

Knowledge of primary and secondary school students regarding obesity – a new challenge or a trivial issue?

Wiedza uczniów szkół podstawowych i ponadpodstawowych w zakresie otyłości – nowe wyzwanie czy błahy problem?

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Abstract

Introduction and objective: Obesity, once considered a symbol of high social status, has now become one of the main factors contributing to the development of many diseases that adversely affect both the length and quality of life. The aim of this study was to assess the actual level of knowledge about obesity among primary and secondary school students. **Materials and methods:** A total of 911 students participated in the study, which was conducted using a proprietary questionnaire. The study was approved by the Bioethics Committee of the Medical University of Silesia. Both participants and their legal guardians gave their informed consent to participate. **Results:** The most frequently indicated cause of obesity was improper nutrition (879; 96.49%). The Chi² test showed a statistically significant difference between the number of answers given by boys and girls concerning the influence of hereditary factors on the development of obesity. Over 55% (514; 56.42%) of the respondents assessed their knowledge about obesity as good, but almost 15% (130; 14.27%) claimed that obesity is not a disease. The Wilcoxon test for pairs of observations showed a statistically significant difference between the self-assessed knowledge of the subjects and the scores obtained on the basis of the correctness of the answers given ($Z = 21.549, p < 0.001$). **Conclusions:** The knowledge of the surveyed students was generally insufficient, and the results showed that students were overly confident regarding their knowledge. This highlights the need for systematic education on a healthy lifestyle from the earliest school years to help prevent obesity.

Keywords: obesity, knowledge, students

Streszczenie

Wprowadzenie i cel: Otyłość, niegdyś uważana za symbol wysokiego statusu społecznego, jest obecnie jednym z głównych czynników prowadzących do rozwoju wielu chorób, które niekorzystnie wpływają na długość i jakość życia. Celem badania była ocena rzeczywistej wiedzy uczniów na temat otyłości. **Materiały i metody:** W badaniu przeprowadzonym za pomocą autorskiej ankiety wzięło udział 911 uczniów. Na przeprowadzenie badania uzyskano zgodę Komisji Bioetycznej Śląskiego Uniwersytetu Medycznego. Zarówno uczestnicy, jak i ich opiekunowie prawni wyrazili świadomą zgodę na udział w badaniu. Wiedzę respondentów zbadano w trzech obszarach – domenie przyczyn otyłości, domenie skutków otyłości oraz domenie wiedzy ogólnej i wskaźnika masy ciała. **Wyniki:** Najczęściej wskazywaną przyczyną otyłości było niewłaściwe odżywianie (879; 96,49%). Test Chi² wykazał istotną statystycznie różnicę pomiędzy liczbą odpowiedzi udzielonych przez chłopców i dziewczęta w zakresie wiedzy na temat wpływu czynników dziedzicznych na rozwój otyłości. Ponad 55% (514; 56,42%) ankietowanych oceniło swoją wiedzę na temat otyłości jako dobrą, ale prawie 15% z nich (130; 14,27%) stwierdziło, że otyłość nie jest chorobą. Test Wilcoxona dla par obserwacji wykazał istotną statystycznie różnicę pomiędzy samooceną badanych a wynikami uzyskanymi na podstawie poprawności udzielonych odpowiedzi ($Z = 21,549, p < 0,001$). **Wnioski:** Wiedza ankietowanych uczniów była w większości niewystarczająca, a wyniki wykazały, że byli oni zbyt pewni swoich wiadomości. Istnieje potrzeba prowadzenia systematycznej edukacji w zakresie zdrowego stylu życia już od najmłodszych lat szkolnych, a w konsekwencji zapobiegania otyłości.

