



Environmental variations of nutritional mistakes among Polish school-age adolescents from urban and rural areas

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Abstract

Introduction and objective. Many studies have indicated numerous nutrition mistakes among school-aged children and adolescents in both urban and rural environments. The aim of this study was to assess the nutritional habits of the Polish population, consisting of 7,974 individuals aged 12–17, from rural and urban environments, as well as to identify environmental variations of these habits and to verify the existing information on the incorrect nutrition of school-age children and adolescents.

Materials and method. The research covered a group of 7,974 respondents – school-age adolescents with a similar age structure (12–17 years). The study on subjects from secondary school grades 1 – 3 was conducted in randomly selected schools from 2 random Polish provinces; 5 counties were randomly selected, followed by a choice of 2 communes: one rural and one urban. The research technique was a self-designed survey questionnaire. The obtained results were subjected to statistical analysis using the Pearson Chi 2 and V Cramer test.

Results. The research revealed environment-based differences in subjects' nutrition. Breakfast was consumed daily by a statistically significantly fewer subjects from the rural environment (36.31%) than from the urban areas (51.32%); second breakfast was consumed by an insignificantly smaller proportion of respondents from the urban environment (40.00%) than from the rural one (46.00%); dinner was eaten daily by 86.00% of urban subjects and 82.00% of rural respondents; afternoon tea and supper were eaten rarely by respondents from both environments. The diet of respondents was dominated by anti-health behaviours.

Conclusions. Most of the respondents displayed incorrect nutritional behaviours. Nutritional mistakes occurred among respondents from both rural and urban environments, with the predominance of the rural areas.

Key words

nutrition, children and adolescents, rural environment, health behaviours, urban environment

INTRODUCTION

Incorrect nutrition, low physical activity, overweight and obesity have tremendous consequences for the psycho-physical development of children and adolescents; they may also cause many diseases in adulthood (e.g. diabetes, cardiovascular diseases, malignant tumours, osteoporosis). These diseases are referred to as chronic, non-infectious diseases or 'nutrition-related diseases' [1, 2, 3, 4, 5, 6, 7, 8].

Many studies have indicated numerous nutrition mistakes among school-aged children and adolescents in both urban and rural areas [4, 9, 1, 11, 12, 13]. For many years, various social campaigns and educational activities have been undertaken (especially in the media) to encourage people to change their nutritional behaviours to healthier options

[4]. Proper nutrition should be an important element of health promotion [14, 15, 16, 17].

Studies [9, 14, 17, 18] prove that not only children, but also their parents, are unaware of the nutritional mistakes they make. The most common mistakes include: irregularity of meals; skipping breakfast before going to school, skipping second breakfast at school; and incorrect frequency of consumption of some food products. These and other dietary mistakes may have an adverse effect on the development and health of children and adolescents [1, 19, 20].

Above all, it should be noted that proper nutrition is one of the basic factors of physical development; nutritional behaviours shaped in childhood determine one's nutrition in adulthood, and are difficult to modify; incorrect nutrition may cause various disorders in childhood and youth (short stature, overweight, anaemia, and tooth decay), as well as increase the risk of many chronic diseases in adulthood [21, 22, 23, 24, 25, 26].

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OBJECTIVE

The aim of this study was to assess the nutritional habits of the Polish population, consisting of 7,974 individuals aged 12–17, from rural and urban environments, as well as to identify environmental variations of these habits, and to verify the existing information on incorrect nutrition of school-age children and adolescents.

MATERIALS AND METHOD

Studies on adolescents from the 1st, 2nd and 3rd high-school grades were conducted in randomly selected schools, in 2 randomly selected provinces in Poland, from which 5 counties were selected randomly; in each county, 2 communes were selected: one rural and one urban. In total, the study was carried out in 10 counties and in 20 communes (10 rural and 10 urban). The selection of counties, communes and schools was carried out by a stratified random sampling method, while the population was selected by means of targeted selection. The authors' self-designed survey questionnaire, tested in pilot studies, was used.

