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ANALYSIS OF MENUS IN SELECTED DAYCARE CENTERS IN THE OPOLE PROVINCE: AN OBSERVATIONAL STUDY

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A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

Background: In the first years of a child's life, eating habits and preferences are formed. The main influence on the nutrition of a child between 13 and 36 months of age is the people who take care of him. The nursery is also responsible for providing children with adequate food.

Aim of the study: This study aimed to analyze the menus of children aged 1 to 3 in selected daycare facilities in the Opolskie Voivodeship.

Material and methods: The analysis concerned 10-day menus obtained from 8 different regional institutions looking after children aged 1–3 years. The analysis was based on a comparison of menus with the current nutritional standards and evaluated in terms of quantity.

Results: The results showed an excess of protein (388%) and sodium (529%) intake and insufficient coverage of the requirements for vitamin D (6.5%), calcium (87%), and iron (83%).

Conclusions: The analysis of the menus showed a number of irregularities in the nutrition of children aged 1–3 staying in care and educational institutions. This analysis revealed the weak points of nursery diets.

KEYWORDS: diet, child nutrition, menu, nursery

Background

Nutritionists and people dealing with the issues of nutrition point to the increasingly clear trend of being overweight among adolescents. According to the results of research published in 2019 by the Central Statistical Office, 57% of adults in Poland were overweight or obese. At the end of 2019, almost 65% of all men had a relatively high body mass index (about 46% were overweight, and less than 20% were obese). Additionally, nearly 49% of adult women were classified with a body mass index at an overweight or obese level (more than 31% were overweight, and almost 18% were obese). In the two youngest age groups (aged 15–19 and 20–29), a relatively low percentage of overweight or obese people was recorded (16% of people aged 15–19 and 35% of people aged 20–29). In the next two age groups (aged 30–39 and 40–49), there was a systematic increase in the share of overweight or obese people (50% among people aged 30–39 and 60% among people aged 40–49). In the last three

age groups (aged 50–59, 60–69, and 70–79), the percentage of overweight or obese people was at a similar level – about 70%. In the last age group (80 years and older), 63% of people had this problem [1]. In the case of preschool children (up to 6 years of age), the obesity epidemic has become a fact. In the first decade of the 21st century, the percentage of obese girls and boys from this group in Poland was high and amounted to 8% [2]. Among the four main factors that determine human health, lifestyle has an impact on total mortality of up to 50%. The remaining factors are biological (20%), environmental (20%), and healthcare (only 10%) [3,4].

Obesity is a condition in which excess body weight occurs due to the excessive growth of adipose tissue, exceeding 20% of the weight for age, sex, and height [5]. However, the education of society in the field of proper nutrition seems to be crucial, as overweight and obesity can be easily observed among the youngest children, whose eating habits are derived from their closest patterns.

These are the very early years of a child's life when food habits and preferences are formed. The main influence on the diet of a child between the ages of 13 and 36 months is the people who look after them. The fast lifestyle and urgent need to quickly return to work right after giving birth causes more and more children to be sent to nurseries. The main task of such facilities, apart from child care, is to provide adequate nutrition. A very often observed phenomenon among carers is the lack of sufficient knowledge about the products that can be given to a child at certain stages of development [6]. Dietary errors in children aged 5 to 36 months can cause abnormal weight in 32% of children [7]. An adequate diet during the preschool years (usually 2–5 years) is crucial for a children's short- and long-term health. A proper balance of nutrients can improve the cognitive development of children [8]. What is more, it reduces the risk of overweight and obesity (in the short term) [9]. Eating habits developed in the nursery and preschool period affect the risk of better or worse health throughout life [10].

