did not find a statistically significant difference between boys and girls BMI [8].

Our research shows that, based on the linear regression model, with each passing year of life, the BMI percentile will increase. Identical conclusions were drawn by Majcher *et al*. in a large study involving 3,320 children aged 5–18 years, covering years 2002–2020. The results showed that obesity was observed as early as at the age of 2 years, with the prevalence increasing in subsequent years of life (at the age of 4 and 6 years) [17]. Obesity affects children of all ages. Of great concern is the fact that the onset of the disease occurs at an earlier and earlier age, as confirmed by reports from many authors around the world [14–17]. It is worth mentioning that in the age group below 2 years, it is difficult to practically define and measure excess body fat [4]. Nevertheless, preventing obesity in children, raising awareness about the risks of excessive body weight among caregivers, disseminating knowledge on healthy lifestyle, including proper nutrition, changing unhealthy eating habits, and increasing physical activity, are all crucial for current and future health of children.

In our study, BMI strongly correlated with WHtR, which justifies its application in the assessment of overweight and obesity in daily practice. This was also highlighted in studies by Kobylińska *et al*. and Wieniawski *et al*. [8, 9]. We found that boys had approximately 0.02 higher values of the WHtR index compared to girls, with this difference being statistically significant ($p < 0.001$). Regardless of sexual maturity, there is evidence suggesting that boys may exhibit higher levels of body fat around the waist [8]. Additionally, Santos *et al*. emphasize that puberty affects increased body fat content, leading to centralization of fat and an android body shape [18]. Furthermore, Kobylińska *et al*. point out that before reaching the age of 12, boys and girls have similar body compositions, however, at a later stage, differences in body composition occur, especially in the case of fat distribution. This finding highlights the need for a deeper assessment of body mass, particularly in adolescents, and use of other methods in the assessment of body composition such as bioelectrical impedance analysis [8]. In a recent study, sexual dimorphism in fat distribution and obesity can be detected as early as in the 7th year of life [19].

An interesting observation in our study is that with each passing year of life, BMI increases, while WHR and WHtR decrease. This phenomenon may result from the fact that when children grow, these values change accordingly. Our results showed statistically significant correlations between BMI percentiles and WHR and WHtR ($p < 0.001$). Other researchers have confirmed this correlation as well [20]. However, in the study by Chabowska *et al*., it was shown that WHR was not a good indicator of obesity in children and did not correlate with BMI [3].

In our work, we presented varying rates of obesity in children depending on the diagnostic indicators used, i.e., BMI (obesity 8.2%), WHR (6.5%), and WHtR (11.7%). The results of our study suggest that the choice of method for assessing obesity in children can determine the diagnosis. Similar observations were presented by Chabowska *et al*. The results of this study were also based on fat tissue assessment [3].

The study was conducted in the post-COVID-19 pandemic period, which may have an impact on the obtained results since the pandemic is considered a risk factor for higher obesity. The COVID-19 pandemic forced home isolation, sedentary lifestyle, online activities, and lack of physical education classes, which led to a positive energy balance. When analyzing the relationship between eating habits and changes in body weight during the pandemic, Kołota and Głąbska. concluded that factors contributing to development of obesity were unhealthy diet and decreased physical activity. This relation was observed to occur especially among adolescent girls [13]. Also, in a recent study, Rękas and Burzyńska highlighted the connection between smartphone addiction among Polish adolescents and overweight and obesity [21].

The authors are aware that this study has some limitations. One of them is the fact that it was impossible to perform bioelectrical impedance analysis in the children, mainly due to the costs of transporting the equipment. Additionally, the study included only children whose parents gave consent, whereas the original plan was to assess a significantly larger number of individuals. Consequently, there was no age group division due to the varying number of participants. However, we should not exclude higher body weight among children who did not want to undergo the examination (lack of parental consent) possibly due to abnormal body mass, peer acceptance issues, or embarrassment of being examined by a doctor. Therefore, the authors of this study assume that the actual prevalence of obesity may be higher in the pediatric population. Moreover, the study was conducted at different times of the day, before or after the children had lunch.

One of the strengths of our study is that the assessment included a relatively large group of school-age children from the Lodzkie Voivodeship. It allowed us to highlight the growing problem of obesity in the developmental-age population. Perhaps the current Health Policy Program on Overweight and Obesity Prevention in Children from the Lodzkie Voivodeship – 2025–2027 may serve as a follow-up element of this study.

Collaboration between healthcare and administrative bodies can contribute to building awareness about proper health behaviors, which will reduce the number of chronic diseases, improve quality of life, and extend the lifespan of the Lodzkie Voivodeship residents.

CONCLUSIONS

One in five school children had an abnormal body mass, and one in four had overweight or obesity, as assessed in the "Grow Healthy" project in the Lodzkie Voivodeship. The choice of body measurement method, i.e., BMI, WHR or WHtR, can influence the diagnosis of obesity or overweight in children. Promoting physical activity, which is the foundation of the nutrition pyramid in the pediatric population, along with nutrition education, are the key goals to be continued in the "Grow Healthy" project.

DISCLOSURES

1. Institutional review board statement: The written informed consent to publish the cases was obtained from the mother of the affected patients.
2. Assistance with the article:
3. Financial support and sponsorship: None.
4. Conflicts of interest: None.

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