The analysis included 7,974 correctly completed self-designed survey questionnaires; information contained therein was compiled using digital machines and computer techniques. Ultimately, the study covered 6,417 subjects from the urban environment and 1,557 respondents from the rural environment, with similar age and gender structure with no statistically significant differences ($p > 0.05$). The obtained results, presented in the Tables, were subjected to statistical analysis using the Chi 2 Pearson test, V Cramer test.

RESULTS

The age structure of respondents from urban and rural areas was similar in particular age subgroups: in the 12–13 subgroup: urban – 30.69%, rural – 33.0%; in the 14–15 subgroup, urban – 66.8%, rural – 65.0%; and in the 16–17 subgroup: urban – 3.23%, rural – 2.9% (Tab. 1).

Table 1. The age structure of the subjects

Age (in years)	Urban		Rural		Total	
	n	%	n	%	n	%
12–13	1,969	30.69	516	33.00	2,485	30.13
14–15	4,240	66.08	1,002	65.00	5,242	66.29
16–17	207	3.23	39	2.90	246	3.58
Total	6,417	100.00	1,557	100.00	7,974	100.00
Pearson's chi-square test	p=0,256					

p – p-value

The size of the subgroups in terms of gender was similar. No statistically significant differences were observed ($p > 0.05$). In the girls' and boys' subgroups, there were no statistically significant differences regarding place of residence (urban vs. rural) ($p > 0.05$) (Tab. 2).

In terms of subject structure based on the place of residence, 51.17% came from the urban environment and 48.83% from rural areas (Tab. 3).

Table 2. Gender structure of the subjects

Gender	Urban	Rural	Total
Girls	51.77%	50.28%	50.70%
Boys	48.23%	49.72%	49.30%
Total	100.00%	100.00%	100,00%
Pearson's chi-square test	p=0,308		

p – p-value

Table 3. Structure of subjects by place of residence

Place of residence		Urban	Rural	Total
		%		
	n	6,417	1,557	7,974

Analysis of the results showed statistically significant differences in the frequency of breakfast consumption before leaving for school between respondents from the urban and rural environments – breakfast was consumed more often by adolescents from urban areas ($p < 0.001$) (Tab. 4).

Table 4. Frequency of eating breakfast before going to school

Eating breakfast before going to school	Urban		Rural		Total (%)
	n	%	n	%	
Daily	3,293.2	51.32	570.0	36.61	48.44
Several times a week	1,239.7	19.32	406.9	26.17	20.64
Randomly	979.2	15.26	363.4	23.34	16.83
Never	904.8	14.10	216.4	13.91	14.09
Total	6,417	100	1,557	100	100
Pearson's chi-square test	p<0,001				

p – p-value

Analysis of the results showed statistically significant differences in the frequency of second breakfast consumption between respondents from the urban and rural environments. Second breakfast was consumed more often by adolescents from urban areas ($p < 0.001$) (Tab. 5).

Table 5. Frequency of eating second breakfast by subjects

Frequency of eating second breakfast	Urban		Rural		Total (%)
	N	%	N	%	
Daily	2,629.0	40.97	724.16	46.51	42.05
Several times a week	1,533.0	23.89	316.8	20.35	23.19
Sometimes, randomly	1,120.0	18.24	295.4	18.97	17.75
Never	1,135.8	17.70	220.7	14.18	17.01
Total	6,417	100	1,557	100	100
Pearson's chi-square test	p<0,001				

p – p-value

Study results showed statistically significant differences in the frequency of eating dinner between adolescents from urban and rural environments. The respondents from urban areas showed greater divergence: urban adolescents ate dinner every day relatively more often, but also the majority 'never' ate dinner, compared to rural subjects ($p < 0.001$) (Tab. 6).

Analysis of the research results showed statistically significant differences in the places where dinner was eaten

Table 6. Frequency of eating dinner by subjects

Frequency of eating dinner	Urban		Rural		Total (%)
	N	%	n	%	
Daily	5,551.3	86.51	1,289	82.80	85.8
Several times a week	454.9	7.09	152.7	9.81	7.6
Sometimes, randomly	265.6	4.14	142	6.05	5.4
Never	145.0	2.26	20.9	1.34	2.08
Total	6,417	100	1,557	100	100
Pearson's chi-square test					p<0,001

p – p-value

between the respondents living in the urban and rural environments. Urban adolescents ate dinner in restaurants, at the family home and in other places more frequently, and less frequently at school and at home ($p<0.001$) (Tab. 7).