When feeding children, attention should be paid to the appropriate frequency and organization of meals and selection of products to ensure the child is adequately supplied with energy during the day. Young children should receive 4 to 5 meals a day [6], including three main meals and one or two extra meals. The diet of a small child should resemble the easily digestible diet of an adult. The desired food preparation technique is cooking. Vegetarian or other elimination diets that may cause deficiencies of essential nutrients are not recommended [11]. The effects of improper nutrition at a young age (1–3 years) affect the risk of cardiovascular diseases, hypertension, overweight, obesity, metabolic syndrome, diabetes, and glucose intolerance in adulthood [12]. One of the most commonly observed deficiencies in a children's diet is a negligible amount of vegetables. Products in this group are the basis for soups and salads. They are an important source of minerals, carbohydrates, and vitamins. In the children's diet, it is best to use fresh, seasonal vegetables. Fruits, including juices, are a source of energy in the form of simple and complex carbohydrates. Minerals present in fruits regulate many processes happening in the body. Vitamins, especially vitamin C and pro-vitamin A, have anti-inflammatory and antioxidant effects [6]. The source of power in fats can affect brain development. Fats contain vitamins A, D, and E. Because of the negative effect on a child's growth and development, limiting the amount of fats in their diet is highly dissuaded. Butter and vegetable oils (rapeseed and olive oil) are advised to be given [6, 11]. Harmful products for children or products whose amount should be reduced significantly are mushrooms, raw meat, sugar, salt, ready and highly processed food, and unhealthy, fizzy drinks [13]. Nurseries should provide 75% of the recommended daily food rations for children [14]. The menus should provide the amount of nutrients adequate for both age and physical activity. When arranging the menu, elements such as taste preferences and the ability to bite, chew, or use cutlery should be taken into account [15]. It is also very important to remember that a properly arranged menu covers energy needs and provides all the necessary nutrients [16, 17]. Children spend 7–8 hours a day in the nursery or kindergarten, so the meals served during this stay should be properly balanced to ensure their proper development [18].

Aim of the study

This study aimed to analyze the menus of children aged 1 to 3 in selected daycare facilities in the Opolskie Voivodeship. Their menus were compared with the current nutritional standards, which assume the coverage of demand at a level of 75%. The menus were analyzed quantitatively, checking whether the nutrition was adequate. The quantitative analysis concerned selected micronutrients included in the meals.

Material and methods

Study design

For the quantitative analysis of studies, information about the level of coverage in children of energy, protein, fat, carbohydrates, iron, vitamin D, and so-

dium were obtained. Nutritional value tables to determine the content of the analyzed ingredients were used. A qualitative analysis (understood as an evaluation of compliance with basic recommendations for the supply of macro and micronutrients) was conducted within each food group, as well as a quantitative analysis limited to the analysis of the declared portion sizes served within a meal.

The research sample consisted of 8 collective catering facilities located in the Opole Voivodeship. The criteria for selecting the facilities included diversity in the area of meal preparation. The sample included facilities with their own kitchen facilities as well as those that relied on external companies for meal delivery. The analysis was conducted under real conditions without interfering with the planned ten-day meal schedules served to children in the nurseries. From the evaluators' perspective, parameters such as the size of the facility, the number of groups in the nurseries, and the ethnic diversity of the children were not significant in assessing the dietary plans. The study was conducted as an illustrative study to determine whether or not deviations from nutritional norms existed. The location was important, as it allowed for specific references to the particular area. This was particularly relevant in terms of identifying any observed deviations from nutritional norms for the entities responsible for monitoring the children's nutrition in the facilities. This practice did not involve identifying specific nurseries but rather signaling potential problems in general. During the study, the facilities were encoded and ensured anonymity, in which the facilities had access to the data. The facilities were randomly selected, and the ten-day meal schedules were obtained during a single period. This practice was important to enable data comparison between facilities. During the collection of data on the meal plans, interviews were conducted to determine, for example, whether meals were prepared on-site, whether the plans were developed in collaboration with a nutrition specialist, or whether computer applications supporting meal planning were used. After obtaining data on the menus, including ingredients, portion sizes, and frequency of serving, a qualitative analysis (understood as an evaluation of compliance with basic recommendations for the supply of macro and micronutrients) was conducted within each food group, as well as a quantitative analysis limited to the analysis of the declared portion sizes served within a meal. Measuring the portion sizes served to children seemed unnecessary due to differences in the manual abilities of the nursery's wards. Different levels of self-feeding skills excluded the accuracy of information on portion sizes as it did not guarantee that the provided portion size was consumed. In the next step, the nutritional and caloric values of the consumed meals were calculated, and the data were statistically processed to highlight differences in energy and nutrient intake between the analyzed groups. The obtained data were compared with applicable standards and nutritional recommendations, which enabled summarizing the study and formulating conclusions.

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Data source

For the purposes of this study, 8 menus for 10 days (decade menus) were obtained from 8 different regional institutions looking after children aged 1–3 years. The menus were from the autumn period. These menus were the source of data for analysis. The research was carried out in facilities located in the Opolskie Voivodeship.

