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PART I. DISEASES AND PROBLEMS DISTINGUISHED BY WHO AND FAO

Type of products selected and beverages consumed by primary school children

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A. Study design/planning
B. Data collection/entry
C. Data analysis/statistics
D. Data interpretation
E. Preparation of manuscript
F. Literature analysis/search
G. Funds collection

Abstract

Background. Unhealthy diet of children and adolescents is a major public health problem. The purpose of the study was to assess the frequency of consumption of selected products and beverages by children in the Wołomin county of the Mazowieckie voivodeship, Poland.
Material and methods. A total of 146 pupils aged 6-13 from primary schools in the Wołomin county of the Mazowieckie voivodeship took part in the survey. The research tool was in the form of an anonymous questionnaire on the frequency of consumption of selected products and beverages. An attempt was also made to assess nutritional status using BMI interpretation. All the necessary analyses were carried out in a statistical program (STATISTICA PL 10.) at an assumed significance level of $\alpha=0.05$.
Results. The respondents consumed white bread most often, i.e. several times a day, (53.4%) while least often consumed foods were pulses (2.7%) and fish (2.7%). As for drinks, 63.7% of the respondents drank water daily, and it was the most commonly drunk beverage. Boys were significantly more likely than girls to drink sugary drinks, cola-type drinks, energy drinks and coffee, and to eat fast food products ($p<0.05$).
Conclusions. Dietary abnormalities found among the participants in the study were found especially among boys. Further education of young people regarding good nutrition is necessary.

Keywords: frequency of consumption, nutritional status, food product, children, health

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Introduction

A well-balanced diet provides all the macro- and micro-nutrients essential for the proper growth and development of young bodies. Diets deficient in vitamins or minerals, as well as those inadequate in terms of energy, can consequently lead to growth-related developmental disorders [1,2]. Current dietary guidelines for school-age children point out the need to provide at least five portions of cereal products, 3-4 portions of milk or milk products, meat, fish, eggs and pulses with at least 2 portions per day and at least 5 portions of vegetables and fruit per day with the daily menu. A young person's diet must not lack water (at least 6 glasses) and fats (from fish, nuts and vegetable oils) but only as an addition to meals. Restrictions are also included. These concern sweets and the consumption of table salt. It is equally important to eat four to five meals during the day, especially the breakfast. With the right number of meals, adequate intervals are maintained between them [3-7].

Correct nutrition not only influences the development of the young body, but is also linked to the prevention of overweight and obesity alongside environmental factors. In the light of scientific evidence, overweight and obesity in children and adolescents is now a significant public health problem. For example, around 41% of children aged 6 to 9 years were overweight/obese in Spain in 2015, which is the second-highest prevalence in Europe [8]. Based on the available data, the World Obesity Federation estimated in 2019 that there would be 206 million children and adolescents aged 5-19 years suffering from obesity in 2025 and 254 million in 2030. Of the 42 countries where the number of children suffering from obesity will exceed 1 million in 2030, it is estimated that China will top the list, followed by India, the US, Indonesia and Brazil, with only seven of the 42 largest countries being high-income countries [9].

Unhealthy diet of children and adolescents is a major public health problem. Eating behaviors formed in childhood and adolescence influence the dietary choices made in adulthood and are related to the risk of chronic diseases in the future [10,11]. Many foods frequently chosen by children are rich in simple sugars. Due to the ever-increasing problem of overweight and obesity in children, research has been undertaken on the frequency of consumption by children of various foods, including beverages.

Aim of the work

The study was designed to assess the frequency of consumption of selected food and drink products among children.