Table 7. Most frequent place of eating dinner by subjects

Place of eating dinner	Urban	Rural	Total
At school	9.82%	17.84%	14.42%
Always at home	55.94%	63.06%	61.13%
In bars	2.01%	1.56%	1.54%
In restaurants	3.99%	1.67%	2.35%
At family's	6.58%	3.04%	4.83%
At friends'	1.29%	1.18%	1.14%
It varies	20.09%	11.31%	14.28%
Nowhere	0.28%	0.34%	0.31%
Total	100%	100%	100%
Pearson's chi-square test			p<0,001

p – p-value

The conducted research identified significant differences in the frequency of afternoon tea consumption between the respondents from urban and rural environments. Adolescents from urban areas were less likely to have afternoon tea than respondents from rural areas ($p<0.001$) (Tab. 8).

Table 8. Frequency of eating afternoon tea by the subjects

Frequency of eating afternoon tea	Urban		Rural		Total (%)
	n	%	N	%	
Daily	1,556.8	25.82	482.7	31.00	26.83
Several times a week	1,666.5	25.97	447.9	28.77	26.51
Sometimes, randomly	1,975.7	30.79	395.8	25.42	29.74
Never	1,117.8	17.42	230.6	14.81	16.9
Total	6,417	100	1,557	100	100
Pearson's chi-square test					p<0,001

p – p-value

The results obtained on the consumption of the third crucial meal of the day – supper – showed that there were statistically significant differences in the frequency of eating supper between respondents from urban and rural environments (Tab. 9). Adolescents from urban areas ate supper relatively more often than subjects from the rural environment ($p<0.001$) (Tab. 9).

By analysing the number and frequency of meals consumed by the subjects, the following were found:

Table 9. Frequency of eating supper by subjects

Frequency of eating supper	Urban		Rural		Total (%)
	n	%	N	%	
Daily	4,485.5	69.90	1,074.6	69.02	69.72
Several times a week	904.8	14.1	177.0	11.37	13.56
Sometimes, randomly	768.8	11.98	195.7	12.57	12.09
Never	257.9	4.02	109.8	7.05	4.61
Total	6,417	100	1,557	100	7,974
Pearson's chi-square test					p<0,001

p – p-value

- statistically significant differences in the number and frequency of eating 5 meals between respondents from urban and rural areas – adolescents from urban environment consumed 5 meals a day relatively less often than their peers from rural areas ($p<0.001$);
- no statistically significant differences in the number and frequency of eating 4 meals a day between urban and rural respondents ($p=0.074$);
- no statistically significant differences in the number and frequency of eating 3 meals a day between urban and rural respondents ($p=0.236$);
- no statistically significant differences in the number and frequency of eating 2 meals a day between urban and rural respondents ($p=0.159$);
- statistically significant differences in the number and frequency of eating 1 meal between respondents from urban and rural areas – adolescents from the urban environment consumed 1 meal a day relatively less often than their peers from rural areas ($p<0.001$) (Tab. 10).

Favourite and consumed dishes/products of the subjects were: 'pierogi' dumplings and pancakes, sweets, yogurts, meat and crisps, whereas the least liked were: 'bigos' stew, liver, tripe, and vegetables such as onion and spinach. Analysis of the study results identified statistically significant differences between the consumption of favourite dishes/products during the day, and the place of residence of the respondents (urban vs rural environment). Urban adolescents are their favourite products/dishes, such as fast food, crisps, yoghurt, fish, meat, sweets, dumplings, pancakes, pizza, fruit and others, more often than their urban peers (Tab. 11).

Analysis of the study results identified statistically significant differences in the choice of snacks and the place of residence of the respondents (urban vs rural environment). Urban adolescents snacked more often than their rural counterparts ($p=0.001$); urban subjects chose yoghurt as a snack more often than their rural peers ($p=0.048$) (Tab. 12).

Table 13 lists the health symptoms related to nutrition. Symptoms such as hyperphagia and lack of control over eating were reported by 14.41% of urban respondents and 11.09% of their rural counterparts ($p=0.001$).