Słowa kluczowe: otyłość, wiedza, uczniowie

BACKGROUND

The history of obesity dates back to prehistoric times, and descriptions of patients with this condition appearing across various cultures and epochs should be considered in both medical and cultural terms. The reason is that there have been different interpretations of the discussed phenomenon over the centuries⁽¹⁾. From the Stone Age, through antiquity, up to the eighteenth century, an above-average body size was considered an indicator of strength, fertility, wealth, and a higher social status reserved only for privileged social groups⁽²⁾. The first to realise the dangers of obesity were the ancient Greeks, and the earliest mention of its harmful effects on human health is attributed to Hippocrates, who in his book of aphorisms (Aphorisms II, 44) wrote: “sudden death is more common among those who are by nature more fat than thin”. He further noted that “obesity is not only a disease in itself but also a harbinger of many other diseases...”⁽³⁾.

Currently, obesity is defined by the World Health Organization as an abnormal or excessive accumulation of adipose tissue that poses a health risk⁽⁴⁾. Its effects include, among others: cardiovascular diseases, type 2 diabetes, or complications resulting from injuries and their treatment^(5–7).

Despite ongoing public awareness campaigns about the harmful effects of excessive body weight on health and the widespread availability of verified medical information on this topic, obesity has become another global pandemic contributing to the deaths of approximately 4 million adult patients annually^(8–11). The aim of this study was to assess the knowledge of primary and secondary school students in the field of obesity, taking into account factors such as gender and body mass index (BMI). An attempt was also made to examine the significance of discrepancies between the self-assessed level of knowledge in this area among the respondents and the assessments based on the accuracy of their responses.

MATERIALS AND METHODS

Before the research began, a project entitled *Transcriptional activity of selected genes in civilization diseases, taking into account knowledge and lifestyle and pro-health behaviours of the surveyed patients*, part of which are the results presented in this article, was submitted for approval to the Bioethics Committee of the Medical University of Silesia in Katowice. After reviewing the project, the Bioethics Committee approved its implementation including all experimental protocols (PCN/0022/KB1/36/21). All experiments were performed in accordance with relevant guidelines and regulations. The inclusion criteria were as follows: written informed consent from parents, the student's individual and voluntary willingness to participate in the study, and the ability to understand and answer the questions. Data obtained from 911 primary and secondary school students were analysed. The majority of the study group were girls (499; 54.77%), and the respondents were aged 14 to 18 (16.14 ± 1.5) years. All methods used in this study complied

with applicable guidelines and regulations for conducting scientific research^(12,13). For the purposes of statistical analyses, the respondents were divided based on the calculated BMI into subjects with reduced (UR), normal (HWR), and increased (OR) body weight. The gender of the respondents was also taken into account in the statistical analyses. An original questionnaire, consisting of 12 single- and multiple-choice questions, was used for the study. From the pool of the above-mentioned questions, five concerned the general characteristics of the respondents, and one assessed their opinions on the level of their own knowledge about obesity. The remaining questions concerned general knowledge about the disease – 2, knowledge of its underlying causes – 1, and knowledge of its complications – 1. The final questions focused on knowledge of the BMI – 2. Initially, 1,235 questionnaires were prepared and distributed, of which 911 were correctly filled in and analysed. The questionnaires were distributed in a traditional paper form to randomly selected primary and secondary schools (after obtaining informed consent from the directors of these institutions) located in the Silesia Voivodship (Poland). Each respondent received a questionnaire with a description of the study and a parental informed consent form in a white, unmarked envelope. After completing the questionnaires, the participants sealed the envelopes with their questionnaires. Signed parental informed consents were collected simultaneously by the interviewers and placed away from the sealed envelopes in a specially prepared, lockable box that was opened and the envelopes were removed only when entering data into a spreadsheet. The procedures described above ensured the respondents could not be identified, thereby preserving their complete anonymity. The study was conducted from September 2021 to February 2022.

After entering the data into a spreadsheet, the analysis began. The knowledge of the respondents was tested in three domains: the causes of obesity (10 statements), the effects of obesity (14 statements), and general knowledge and BMI (6 statements). For each correct answer in each domain, 1 point was awarded. The obtained points were summed up, and the percentage of correct answers was calculated, with a maximum possible score of 30 points. The percentages received were converted to a four-point proprietary scale created for the purposes of this study (0–25% – unsatisfactory, 26–50% – satisfactory, 51–75% – good, >75% – very good) and compared using the Wilcoxon test with the respondents' self-assessment of their knowledge on the topic in question. The Wilcoxon test applied based on the result of the Shapiro–Wilk test, which indicated that the scores did not follow a normal distribution. In all analyses, the level of statistical significance was set at $p < 0.05$.