Material and methods

The survey was conducted between April 2022 and October 2023. Participants consisted of 146 pupils aged 6-13 who used the Specialized Outpatient Clinic of the Hospital of Our Lady of Perpetual Help in Wołomin (dietary outpatient clinic). The study was conducted by a nutritionist who is also a psychologist. The children taking part in the study were pupils from primary schools in the Wołomin county of the Mazowieckie voivodeship, Poland. The research tool was an anonymous self-designed questionnaire on the frequency of consumption of selected products and beverages, prepared on the basis of the recommendations issued by the Panel of Behavioral Determinants of Nutrition of the Committee of Human Nutrition Sciences at the Polish Academy of Sciences [12]. The questionnaire consisted of a metric and three thematic sections (eating habits, attitudes towards one's figure, and lifestyle). For example, respondents were asked about the frequency of food consumption. A six-point response scale was used: never, 1-3 times

a month, once a week, several times a week, once a day and several times a day. A total of 29 products were included in the consumption frequency table, including beverages. Respondents could choose one answer only.

The questionnaire study of the children was attended by their parents or legal guardians who received verbal and written information about the purpose of the study. Only questionnaires from children were included in the study after prior verbal consent was obtained from their carers. The questionnaires were completed by parents or legal guardians at a table with an urn specially prepared for this purpose, after they left the office. The anonymity of participants was ensured by depositing the completed questionnaires in a box (urn) prepared for the purpose, which prevented the identification of the data identifying the studied child. As part of the study, anthropometric measurements were also taken in the children whose parents had given their consent to participate in the study. Anonymized test results (height, weight, waist and hip circumferences) were recorded on a separate sheet preventing the identification of the child's personal data and attached to the survey questionnaire before its completion for those interested in the study. In order to take anthropometric measurements, the following tools were used: a Tanita TBF-300 scale with body composition analyzer, a centimeter tape graduated to 1 mm, and a Marsden-HM-250P portable height gauge. When measuring height, the measured children stood upright with their backs to the height meter. Their arms were relaxed and the head was positioned so that the ear canal was in line with the cheekbone. During the weight measurement, the children were in an upright position in the middle of the device, looking ahead and distributing their weight evenly on both legs. Waist circumference was measured, as follows: after several natural breaths taken by the child, in a position parallel to floor level, halfway between the lower edge of the last rib arch and the apex of the iliac crest. The examined child were to stand upright with feet kept together, distributing body weight evenly on both legs. The data collected was used to determine Body Mass Index (BMI) and Waist to Height Ratio (WHtR). BMI was interpreted on the basis of the centile charts of children and adolescents in Poland developed by Kulaga et al. [13]. The WHtR was also calculated using an empirical formula, i.e. waist circumference (cm)/hip circumference (cm). A fixed WHtR for both sexes of 0.5 was used to interpret this index; derived from the Łódź study on abdominal obesity in children and adolescents [14].

Due to the nature of the study, it was conducted in accordance with the principles of the Declaration of Helsinki [15] and was voluntary and anonymous.

All the necessary analyses were carried out in a statistical program (STATISTICA PL 10.). The non-parametric Mann-Whitney U test and the Chi^2 test were used to analyze the quantitative data collected in groups divided by gender, at an assumed significance level of $\alpha=0.05$.

Results

A total of 146 primary school pupils took part in the study, including 53.4% boys and 46.6% girls, with an average age of 11.49±1.13 years. The majority of respondents lived in rural areas (54.8%) while 45.2% of respondents lived in urban areas ($p<0.05$). 85.62% of the respondents had siblings.

The study group is characterized in Table 1 using the parameters included there. The study population did not differ in terms of the mean values of the highlighted parameters (Table 1).

Table 1. Nutritional status of the study population by gender

Parameter	Total respondents n=146	Girls n=68	Boys n=78
	X±SD	X±SD	X±SD
Age [years]	11.49±1.12	11.55±1.13	11.43±1.13
Waist circumference [cm]	64.59±9.03	63.25±8.40	65.76±9.45
Hip circumference [cm]	79.72±8.84	80.43±9.14	79.10±8.58
Body weight [kg]	43.11±11.86	42.94±11.68	43.26±12.07
Height [m]	1.69±0.09	1.49±0.10	1.50±0.09
WHtR	0.43±0.06	0.42±0.05	0.44±0.05
BMI [kg/m^2]	19.05±7.78	19.09±3.95	19.01±3.63

Notes: N – number of participants, BMI – Body Mass Index, WHtR – Waist to Height Ratio.