To determine the amount of each food group, the study used a standardized amount of grams from kindergartens. Quantitative analysis made it possible to determine which groups of products dominate or are missing in the children's diet, as well as to determine whether they deviate from the quantitative norms.

Statistical methods

The research results were described quantitatively in Excel. The data obtained for the analysis were compared with the applicable standards and recommendations regarding nutrition and the requirements for individual ingredients in children aged 1 to 3 years.

Results

Table 1 shows the comparison of the feeding rations from the nurseries with the model. The data presented in the table respects the percentage of compliance and the average amount of food rations with the model nutrition ration served in nurseries. The highest breach was observed in the group of meat and cooked meats. Their supply was exceeded by 331%. In the case of mixed-type bread, the supply was exceeded twice if compared with the model ration. The average coverage of the demand for flour and pasta was only 34% of the recommended intake in nurseries. A similar situation was with vegetable oils (39%).

Table 1. The comparison of model food intake with the amount of specific foods, calculated on the basis of analyzed menus, and the percentage of implementation of the model ration [17]

Products	Daily amount in the model ration [g]	75% of daily amount in model ration [g]	Amount in the nursery [g]	The percentage of compliance with the model ration food [%]
Cereal products and potatoes				
Mixed type bread	20	15	29	193
Flour and pasta	25	18.7	6.6	35
Groats, rice, breakfast cereals	30	22.5	21.7	96
Potatoes	80–100	67.5	55.4	82
Fruit and vegetables				
Vegetables	200	150	102	68
Fruit	250	187.5	101	54
Milk and dairy products				
Milk	450	337.5	166.4	49
Dairy fermented drinks	100	75	39.6	53
Cottage cheese	12.5	9.4	9	96
Rennet cheese	2	1.5	1.8	120
Meat, cooked meats, fish, eggs				
Meat, poultry, cooked meats	20	15	49.7	331
Fish	10	7.5	8.7	116
Eggs	30	23	18	78
Fats				
Animal: butter and cream	6	4.5	6	133
Vegetable: oil	10	7.5	2.9	39
Sugar and sweets	20	15	16.1	107

Table 2. The average daily intake and the percentage of implementation of feeding recommendations in the nursery [11,13,16,20]

Component	Unit	Daily amount in the model ration	75% of daily amount in model ration	Amount in the nursery	The percentage of compliance with the model ration food [%]
Energy	kcal	1000	750	640.24	85
Protein	g	13	9.75	37.84	**388**
Fats	g	39	29.25	20.67	71
Carbohydrates	g	115	86.25	96.31	112
Calcium	mg	600	450	393.65	87
Iron	mg	5	3.75	3.11	83
Vitamin D	µg	15	11.25	0.73	**6.5**
Sodium	mg	750	562.50	2975.62	**529**

Children received nearly half the amount of fruits, milk, and milk-fermented drinks than they should. The best situation is in the supply of porridge rice and cereals, cottage cheese, sugars, and sweets. The difference in consumption of these products is on minimum value (less or close to 1 gram).

Figures 1–8 show a comparison of feeding rations (average from decade menus) in all tested nurseries with the required feeding quantities.

Two of the eight analyzed menus exceed the standards for energy supply in the nursery. In other diets, there are deficiencies from about 65 to 309 kcal, which indicate a significant energy deficiency. The average amount of energy supplied in the diets of nurseries participating in the study is 640.24 kcal which constitutes 85% of the recommended consumption in the nursery and 65% of the daily requirement (Table 2). The level of protein con-

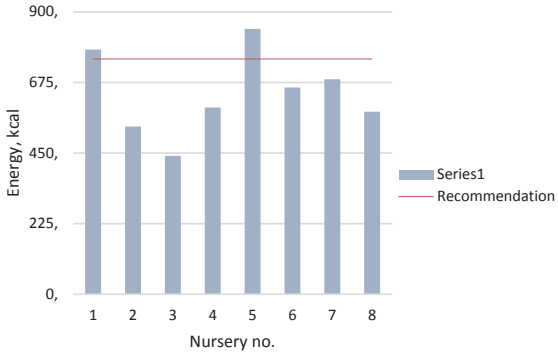

Figure 1. The comparison of the energy content in the feeding rations in all tested nurseries with the recommended quantities