RESULTS

General characteristics of the participants

The general characteristics of the study group are presented in Tab. 1.

All participants (911; 100%)						
Variables				<i>n</i>	%	
Age [years]				14	182	19.98
				15	168	18.44
				16	138	15.15
				17	178	19.54
				18	245	26.89
Sex				Females	499	54.77
				Males	412	45.23
Place of residence				Town/city	847	92.97
				Village	64	7.03
School				Primary	186	20.42
				Secondary	725	79.58
Body mass index (BMI)				Underweight range (<18.5 kg/m ²)	158	17.34
				Healthy weight range (18.5–24.99 kg/m ²)	623	68.39
$\bar{x}$	<i>SD</i>	<i>Min.</i>	<i>Max.</i>	Overweight range (≥25.0 kg/m ²)	130	14.28
21.49	3.56	13.88	39.06			
BMI – interpretation of body mass index; $\bar{x}$ – mean; <i>SD</i> – standard deviation; <i>Min.</i> – minimum value; <i>Max.</i> – maximum value.						

Tab. 1. General characteristics of the surveyed group of primary and secondary school students

Taking into account the “Age” variable, the largest percentage of the study group were students aged 18 (245; 26.89%), and “Gender” – girls (499; 54.77%). Over 90% of the respondents lived in cities (847; 92.97%), and about 15% of the respondents had a BMI ≥25.0 kg/m².

Domain of causes of obesity development

The characteristics of the study group, considering the respondents’ knowledge of the causes of obesity, are presented in Tab. 2, while those taking into account gender and BMI are shown in Tab. S1 and S2 (Supplementary Material). In the study group, the most frequently indicated cause of obesity development was improper nutrition (879; 96.49%), while the least frequent was low birth weight (20; 2.20%). Taking into account the respondents’ sex and BMI, similar results were observed compared to those obtained in the entire study group. The Chi² test revealed a statistically significant difference between the number of answers given by boys and girls regarding the influence of hereditary factors/genetic load, drug use, and stress load on the development of obesity. In all three cases, girls more often than boys perceived these influences (hereditary factors/genetic predisposition – 89.38% vs. 21.84%, drug use – 78.36% vs. 51.94%, stress burden – 69.54% vs. 45.63%). With respect to BMI, a statistically significant difference was found between the responses regarding improper nutrition and cultural customs. Respondents with reduced body weight less often than those from other groups indicated that cultural customs affect the development of obesity (UR – 17.72%, HWR – 24.08%, OR – 33.85%), and respondents with increased body weight less often mentioned improper nutrition as

All participants (911; 100%)				
Reasons for the development of obesity	Contributes to the development of obesity		Has no effect on the development of obesity	
	<i>n</i>	%	<i>n</i>	%
Improper nutrition	879	96.49	32	3.51
Sedentary lifestyle/lack of physical activity	840	92.21	71	7.79
Hereditary factors/genetic predisposition	768	84.30	143	15.70
Excessive food/calorie loading	779	85.51	132	14.49
Medications used	605	66.41	306	33.59
Stress load	535	58.73	376	41.27
Alcohol abuse	417	45.77	494	54.23
Cultural customs	222	24.37	689	75.63
Smoking	140	15.37	771	84.63
Low birth weight	20	2.20	891	97.80

Tab. 2. Characteristics of the study group considering the respondents’ knowledge of the causes of obesity

All participants (911; 100%)				
Complications of obesity	It's a complication		It's not a complication	
	<i>n</i>	%	<i>n</i>	%
Type 2 diabetes	757	83.10	154	16.90
Diseases of the digestive system	713	78.27	198	21.73
Cardiovascular diseases	697	76.51	214	23.49
Joint diseases	636	69.81	275	30.19
Atherosclerosis	570	62.57	341	37.43
Depression	506	55.54	405	44.46
Lipid metabolism disorders	339	37.21	572	62.79
Menstrual disorders in women	307	33.70	604	66.30
Brain strokes	253	27.77	658	72.23
Neoplasms	250	27.44	661	72.56
Erectile dysfunction in men	206	22.61	705	77.39
Infertility	187	20.53	724	79.47
Insomnia	180	19.76	731	80.24
Severe headaches	121	13.28	790	86.72

Tab. 3. Characteristics of the study group considering the respondents’ knowledge of the effects of obesity

a factor in its development (OR – 120; 92.31%, HWR – 605; 97.11%, UR – 154; 97.47%).