The respondents also pointed to other ailments related to eating disorders such as: fear of gaining weight, provoking vomiting or anorexia – there were no statistically significant differences between these ailments and the place of residence of the respondents (urban vs rural environments).

Table 10. Number and frequency of meals consumed by the subjects (in %)

Number and frequency of meals	Urban				Rural				Daily total	'Several times a week' total	'Rarely' total	'Never' total	p
	Daily	Several times a week	Rarely	Never	Daily	Several times a week	Rarely	Never					
5 meals per day	18.86	14.79	20.45	13.55	21.87	11.92	16.51	10.14	21.18	13.84	17.60	11.17	p<0,001
4 meals per day	23.73	20.34	15.39	5.59	22.63	15.76	11.96	4.56	23.24	16.93	13.06	4.88	p=0,074
3 meals per day	30.40	12.46	12.20	5.14	23.69	9.72	11.01	5.01	27.10	10.66	11.25	5.27	p=0,236
2 meals per day	11.92	5.83	13.93	21.14	11.20	4.06	11.73	16.17	10.92	6.08	12.44	18.65	p=0,159
1 meal per day	9.11	2.06	7.14	33.23	9.83	0.99	4.90	26.6%	8.88	2.33	5.90	29.33	p=0,001

p – p-value

Table 11. Favourite foods or products consumed during the week

Favourite dishes	Urban	Rural	p
Fast food	26.97%	7.55%	<0,001
Crisps	24.16%	11.21%	<0,001
Yoghurt	36.64%	17.58%	<0,001
Fish	16.34%	7.85%	<0,001
Meat	33.63%	15.99%	<0,001
Sweets	39.64%	16.01%	<0,001
'Pierogi' and pancakes	57.24%	27.14%	<0,001
Pizza	1.33%	0.28%	0,001
Vegetables	0.30%	0.11%	0,378
Fruit	0.75%	0.26%	0,047
Carbonated drinks	0.04%	0.04%	1
Non-carbonated drinks	0.04%	0.04%	1
Other	4.85%	2.46%	<0,001

p – p-value

Table 12. Products snacked between meals

Snacks	Urban	Rural	p
Sweets	20.53%	18.66%	0,114
Bread	12.72%	13.66%	0,329
Biscuits	13.99%	13.33%	0,542
Fruit	23.20%	23.86%	0,588
Yoghurt	14.17%	12.23%	0,048
Fast food	0.45%	0.25%	0,392
Crispp	0.08%	0.17%	0,403
'Pierogi' and pancakes	0.04%	0.10%	0,555
Pizza	0.03%	0.05%	1
Other	2.05%	1.77%	0,581
Total of subjects who consumed snacks	87.26%	84.08%	0,001

p – p-value

Table 13. Health symptoms related to nutrition

Symptoms	Urban	Rural	p
Hyperphagia and lack of control over food consumption	14.41%	11.09%	0,001
Irresistible fear of gaining weight	12.54%	12.00%	0,596
Provoked vomiting after a meal	2.94%	2.73%	0,762
Anorexia (avoiding food)	12.03%	12.98%	0,329
Total	41.00%	38.8%	0,118

p – p-value

DISCUSSION

Proper nutrition is of particular importance in children and adolescents due to the very intense processes of growth and development at this stage of life. Both nutrient deficiencies and excessive consumption have negative health consequences [11, 15, 16, 27, 28, 29, 30]. In recent years, in Poland and in Europe, the nutrition situation of children and adolescent has been unsatisfactory in many respects; this is valid both for the rural and urban environments [4].

Nutrition mistakes of children and adolescents are related to excessive consumption of fats. Its excess is already observed in pre-school children and increases with age, and is particularly pronounced in adolescents. Children and adolescents are prone to eating products and foods that contain significant amounts of fat. Chips and other fast-foods items belong to their favourite foods – which was confirmed in these studies. The research indicated that the majority of young people – both from the urban (57.24%) and rural (27.14%) environments – indicated as favourite foods: dumplings and other flour products. Therefore, obesity in children and adolescents is of great importance. Numerous studies confirm that the occurrence of obesity in adolescents is associated with increased morbidity and mortality in the population aged 50+, regardless of body weight in adulthood [1, 19, 20, 24, 28, 31].