Assessment of nutritional status showed normal body weight in two-thirds of the pupils surveyed (67.8%) according to the BMI interpretation. Overweight was present in 17.8% of the pupils surveyed and obesity in 6.2% of them (Figure 1). Normal body weight was more common among the boys than among the girls surveyed, but the difference was not statistically significant (p=0.8697).

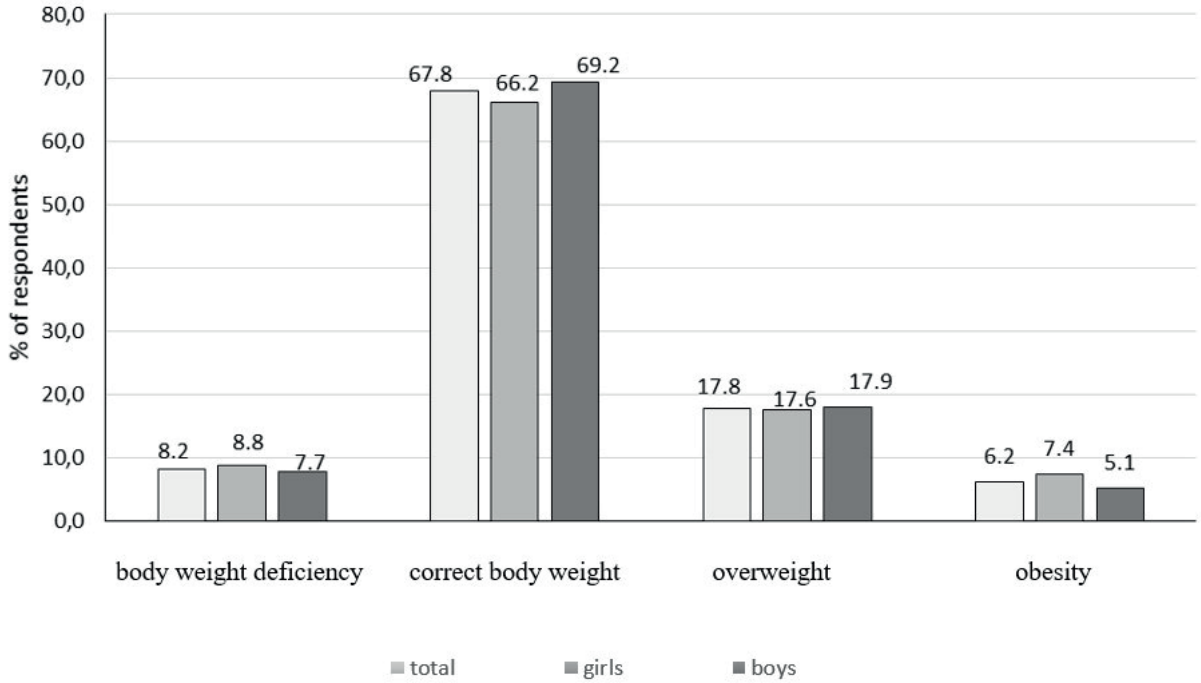


Figure 1. Assessment of the nutritional status of the study population according to the BMI interpretation

Abdominal obesity according to the interpretation of the WHtR index was present in 13% of the surveyed pupils. It was non-significantly (p=0.8093) more frequent in the boys surveyed (14.1%) than in the girls (11.6%).

Half of the respondents ate four meals a day (50.0%), and 17.1% ate five meals a day. 5.5% of respondents ate less than three meals per day. The majority (72.1%) of young respondents ate at regular times. More than 30% of pupils snacked between meals several times a day every day. 22.1% of the pupils surveyed snacked once a day and 16.2% snacked several times a week. Less than 6% of respondents never snacked between meals. The study groups of boys and girls did not differ in terms of frequency of meals consumed (p=0.0758) and frequency of snacking between meals (p=0.05491). Most often, respondents reached for fruit between meals (74.7%). Unsweetened dairy drinks and dairy desserts were equally popular (30.1%) as were sweetened dairy drinks (27.4%). The pupils least frequently chose nuts, almonds and other seeds (19.2%).