Domain of obesity effects

Tab. 3 presents the characteristics of the study group, focusing on the respondents’ knowledge of the effects of obesity. Tab. S3 (Supplementary Material) presents the characteristics of the study group, taking into account the respondents’ knowledge of the effects of obesity and gender, and Tab. S4 (Supplementary Material) considering the respondents’ knowledge of the effects of obesity and BMI. The most frequently indicated complications of obesity were type 2 diabetes (757; 83.10%) and diseases of the

All participants (911; 100%)				
Questions	Correct answer		Incorrect answer	
	<i>n</i>	%	<i>n</i>	%
General knowledge				
Is obesity a disease?	781	85.73	130	14.27
Is being overweight the same as being obese?	861	94.51	50	5.49
Body mass index knowledge				
The subject is able to define the term "body mass index – BMI"	439	48.19	472	51.81
The subject correctly calculated his/her body mass index	650	71.35	261	28.65
Range of body mass index values for:				
Correct body mass range	422	46.32	489	53.68
Overweight range	40	44.79	103	55.21
Obesity range	373	40.94	538	59.06

Tab. 4. Characteristics of the study group considering the respondents' general knowledge of obesity and body mass index

digestive system (713; 78.27%). Identical results were obtained by analysing the respondents' answers taking into account their sex and BMI. Considering the respondents' sex, there were statistically significant differences in the number of responses given between girls and boys in terms of listing type 2 diabetes ($p = 0.04$), diseases of the digestive system ($p = 0.044$), cardiovascular diseases ($p = 0.017$), joint diseases ($p = 0.0002$), atherosclerosis ($p = 0.042$), depression ($p = 0.034$), lipid metabolism disorders ($p < 0.001$), menstrual disorders in women ($p = 0.0002$), brain strokes ($p < 0.001$), infertility ($p = 0.001$), insomnia ($p = 0.006$), and severe headaches ($p = 0.002$) as complications of obesity. However, taking into account the BMI, statistically significant differences were found in the number of answers given between respondents with normal and increased and reduced body weight in terms of mentioning cardiovascular diseases ($p = 0.003$), joint diseases ($p = 0.018$), menstrual cycle disorders in women ($p = 0.028$), stroke ($p = 0.015$), and infertility ($p = 0.016$) as complications of obesity.

Domain of general knowledge regarding obesity and BMI

Tab. 4 presents the characteristics of the study group, focusing on the respondents' general knowledge of obesity and BMI. Additional characteristics of the study group, taking into account the respondents' general knowledge of obesity, BMI, sex and BMI of the respondents, are presented in Tabs. S5 and S6 (Supplementary Material).

Almost 15% of the respondents (130; 14.27%) did not know recognised obesity as a disease, and more than 5% of the respondents believed that "being overweight" was the same as "being obese" in terms of medical categories. While less than 50% (439; 48.19%) of the respondents were able to define their BMI, more than 70% (650; 71.35%) of them correctly calculated it. About 55% (503; 55.21%) and almost

Variables	Median	Mode (mode value; % participant)	Min.	Max.
Earned points	15	18 (74; 8.12%)	2	29
% of maximum points	50	60 (74; 8.12%)	7	97
Obtained assessment	3	2 (447; 49.06%)	2	5
Knowledge self-assessment	4	4 (514; 56.42%)	2	5

Min. – minimum value; Max. – maximum value.