In 2025, as many as 2.7 billion people – or every fourth person in the world – may suffer from overweight or obesity. According to the latest data from the World Food Safety Index, prepared by the Economist Intelligence Unit (EIU), in Poland 23.2% of the population already suffer from obesity [31, 32].

In Europe, obesity has reached epidemic proportions. Over the last 2 decades, the incidence of obesity has tripled. It is estimated that if no action is taken, in 2020 in the WHO European Region, about 150 million of adults (20% of the population) and 15 million of children and adolescents (10% of the population) will be obese [31, 33, 34].

According to A. Oblacińska [35], obesity is a disorder influenced significantly by environmental factors, such as lifestyle with health behaviours. These factors may be largely modified, mainly through health promotion and preventive activities.

Incorrect nutrition status, i.e. overweight and obesity, as well as body mass deficiency, may lead to many disorders. The current study shows that youth from the urban environment in particular had improper nutrition habits, which may have a huge impact on their health in the future. Research conducted in numerous centres in Poland confirmed these reports [24, 27, 38].

According to Platt [16], the nutrition and eating habits of adolescents have an impact on the course of adolescence, growth process and maintaining a normal body weight [13, 14, 15].

Research results on eating behaviours of adolescents during puberty from urban and rural environments [11, 15, 20, 27] repeatedly indicate improper nutrition: invalid nutrition model (irregular meal times, long intervals between meals, skipping breakfast), snacking between main meals, e.g. sweets, soft drinks, etc.); unbalanced diet: prevalence of energy from fat, high-energy foods and carbohydrates with a high glycaemic index, with decreased consumption of milk, its products, fibre and whole-grain bread.

In the presented study, the structure of consumption of food products preferred by the respondents showed that the highest number of subjects (57.24% of respondents from the urban environment and 27.14% from rural areas) consumed 'pierogi' dumplings and pancakes. Fruit and vegetables were selected rarely (by less than 2% of respondents from both environments); sweets were consumed by 39.64% of respondents from the urban environment and by 16.01% of rural subjects. This structure was similar to that of Kock et al., as the differences depended on the environment and region of residence. In a week, an average of 2/3 of subjects consumed flour products, while 1/2 of respondents vegetables and fruits [5].

Breakfast was consumed daily by 51.32% of urban respondents and 36.61% of rural subjects, similar to other studies [1,19,20]. Skipping breakfast has an adverse effect on the well-being and fitness of adolescents. According to Ziółkowska et al. [13], such individuals eat snacks more often (crisps, bars, sweet drinks), which may result, for example, in tooth decay and excessive body weight. A significant percentage of the subjects (14.10% of urban and 13.91% of rural respondents) did not eat breakfast; these results were similar to the results presented by B. Woynarowska et al. [29]. Second breakfast was consumed by 40.97% of urban and 46.51% of rural respondents; this was confirmed by research conducted by, among others, Ziółkowska et al. [13]. Dinner was consumed by 86.51% of urban and 82.80% of rural respondents. In the studies of B. Woynarowska et al. [30], this value was 70% (on school days) and 90% at weekends. Afternoon tea was consumed only by 25.82% of youths from the urban environment and 31.00% of subjects from rural areas, whereas supper was eaten by 69.90% of urban and 69.02% of rural respondents. In the studies by B. Woynarowska, 12.4% of urban adolescents did not eat supper. In other research by the authors of the presented study, almost half of the surveyed adolescents reported that they ate breakfast, second breakfast, dinner and supper [17, 29, 30].

An important problem affecting the health of young people is eating between meals, which concerns 87.26% of youth from the urban environment and 84.08% of subjects from the rural environment. In the current study, adolescents from both the urban and rural environments usually chose: fruits, sweets, cookies, and bread. In studies conducted by Przybylska et al. and Stefańska et al., frequent snacking between meals were discovered, and the most frequently selected products were sweets and crisps [28, 38].

Additionally, nutrition-related symptoms – which are often ignored by researchers – were investigated: hyperphagia (12.5%), anorexia (12%), provoked vomiting after eating –

(2.9%), which may lead to eating disorders, such as anorexia nervosa or bulimia nervosa [17, 35, 36, 37, 38].