Of all the products (Table 2), respondents consumed butter (49.3%), white bread (53.4%) and fruit (47.3%) most often, i.e. several times a day. They were least likely to eat pulses (2.74%), fast food (4.11%) and fish (2.7%). For the most part, the studied groups of boys and girls did not differ significantly when it came to the frequency of consumption of the selected products. Only fast food products were statistically significantly more likely to be eaten by boys (p=0.0332).

Table 2. Frequency of consumption of selected food products in the study population

Product	Total respondents n=146		Girls n=68		Boys n=78	
	X±SD	Me	X±SD	Me	X±SD	Me
Butter	5.09±1.32	6.00	5.10±1.39	6.00	5.07±1.25	5.00
White bread	5.08±1.38	6.00	5.00±1.42	6.00	5.14±1.34	6.00
Fruit	5.07±1.14	5.00	5.12±1.14	5.50	5.03±1.15	5.00
Vegetables	4.65±1.28	5.00	4.68±1.18	5.00	4.63±1.37	5.00
Potatoes	4.16±1.10	4.00	4.15±1.07	4.00	4.17±1.14	4.00
Cured meats	4.15±1.29	4.00	4.03±1.30	4.00	4.26±1.28	4.00
Sweets	4.14±1.39	4.00	4.09±1.42	4.00	4.18±1.37	4.00
Milk	3.87±1.47	4.00	3.85±1.47	4.00	3.88±1.49	4.00
Eggs	3.47±1.18	3.00	3.47±1.11	4.00	3.47±1.25	3.00
Rice, pasta, groats	3.38±1.30	3.00	3.25±1.21	3.00	3.50±37	3.00
Yellow cheeses	3.28±1.60	3.00	3.35±1.59	3.50	3.21±62	3.00
White meat	3.26±1.17	3.00	3.32±1.15	3.50	3.19±18	3.00
Oatmeal, coarse cereals	3.19±1.54	3.00	3.18±1.53	3.00	3.19±56	3.00
Wholemeal bread	3.03±1.65	3.00	3.13±1.68	3.00	2.93±62	2.00
Red meat	2.99±1.37	3.00	2.91±1.28	3.00	3.07±45	3.00
Curd cheeses	2.90±1.35	3.00	3.13±1.30	3.00	2.69±36	2.00
Fish	2.76±1.18	3.00	2.72±1.07	3.00	2.79±27	2.00
Fast food	2.53±1.27	2.00	2.25±1.00*	2.00	2.79±44*	2.00
Legume seeds	2.44±1.24	2.00	2.59±1.30	2.00	2.31±18	2.00

Notes: * Statistically significant difference: p<0.05, X – mean, SD – standard deviation, Me – median. Frequency of consumption of products and beverages: 6 – a few times a day, 5 – once a day, 4 – a few times a week, 3 – once a week, 2 – 1-3 times a month, 1 – never.

Precise characteristics of the frequency of consumption of selected products and beverages in the total study population divided by gender are summarized in Tables 2 and 3.

Water was the most popular choice of beverage, with 63.7% of respondents drinking it several times a day. The majority of pupils declared that they do not drink alcoholic beverages (99.3%), energy drinks (72.6%) and coffee (76.0%). Boys were significantly more likely than girls to drink sugary drinks, cola-type drinks, energy drinks and coffee (p<0.05) (Table 3).

Table 3. Frequency of consumption of selected beverages in the study population

Product	Total respondents n=146		Girls n=68		Boys n=78	
	X±SD	Me	X±SD	Me	X±SD	Me
Mineral water	5.12±1.41	6.00	5.19±1.44	6.00	5.05±1.39	6.00
Tea	5.08±1.14	5.00	4.93±1.26	5.00	5.22±1.01	6.00
Fruit juices	4.62±1.33	5.00	4.61±1.36	5.00	4.64±1.31	5.00
Milk	3.87±1.47	4.00	3.85±1.47	4.00	3.88±1.49	4.00
Fermented milk beverages	3.60±1.41	4.00	3.55±1.39	4.00	3.65±1.43	4.00
Vegetable juices	3.24±1.71	3.00	3.15±1.76	3.00	3.32±1.67	3.00
Sweet drinks	3.17±1.50	3.00	2.84±1.45*	2.50	3.46±1.48*	3.50
Cola drinks	2.69±1.46	2.00	2.21±1.20*	2.00	3.12±1.54*	3.00
Coffee	1.57±1.21	1.00	1.35±0.94*	1.00	1.75±1.39*	1.00
Energy drinks	1.39±0.78	1.00	1.12±0.53*	1.00	1.64±0.88*	1.00
Alcohol	1.03±0.41	1.00	1.00±0.00	1.00	1.06±0.57	1.00