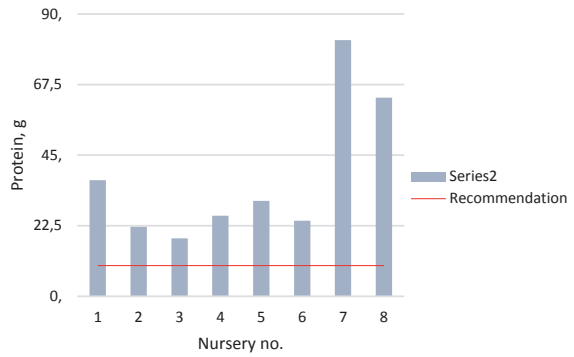

Figure 2. The comparison of the protein content in the feeding rations in all tested nurseries with the recommended quantities

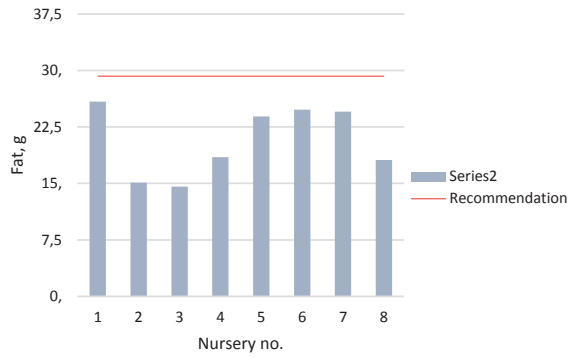

Figure 3. The comparison of the fat content in the feeding rations in all tested nurseries with the recommended quantities

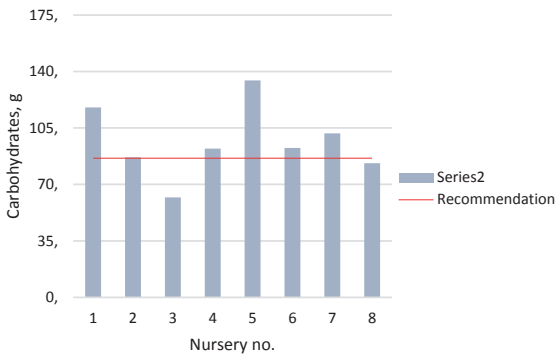

Figure 4. The comparison of the carbohydrate content in the feeding rations in all tested nurseries with the recommended quantities

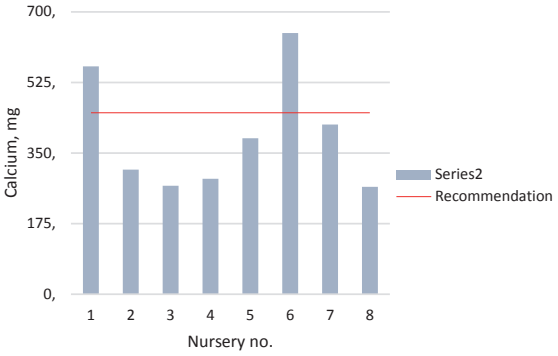

Figure 5. The comparison of calcium content in the feeding rations in all tested nurseries with the recommended quantities

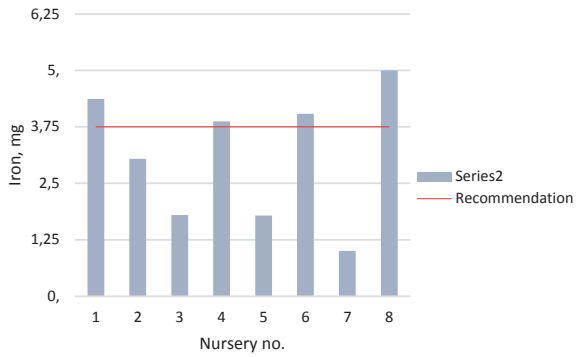

Figure 6. The comparison of iron content in the feeding rations in all tested nurseries with the recommended quantities

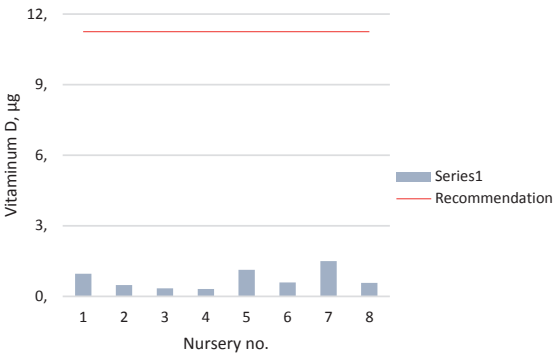

Figure 7. The comparison of vitamin D content in the feeding rations in all tested nurseries with the recommended quantities