CONCLUSIONS

1. It was found that among the researched population of 12–17-year-olds, incorrect nutritional behaviours prevailed, which were present both in the urban and rural environments.
 - a. The urban respondents consumed breakfast and second breakfast considerably more often than their peers from the rural environment.
 - b. Regular consumption of 5 meals a day was reported by significantly more subjects from the rural than the urban environment.
 - c. The urban respondents snacked between meals significantly more often.
2. The respondents chose and consumed unhealthy products, such as sweets, junk food and crisps, relatively often – this applied mainly to urban respondents.
3. The respondents reported disorders related to improper nutrition.
4. The obtained results may be used to guide the nutritional education of adolescents, who displayed an urgent need for such education.

REFERENCES

1. Felińczak A, Hama F. Występowanie zjawiska nadwagi i otyłości wśród dzieci i młodzieży we Wrocławiu [Incidence of overweight and obesity in children and adolescents in Wrocław]. *Zdr Publ.* 2011; 1(4):11–18. (in Polish)
2. Małkowska-Szcutnik A, Mazur J, Łata E. Aktywność fizyczna i zachowania żywieniowe młodzieży w świetle badań HBSC [Physical activity and dietary behaviors of adolescents according to HBSC research], 2017. (in Polish)
3. http://dnsalias.org/test/index_pliki/HBSC.ppt (access: 2018.06.20).
4. Jarosz M. Ogólnopolskie działania w zakresie zwalczania nadwagi i otyłości, ze szczególnym uwzględnieniem dzieci i młodzieży [Poland-wide activities to combat overweight and obesity, with special focus on children and adolescents]. Instytut Żywności i Żywnienia Warszawa, Warszawa, 2013. (in Polish).
5. Jarosz M. Zasady prawidłowego żywienia dzieci i młodzieży oraz wskazówki dotyczące zdrowego stylu życia. [Rules of proper nutrition of children and adolescents, and recommendations for healthy lifestyle] Instytut Żywności i Żywnienia, Warszawa, 2008. (in Polish)
6. Kocka K, Kachaniuk H, Bartoszek A, Fałdyga U, Charzyńska-Gula M. Najczęstsze problemy zdrowotne dzieci w wieku szkolnym – na przykładzie szkoły podstawowej i gimnazjum w Lublinie [The most frequent health problems of school-aged children, illustrated with an example of primary school and junior high school in Lublin]. *Med. Ogól. Nauk Zdr.* 2013; 19(4):508–513. (in Polish)
7. Lee M, Okumura M, Davis M, Herman W, Gurney J. Prevalence and determinants of insulin resistance among U.S. adolescents: a population-based study. *Diabet. Care.* 2016; 29(2): 2427–2432. <https://doi.org/10.2337/dc06-0709>.
8. Urakami T, Owada M, Kitagawa T. Recent trend toward decrease in the incidence of childhood type 2 diabetes in Tokyo. *Diabet. Care.* 2016; 29(2): 2176–2182. <https://doi.org/10.2337/dc06-1017>.
9. Weiss R, Dziura J, Burgert T, Tamborlane W, Taksali S, Yeckel C, Allen, Lopes M, Savoye M, Morrison J, Sherwin R, Caprio S. Obesity and the Metabolic Syndrome in Children and Adolescents. *N Engl J. Med.* 2014; 350(12): 2362–2374. doi. 10.1056/NEJMoa031049.
10. Baba R, Koketsu M, Nagashima M, Tamakoshi A, Inasaka H. Role of insulin resistance in non-obese adolescents. *J Med Sci.* 2010; 72 (3): 161–166. PMID: 20942271.
11. Copeland K, Becker D, Gottschalk M, Hale D. Type 2 diabetes in children and adolescents: risk factors, diagnosis, and treatment. *Clin. Diabet.* 2015; 23(6): 181–185.