Notes: * Statistically significant difference: p<0.05, X – mean, SD – standard deviation, Me – median. Frequency of consumption of products and beverages: 6 – a few times a day, 5 – once a day, 4 – a few times a week, 3 – once a week, 2 – 1-3 times a month, 1 – never.

Discussion

In a study by Malczyk et al. [16] overweight and obesity among children aged 7-12 affected a smaller proportion of the subjects, i.e. 10% of boys and 12% of girls. Obesity was also less common among the participants of the cited study, i.e. in 5% of girls and 5% of boys, compared to the results of our own study. The WHtR index was used to assess nutritional status. The prevalence of abdominal obesity differed from the results of our own study and affected 9% of boys and 6% of girls [16]. The prevalence of overweight and obesity among children from the Bieszczady region (19.3% of those surveyed) was lower than in our own study [17]. In the study by Łuszczki et al. [18], in a group of 106 participants (52 girls, 54 boys) aged 6-12, it was shown that 13.2% of participants were overweight and 17.9% were obese. In Decyk and Kolanowski's study, weight loss was demonstrated in 5.8 per cent of the subjects (6.7 per cent of girls and 4.4 per cent of boys); overweight in 16.7 per cent (19.7 per cent of girls, 12.1 per cent of boys) and obesity in 7.3 per cent of the subjects (8.2 per cent of girls, 6.1 per cent of boys) [19], which corresponds to the results of our own study of this area. The prevalence of overweight and obesity among pupils from the Wołomin district is similar to the results obtained by other authors [20-24].

More than 30% of the children surveyed snacked between meals (72.1%) and most snacks were fruit. According to a study by Kostecka, 90% of children had a problem with snacking [25]. Snacking between meals by primary school children was also found by Zbrońska's study, demonstrating as many as 81.9% of cases where respondents declared they did this, 11.7% of pupils snacked "sometimes" and only 6.3%

of respondents showed no inclination to do so [26]. According to a study by Sawicka et al. [27], 25.4% of primary school children surveyed admit to eating extra food after each meal, with 85% of the children surveyed eating sandwiches, fruit or vegetables. 34.5% of respondents consumed one bar/piece of cake. Daily consumption of salty snacks was reported by 3.6% of respondents. Drinking fruit juices was indicated by 53.6% of respondents. In contrast, 65.5% of respondents reported eating fruit every day. Consumption of vegetables was declared by 17.3% of the primary school pupils surveyed. The daily menu of schoolchildren is dominated by mixed bread -50%, followed by white bread -38.2%, with only 11.8% of primary school children choosing wholemeal bread daily [27]. The results of a study by Łuszczki et al. showed a statistically significant relationship between age and fruit and vegetable consumption, which increased with age for both sexes [18]. Jończyk et al. [21] demonstrated that around 4% of the pupils surveyed consumed five or more portions of fruit and vegetables per day. In contrast, 62% of respondents consumed milk or milk products during the day. The consumption of meat several times a week was reported by 83% of the responding children, while salty snacks or sweets during the day were reported by 28% of respondents [21].