Tab. 5. Characteristics of the study group considering the correctness of the students' responses and their self-assessed knowledge in this regard

Rate	Number of ratings in each category based on the respondents' self-assessment	Number of ratings in each category based on the responses provided
Insufficient	28 (3.07%)	447 (49.07%)
Sufficient	291 (31.94%)	351 (38.53)
Good	514 (56.42%)	102 (11.20%)
Very good	78 (8.56%)	11 (1.20%)
<i>t</i> S–W	$p < 0.05$	$p < 0.05$
Wilcoxon's test: "Self-assessment of knowledge" – "Rating obtained": $Z = 21.549, p < 0.001^*$		
<i>Z</i> – Wilcoxon's test value; <i>t</i> S–W – Shapiro–Wilk test. * Statistically significant result at 95% confidence interval.		

Tab. 6. Characteristics of the surveyed group considering differences between the respondents' self-assessed knowledge and the ratings based on their responses

60% (538; 59.06%) of the respondents, respectively, had no knowledge of the BMI values indicating overweight and obesity. To the question "Is obesity a disease?", more correct answers were given by girls (90.58%) than boys (79.85%). This difference was statistically significant ($p < 0.001$). A statistically significant difference in the responses given was also found taking into account BMI. The highest percentage of correct answers came from the respondents with normal body weight (87.96%), and the lowest was observed among those with increased body weight (80.00%).

Assessment of respondents' knowledge

Tab. 5 presents the characteristics of the study group based on the correctness of the students' answers and their self-assessment in this area, and Tab. 6, the characteristics of the study group, taking into account the differences between the respondents' self-assessment and the scores they achieved.

The median score obtained by the respondents was 15. Over 55% (514; 56.42%) of the respondents rated their knowledge about obesity as "good". However, the number of respondents with an unsatisfactory grade based on their responses was slightly less than 50% (447; 49.07%). The Wilcoxon test for paired observations showed a statistically significant difference ($Z = 21.549, p < 0.001$) between

the respondents' self-assessed knowledge of obesity and the assessments based on the correctness of the answers they provided.

DISCUSSION

Despite the growing emphasis on obesity in recent years, the knowledge of children and adolescents about obesity is poor, as reflected in the literature. In the current study group, the least frequently cited cause of obesity was low birth weight (20; 2.20%). This was most likely due to the fact that knowledge about the predisposition of low-birth-weight infants to the development of obesity is treated rather as specialist knowledge⁽¹⁴⁾. Nevertheless, several respondents correctly identified the above answer as one of the factors contributing to the development of the condition. The most common cause of obesity, according to the respondents from the study group, was improper nutrition (879; 96.49%) and sedentary lifestyle/lack of physical activity (840; 92.21%).

Considering BMI, a statistically significant difference was found in the number of responses of between individual subgroups regarding improper nutrition and cultural customs as contributors to obesity. Respondents with lower body weight less often than those from other groups indicated that cultural customs affected the development of obesity (UR – 17.72%, HWR – 24.08%, OR – 33.85%), while respondents with increased body weight less often identified improper nutrition as a factor contributing to its development (OR – 120; 92.31%; HWR – 605; 97.11%; UR – 154; 97.47%).

In the study by Krajewska-Siuda et al., conducted in a group of 125 subjects including 63 with obesity, compared with 62 individuals with normal body weight, the most frequently cited causes of obesity among the respondents with obesity were incorrect eating behaviour in the form of consumption of large amounts of fatty foods (80.90%), low levels of physical activity (76.40%), and incorrect eating habits in the form of excessive consumption of sweets (66.7%). In the group of respondents with normal body weight, the order of the most frequently cited reasons for the development of obesity was the same (79.00%, 74.2%, and 74.2%, respectively)⁽¹⁵⁾. Ślusarska et al., in their study conducted in a group of 100 students, found that the majority of the subjects indicated two factors most strongly influencing the development of obesity: improper diet (94%) and lack of physical activity (93%)⁽¹⁶⁾. Research by Phelan et al. showed that, according to the surveyed students, the main factors contributing to the development of obesity included overeating (88%), low physical activity (87%), and insufficient knowledge of nutrition (75%)⁽¹⁷⁾.