12. Goluch-Koniuszy Z. Ocena sposobu żywienia dzieci w okresie skoku pokwitaniowego z BMI ≤ 5 percentyla z terenu miasta Szczecin [Assessment of nutrition of children during puberty with BMI $\leq 5^{\text{th}}$ percentile, from the city of Szczecin] *Roczn. PZH* 2010; 61(4): 307–315. (in Polish)
13. Litwin M, Śladowska J, Antoniewicz J, Niemirska A, Wierzbička A, Daszkowska J, Wawer Z, Janas R, Grenda R. Metabolic abnormalities, insulin resistance and metabolic syndrome in children with primary hypertension. *Am J Hypertens*. 2007; 20(4): 875–882. <https://doi.org/10.1016/j.amjhyper.2007.03.005>.
14. Ziółkowska A, Gajewska M, Szostak-Węgierek D. Zachowania żywieniowe młodzieży gimnazjalnej z Warszawy i miejscowości podwarszawskich [Nutrition behaviors of junior high school pupils from Warsaw and its suburbs] *Probl Hig Epidemiol*. 2010; 91(4): 606–610. (in Polish)
15. Braczkowska B, Cyran W, Braczkowski R, Kowalska M. Problemy zdrowotne młodzieży szesnastoletniej – uczniów szkół ogólnokształcących w Oświęcimiu [Health problems of 16-year-olds from high schools in Oświęcim] *Probl Hig Epidemiol*. 2008; 89(3): 359–366. (in Polish)
16. Goluch-Koniuszy Z, Fugiel J. Ocena sposobu żywienia i stanu odżywienia dziewcząt będących w okresie adolescencji, w tym stosujących diety odchudzające [Assessment of dietary habits and nutrition of adolescent girls, including girls on weight-loss diet] *Roczn. PZH* 2009; 60(3): 251–259. (in Polish)
17. Platta A, Babicz-Zielińska E, Cyra M. Ocena zwyczajów żywieniowych wybranych uczniów w wieku 13–16 lat uczęszczających do Gimnazjum nr 2 w Bytowie [Assessment of nutrition habits of selected 13–16-year-old students of Junior High School No. 2 in Bytów] *Bromat. Chem. Toksykol*. 2012; 45(2): 1092–1098. (in Polish)
18. Sygit K, Kołtąj W, Wojtyła A, Sygit M, Bojar I, Owoc A. Engagement in risky behaviours by 15–19-year-olds from Polish urban and rural areas. *Ann Agric Environ Med*. 2011; 18: 404–409. PMID: 22216820
19. Utter J, Scragg R, Mhurchu CN, Schaaf D. At-home breakfast consumption among New Zealand children: associations with body mass index and related nutrition behaviors. *J Am Diet Assoc*. 2007; 107: 570–6. doi: 10.1016/j.jada.2007.01.010
20. Fichna P, Skowrońska B. Otyłość oraz zespół metaboliczny u dzieci i młodzieży [Obesity and metabolic syndrome in children and adolescents] *Fam. Med. Prim. Care Rev*. 2008; 10(3): 269–278. (in Polish)
21. Gawlik A, Zachurzk-Buczyńska A, Małecka-Tendera E. Powikłania otyłości u dzieci i młodzieży [Obesity complications in children and adolescents] *Endokrynol. Otyłość* 2009; 5(1): 19–27. (in Polish)
22. Chen W, Sprinivasan S, Li, Xu, Berenson G. Metabolic syndrome variables at low levels in childhood are beneficially associated with adulthood cardiovascular risk: the Bogalusa Heart Study. *Diabet. Care* 2005; 28(2): 126–131. <https://doi.org/10.2337/diacare.28.1.126>
23. Cook S, Wietzman M, Auinger P, Nguyen M, Dietz W. Prevalence of metabolic syndrome phenotype in adolescents. *Arch Pediatr Med*. 2003; 157(6): 821–827. doi:10.1001/archpedi.157.8.821.
24. Jones K. The dilemma of the metabolic syndrome in children and adolescents: disease or distraction? *Pediatr Diabet*. 2006; 7(4): 311–321. doi:10.1111/j.1399-5448.2006.00212.x.
25. Kłosiewicz-Latoszek L. Otyłość jako problem społeczny, zdrowotny i leczniczy [Obesity as a social, health and medical problem] *Probl Hig Epidemiol*. 2010; 91(3): 339–343 (in Polish)