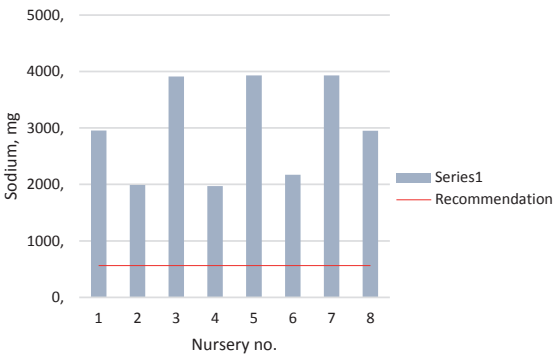

Figure 8. The comparison of sodium content in the feeding rations in all tested nurseries with the recommended quantities

sumption significantly exceeds the recommended amount, both calculated for nursery nutrition and for the daily amount. According to Table 2, nutrition in the nursery covers 388% of protein requirements and 291% of the required protein per day. This result is especially magnified by one of the daycare facilities, where the daily protein intake amount was 81.7 grams. However, even after eliminating this nursery from the calculations, this number was still exceeded. The recommendations regarding the supply of carbohydrates were exceeded and were implemented in the nurseries' nutrition at the level of 112%, while in terms of the daily demand, they covered 84% of the norm (Table 1). In the case of two nurseries, the level of carbohydrates supplied was not achieved. Also, in the case of two nurseries, the amount of carbohydrates supplied exceeded the daily norms. The menus do not cover the daily requirement for calcium – the amount of this element is too small as the average supply is 393.65 mg which accounts for 87% of the recommended consumption in nurseries and 66% of the daily requirement (Table 2). Also, the supply of iron is not ensured, it amounts to an average of 83% of the recommended consumption in a nursery and 62% of the daily requirement (Table 2). Vitamin D deficiencies were very common and amounted to only 6.5% of the recommended consumption in a nursery and 4.9% in relation to daily needs (Table 2). In the case of sodium intake, a significant excess of the norm was noted (529%).

Results presented in Figure 1 show that the lowest energy level was obtained in facility no. 3 (only 441.1 kcal) and the highest (above the norm) in facility no. 5 (845.8 kcal). What's more, in facility no. 3, almost all the analyzed ingredients (except sodium) were deficient. An excessive supply of protein was observed for all institutions (Figure 2), but the highest values were obtained for facilities 7 and 8 (81.7 g and 63.3 g, respectively). In addition, the high protein values in facility 7 also contributed to the high sodium intake (39.3 mg, Figure 8). None of the institutions managed to achieve the norm of fats, but in institutions 2 and 3, it is most notable (15.9 g and 14.6 g, respectively, Figure 3). Only facility no. 2 had a carbohydrate content close to the norm (86.8 g, Figure 4). On the other hand, facility no. 3 obtained the lowest level of this ingredient (62.0 g, Figure 4). Six of the eight analyzed menus had calcium deficiencies, and the other two exceeded the norm (Figure 5). On the other hand, in the case of iron, half of the analyzed menus did not provide the norm of intake, and the other half was characterized by an excess of this component (Figure 6). Very low values were obtained for vitamin D (Figure 7). At the same time, the menus from facilities 3 and 4 had the lowest amount of this vitamin (only 0.34 μg and 0.31μg, respectively). The maximum amount of vitamin D that the children were provided with the diets in the analyzed menus was 1.5 μg and was found in the menu of facility no. 7. All the analyzed menus were characterized by a significant excess of sodium (more than five times the norm), and the highest values were obtained for facilities no. 3, 5, and 7 (39.1 mg, 39.3 mg, and 39.3 mg, respectively, Figure 8). The analysis of menus from individual facilities shows numerous errors. However, three of the selected facilities significantly exceeded standards in relation to the tested ingredients (8 parameters). On this basis, it is possible to indicate that facilities no. 3, 7, and 8 had the largest deviations from the norms recorded. At the same time, for facility no. 3, 5 of the 8 analyzed parameters record deviations (compared to other facilities) from the norms.