Cereal products belong to a group that forms the basis of the daily diet [22]. A study by Wojtyła-Buciora et al. [23] found that only 10.3 per cent of the pupils surveyed were implementing this recommendation. As shown, students eat dark bread reluctantly. 31% of respondents said that they consumed it less than once a week. Only 11% of respondents ate dark bread daily [23]. Zbrońska [26] demonstrated in her study that 37.24% of respondents ate wholemeal bread once a week. Wholemeal bread was consumed less than once a week by 26.59% of respondents. In contrast, 24.47% of respondents ate wholemeal bread once a week. One in eight people ate wholemeal bread occasionally [26]. In contrast, a study by Bielaszek et al. indicating dietary preferences for wholemeal bread demonstrated that 20% of children disliked this product, while according to their parents, 33% of pupils did, and the same number of children liked wholemeal bread very much (21%), which was confirmed by only 14% of parents [28].

Available research data indicate that there is a significant reduction in milk consumption among adolescents, with an inverse increase in the consumption of processed beverages and drinks with high sugar content. Such changes in milk intake have led to calcium intake below the recommended amount and higher consumption of products with low nutritional value [29-31].

As our own research has shown, only 12.3% of the pupils surveyed drank milk several times a day and 10.3% of the respondents in this study drank fermented milk drinks. Less than 25% of respondents reached for these products once a day, while as many as 7.5% of respondents never drank milk (6.2% fermented milk drinks). However, according to a study by Jończyk et al. conducted among 410 surveyed children aged 6-13 from selected primary schools in rural areas of the Śląskie voivodeship (217 – 52.93% were boys, 193 – 47.07% were girls), only 61.71% of pupils (62.18% of girls and 61.29% of boys) consumed milk or milk products on a daily basis [21]. In a study by Wojtyła-Buciora et al., frequent consumption of milk was recorded among pupils from schools in Kalisz, with as many as 48% of the respondents drinking milk daily [23], while in the young people studied by Marcinkowska et al., 10% of them did not drink milk at all, 12% drank one glass a week, 13% drank two glasses a week, 11% drank three glasses a week, 7% drank four glasses, and 10% drank five glasses [32]. A study by Bielaszek et al. demonstrated that the most preferable foods to consume were milk, i.e. for 62% of respondents, and fruit yoghurt, i.e. for 56%. The dairy products least willingly consumed by the respondents were buttermilk – 55% and kefir – 35%, while the least willingly consumed flour product was wholemeal bread – 20% [28].

The frequency of consumption of selected beverages resulting from own research showed that mineral water was the beverage most commonly drunk by students. Daily water consumption was declared by the largest number of respondents in the study group overall, i.e. 63.7%. In a study by Marcinkowska et al., 96% of the subjects drank water [32]. In this study, half of the respondents were most likely to consume sweet drinks 1-3 times a month. The study found that 5.9% of girls and 11.5% of boys drank sweet drinks on a daily basis (p=0.0111). In particular, attention was drawn to the group of boys surveyed with their significantly higher consumption of cola drinks, coffee and energy drinks (p<0.05) in addition to sweet drinks. Cola and coffee were consumed daily by 9.0% and 2.6% of the boys surveyed, respectively. Cola was drunk by 2.9% of girls, but none of the studied girls drank coffee. More than 5% of the boys surveyed drank energy drinks several times a week (none of the girls). The research by Marcinkowska et al. [32] also showed that 44% of pupils admitted to regularly consuming sugary fizzy drinks. Among adolescents drinking sugary drinks, boys (56%) were significantly more likely to do it (p=0.000) than girls (44%) [32]. Children usually drank tea, water or milk for breakfast [33].

The principles of healthy eating for school-age children and adolescents also point to the need to provide two portions of meat, fish or eggs with the daily diet. In the present study, most children reached for these products once a week (eggs, white meat, red meat). As many as 10.25% of the respondents had never eaten fish and 25% of the pupils ate fish once a week. However, the respondents were most likely to consume fish 1-3 times a month. Among pupils from Kalisz schools, fish was most likely to be eaten less than once a week (42%) [23]. As in our own research, 11% of pupils had never eaten fish. Legume seeds as a source of plant protein were the product the respondents were least likely to consume overall and by gender groups. As many as 21.2% of the respondents never ate them and the most frequent consumption among the pupils was 1-3 times a month (43.4%). In the study by Stefańska et al. [34], 10-12 year-old pupils were also most likely to consume legumes less than 2-3 times a week, i.e. by 74.4% of girls and 74.9% of boys, respectively. Pupils in the cited study were most likely to eat meat and meat products 2-3 times a day. This happened significantly more often (p<0.05) in the case of studied boys (50.2%) than in the case of girls (39.2%) [34], which was not demonstrated in our study.