26. Pettitt DJ, Talton J, Dabelea D, Divers J, Imperatore G, Lawrence JM, Liese AD, Linder B, Mayer-Davis EJ, Pihoker C, Saydah SH, Standiford DA, Hamman RF. SEARCH for Diabetes in Youth Study Group. *Diabetes Care*. 2014 Feb; 37(2): 402–408. doi: 10.2337/dc13-1838.
27. Litwin M, Niemirska A. Powikłania narządowe nadciśnienia tętniczego u dzieci [Organ complications of high blood pressure in children] In: Litwin M, Januszewicz A, Prejbisz A., editors. *Nadciśnienie tętnicze u młodzieży i młodych dorosłych. Zapobieganie, diagnostyka, leczenie [High blood pressure in adolescents and young adults. Prevention, diagnostics, treatment]* Kraków: Medycyna Praktyczna; 2011: 241–269. (in Polish)
28. Kolarzyk E, Janik A, Kwiatkowski J. Ocena ryzyka zespołu metabolicznego u dzieci z nadwagą i otyłością. Część I. Antropometryczne i biochemiczne wskaźniki ryzyka wystąpienia zespołu metabolicznego [Risk assessment of metabolic syndrome in overweight and obese children. Part I. Anthropometric and biochemical indicators of metabolic syndrome incidence] *Probl Hig Epidemiol*. 2011; 92(2): 741–746. (in Polish)
29. Przybylska D, Kurowska M, Przybylski P. Otyłość i nadwaga w populacji rozwojowej [Obesity and overweight in population of developmental age] *Hygeia Public Health* 2012; 47(3): 28–35. (in Polish)
30. Woynarowska B, Mazur J. Zachowania zdrowotne młodzieży szkolnej: wyniki badań HBSC 2002 [Health behaviors of school-aged pupils: results of the HBSC research on 2002] *Zdr. Publ*. 2004; 114(2): 44–50. (in Polish)
31. Woynarowska B, Pułtorak M, Wojciechowska A. Zachowania zdrowotne i postrzeganie własnego zdrowia przez młodzież w wieku 11–16 lat w Polsce [Health behaviors and perception of one's own health by 11–16-year-olds in Poland] *Kult. Fiz*. 1991; 45 (7): 11–18. (in Polish)
32. World Health Organization: Physical status: The use and interpretation of anthropometry. WHO Technical Report Series No 854 WHO, Geneva 1995.
33. Global Recommendations on Physical Activity for Health, http://www.who.int/dietphysicalactivity/factsheet_recommendations/en/index.html. (access: 2018.06.11).
34. Janssen I, Leblanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and young. *Int J Behav Nutr Phys Act*. 2010; 11: 7–40. doi: 10.1186/1479-5868-7-40.
35. Janssen I. Physical activity guidelines for children and youth. *Appl Physiol Nutr Metab*. 2007; 32(4): 59–64. doi: 10.1139/H07-112.
36. Oblacińska A, Wrocławska M, Woynarowska B. Częstość występowania nadwagi i otyłości w populacji w wieku szkolnym w Polsce oraz opieka zdrowotna nad uczniami z tymi zaburzeniami [Incidence of overweight and obesity amongst school-aged population in Poland, and health care of pupils with these disorders] *Pediatr Pol*. 1997; 3(2): 241–249. (in Polish)
37. Reinehr T, Kleber M, Toschke A. Small for gestational age status is associated with metabolic syndrome in overweight children. *Eur J Endocrinol*. 2009; 160(4): 579–584. doi: 10.1530/EJE-08-0914.
38. Yin J, Li M., Xu L, Wang Y, Cheng H, Zhao X, Mi J. Insulin resistance determined by Homeostasis Model Assessment (HOMA) and associations with metabolic syndrome among Chinese children and teenagers. *Diabetol Metab Syndr*. 2013; 5(2): 71–77. doi: 10.1186/1758-5996-5-71.
39. Stefańska E, Falkowska A, Ostrowska L. Wybrane zwyczaje żywieniowe dzieci i młodzieży w wieku 10–15 lat [Selected dietary habits of children and adolescents aged 10–15] *Roczn. PZH* 2012; 63(3): 91–98 (in Polish).



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