Discussion

The issue of an inadequately balanced diet for children aged 1–3 years in nurseries was also observed by other authors. In correlation to the existing publications, it may be easily observed that despite the recommendations, prevention of vitamin D deficiencies is still at a low level [1]. The research conducted by Lukasik and others on the parents' awareness of a proper diet in cases of children aged 1–3 years pointed to the lack of vitamin D in the diet suggesting the need for supplementation under pediatrician control. The analysis of menus in selected nurseries in Łódź also showed a very low intake of this vitamin [19]. Their results also reflect too high protein consumption and insufficient iron supply, similar to our research. There was also a problem in nurseries in Łódź, because the children's diet had more calories than the recommended values. In nurseries in Białystok, there has been too high of an intake of foods rich in protein fulfilling approximately 250% of the implementation of the RDA standard [20]. In a study conducted on a group of 3-year-old children, the results showed the intake of protein and carbohydrates was exceeded by three times the safe consumption of sodium. In contrast, the average intake of calcium, iron, and phosphorus was below the recommended levels. The lowest intake was observed for vitamin D (90% of respondents) and B3 (60% of respondents) [1]. The authors of Weker et al. made similar observations, indicating insufficient consumption of energy and ingredients such as fat, calcium, iodine, vitamin D, and vitamin E and an excess of protein, sucrose, and sodium in the diet of children aged 13–36 months [6]. The problems with vitamin D supply in nurseries were also observed in a study led by Trafalska. The same study yielded an over-supply of protein and sucrose and an under-supply of vitamin E and iron [21]. In a study

conducted among children under 11 years of age, an increased risk of being overweight was observed in the group fed a high-protein diet [22]. The analysis of the results acquired in a number of studies leads to the conclusion that the common problem seems to be deficiencies, in the diet of children 1–3 years, of vitamin D, calcium, and iron with an excessive intake of proteins at the same time. The significant excess protein intake must be particularly emphasized. Despite its importance during the period of intense physical growth, it should not be consumed in such large quantities. What needs to be emphasized is that the other authors' findings resulted in the same conclusion. Excess protein consumption can overburden the liver and kidneys by increasing the amount of nitrogen compounds being excreted. Additionally, a long-lasting high-protein diet may later in life contribute to the formation of metabolic disorders, e.g., aberrant methylation processes and increased synthesis of homocysteine which are precursors for the development of atherosclerotic processes [23]. On the contrary, a deficiency of vitamin D and calcium may lead to disorders of skeletal development and later to demineralization and bone deformation. Insufficient iron consumption can result in a decrease in physical conditioning, the development of anemia, disorders of concentration and memory, and even the proper functioning of the heart [5]. Moreover, one of the factors in obesity among children is improper qualitative and/or quantitative nutrition, especially overfeeding children [24]. The obtained results indicate an improper diet in terms of quality.

In connection with the cyclical problem of improper diets in children at nurseries, an act on the care of children under the age of 3 was amended, imposing the obligations to provide children with proper nutrition on the organizers of mass catering (mainly intendants, directors, and dedicated persons). Following these changes, a guide entitled "Nutrition of children in nurseries. Practical implementation of current standards and recommendations" was published [7].

However, it turns out that the determinants of food consumption by children are complex, and so far, not an effective approach has been found to ensure the appropriate quality of a children's diet [25,26].

Limitations

The results presented in this article refer merely to menus. The actual child nutrition must be examined in relation to the weight of food that children consume. Knowing only how much meal the child received is not equal to the information of how much food was physically consumed. The research presented in this paper is preliminary tests. Currently, the research methodology for studying the actual consumption of food rations in nurseries and kindergartens has been developed.

Conclusions

The analysis of the menus included a quantitative analysis of selected elements and micronutrients and showed a number of irregularities in the nutrition of children aged 1–3 staying in care and educational institutions. The analysis revealed the weak points of nursery diets. The main problem turned out to be the supply of too much protein (388% of the norm for the nursery) and sodium (529% of the norm for the nursery). On the other hand, too few minerals, electrolytes, and vitamins (lack of vegetables and fruits). The greatest deficiency in the diet was noted for vitamin D, the coverage of the norm was only 6.5%. The reasons for the excess of protein and sodium can be found in the excessive supply of meat, bread, and rennet cheese. On the other hand, a deficiency of minerals and vitamins (especially vitamin D) may result from an insufficient supply of vegetables and fruits, milk, and fermented milk products. It is also worth enriching the diet with vegetable oils, as our analysis showed their deficiency.

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