In the group of respondents in the present study, the most frequently indicated complications of obesity were type 2 diabetes (757; 83.10%), diseases of the digestive system (713; 78.27%), diseases of the circulatory system (697; 76.51%), and diseases of the joints (636; 69.81%). Different

results were obtained by Ślusarska et al. in their study. The most common complications of obesity reported by the respondents in their study group were hypertension (96%), type 2 diabetes (81%), osteoarthritis (65%), and diseases of the digestive system (35%)⁽¹⁶⁾.

In the present study, in response to the question "Is obesity a disease?", more correct answers were given by girls (90.58%) compared to boys (79.85%). This difference was statistically significant ($p < 0.001$). A statistically significant difference in responses was also observed based on BMI ($p = 0.017$). The highest percentage of correct answers was obtained among the respondents with normal body weight (87.96%), and the smallest among those with increased body weight (80.00%). An interesting observation is that while less than 50% (439; 48.19%) of the respondents were able to define what BMI is, only about 30% (261; 28.65%) miscalculated its value, likely due to using available online calculators or other applications. Ślusarska et al. reported a level of knowledge about the definition of BMI in their study. In the cited studies, as many as 81% of respondents correctly defined BMI⁽¹⁶⁾. Skrzypek et al. showed a much higher percentage of correct answers regarding defining BMI (80%) than in our study, and a similar level of correctness of calculating its value for each respondent (75%) compared to our findings⁽¹⁸⁾.

More than 50% (489; 53.68%) of the respondents from our study group did not have correct knowledge of the BMI range to determine correct body weight, while the study by Ślusarska et al. showed that only 32% of participants reported the correct BMI range, which was a much lower result than our findings⁽¹⁶⁾.

Almost 65% (592; 64.98%) of the surveyed respondents assessed their knowledge of obesity as good or very good. However, different results were obtained when analysing the responses provided by the surveyed students. In fact, the percentage of respondents with good or very good responses oscillated around only 12% (113; 12.40%). The Wilcoxon test for paired observations showed a statistically significant difference between the self-assessment of the level of knowledge about obesity made by the respondents and the assessments based on the correctness of the responses they provided ($p < 0.001$). It can, therefore, be concluded that young people considerably overestimated their knowledge, while in fact, it was at a low level requiring urgent supplementation.

The presented results are particularly concerning given that the area from which the respondents come (Upper Silesia, Poland) is a highly urbanised and industrialised region, characterised by heavy pollution and a specific culture influencing the lifestyle of its inhabitants^(19,20). As a consequence, the discussed area has one of the highest mortality rates due to cardiovascular diseases in Poland, which is undoubtedly linked to the development of obesity and its complications⁽²¹⁾. Therefore, since in such a vulnerable area, the students' knowledge level is insufficient, contributing to the formation of unhealthy behaviours from an early age,

including issues related to increased body weight, it is worth considering what the situation may look like in other regions of both Poland and the world, where the number of additional factors negatively affecting health is much lower or higher. Further research in this area, both in Poland and in other countries, should assess the knowledge of children and adolescents on obesity in much larger groups, while also considering regional factors that threaten the health and the most popular ways of expanding knowledge about obesity, its causes, and complications.

CONCLUSIONS

The knowledge of the surveyed primary and secondary school students was incomplete, especially regarding the causes and effects of obesity. A statistically significant difference between the respondents' self-assessed knowledge and the actual assessments based on the correctness of their answers. This discrepancy highlights an excessive confidence of the respondents in relation to their knowledge. There is a need to prepare interesting educational programmes for students, starting from the earliest school years, focusing on the benefits of maintaining a healthy body weight and promoting a healthy lifestyle, thereby preventing the development of diseases and improving the quality of life.

Conflict of interest

The authors do not report any financial or personal connections with other persons or organisations which might negatively affect the content of this publication and/or claim authorship rights to this publication.

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Author contributions

Original concept of study; collection, recording and/or compilation of data; analysis and interpretation of data; writing of manuscript; critical review of manuscript; final approval of manuscript: JD, OS, ES.

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