The results obtained are partly in line with other studies. In a study by Kawalec and Pawlas involving 200 children aged between 7 and 10, 14 girls (57%) and 86 boys (43%) from classes II and III of Wrocław primary schools, there were 29 children who usually (≥5 times a week) ate cereal with milk or oatmeal for breakfast (14.5%), only 7% of respondents ate fruit or vegetables for breakfast every day and 26.5% never ate fruit or vegetables for breakfast [33]. In contrast, Potempa-Jeziorowska et al. [22] demonstrated in their study that, according to parents, (48.9%) of children aged 6-10 (n=908) attending primary schools in Poland consumed milk or other dairy products on a daily basis. Overall, 74.3% of children drank water every day. A total of 27.6% ate fish less than once a week. Overall, 7.6% of children ate fish several times a week. As many as 20.6% of respondents said that their children ate wholemeal bread several times a week, while 19.9% said that their children never ate wholemeal bread. Overall, 55.1% of children ate fruit and/or vegetables daily. A total of 14.1% of the children surveyed consumed sweets daily [22]. The research conducted by Galczak-Kondraciuk et al. [35] among 1,643 children aged 7-12, demonstrated that 51% of girls and 42.4% of boys consumed fruit and vegetables between main meals, while sweets were consumed two to three times a week by 37.2% of girls and 36.1% of boys respectively. Consumption of dairy products once a week or less frequently was declared by 53% of girls and boys [35]. According to the study by Dolipska et al. [36] conducted among 1138 primary school pupils, 67.36% of girls and 55.4% of boys

declared that they ate the recommended number of meals. Multiple consumption of fruit and vegetables per day was reported by 60.38% and 43.11% of girls and 50.44% and 32.39% of boys respectively. The recommended frequency of consumption of milk and natural yoghurt was declared by 20.07% and 10.12% of girls and 20% and 11.5% of boys respectively. Exclusion of fast food and instant products from their diet was declared by 7.16% and 45.03% of girls and 6.02% and 43.19% of boys respectively [36].

Limitations of research

While interpreting the results, some limitations regarding our study should be mentioned. Firstly, the selected sample cannot adequately represent the broader population due to the fact that it was based on the opinions of 146 pupils aged 6-13 who were receiving specialist counselling (advice from a dietician). Secondly, all the participants resided in the Wołomin county of the Mazowieckie Voivodeship; therefore, the results of the study cannot be generalized to other counties, voivodeships or the entire country. Thirdly, data for the study were only obtained from a sample consisting of a group of children aged 6-13 attending primary school whose parents consented to their participation in the study. Future studies should consider a larger research sample while using standardized tools. Repeating the study in different contexts will make it possible to assess the role of other variables that should be taken into account in the steps taken with regard to nutritional education.

Conclusions

1. Irregularities occurred among the participants in the study when it comes to the frequency of consumption of selected products and beverages.
2. Irregularities were demonstrated for the respondents in terms of recommendations for fruit and vegetable consumption. The pupils surveyed were most likely to eat fruit and vegetables once a day. The above phenomenon is observed among children all over the world. Despite educational efforts, the World Health Organization's (WHO) recommended consumption of 5 portions of fruit and vegetables is not being achieved.
3. Assessment of nutritional status showed a normal body weight in the majority of the pupils surveyed.
4. The findings demonstrate the need for intensified educational measures to minimize negative health effects in the form of diet-related diseases resulting from poor diet.

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The questionnaire study of the children was attended by their parents or legal guardians who received verbal and written information about the purpose of the study. Only questionnaires from children were included in the study after prior verbal consent was obtained from their carers. Due to the nature of the study, it was conducted in accordance with the principles of the Declaration of Helsinki and was voluntary and anonymous.

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