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Evaluation of the actual nutrition of preschool children

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ABSTRACT

Preschool age is a crucial period during which the physical and intellectual maturation of the child takes place, which is necessary for preparing education for school. Children's nutrition at this time is vital since, on the one hand, it should ensure healthy development and, on the other hand, form the proper eating habits, which can affect the rest of their lives. There are some difficulties in assessing optimal nutrition in children because different research groups use other evaluation criteria, including macronutrients, micronutrients, certain foods, frequency of meals, food processing patterns, energy intake, amount of vitamins, trace elements, etc. Indirect indicators can be, for example, the child's body weight and growth retardation in the children's team. The repertoire of nutrition assessment tools is also extensive and may include questionnaires, physical measurements of portions, food tables, diaries, and other methods.The purpose of this article is to review various methods for recording and evaluating the diet of preschool children.

Keywords: *nutrition, diet, preschool period, macronutrients, micronutrients*

INTRODUCTION

Early childhood is a period of growth and development during which eating behaviour is formed. A healthy diet is critical for a child and plays a role in preventing various diseases and metabolic disorders, including obesity. Very often, young children have poor nutritional quality, a shortage of vegetables, dairy and whole grain products, and excess carbohydrates, sodium, and saturated fats [1]. One of the severe problems of preschool children of the Republic of Kazakhstan was iodine deficiency (60-70% of children), lack of vitamin C (60-70%), lack of vitamins A, B1, B2, betacarotene, iron and calcium in 30-40% of children. Coupled with a monotonous, predominantly carbohydrate diet, this contributes to the spread of digestive tract diseases, diabetes mellitus, and obesity among preschool children [2]. In Russian families with many children, a lack of protein is noted in children's diet (11.8% calories), while the fat content exceeds the recommended standards (36.6% calories). In families with low incomes, children's nutrition does not meet medical and biological standards [3].

Physical and social environment factors affect children's nutrition [1]. First, their parents are involved in forming a child's eating habits. Homemade food is often the leading food for preschoolers, and in American families, the home diet accounts for approximately 75% of food energy consumption. In the social aspect, parents' feeding style and practice [4], expectations regarding diet [5, 6], role models [5], and the eating regime [7] influence children's eating behaviour.

Nutrition in preschool institutions should comply with the principles of a regular diet inherent in children and compensate for violations of home nutrition. Nevertheless, although the finished products in children's institutions abide by the SanPiN standards, there is a significant imbalance in the diet regarding caloric content, carbohydrate content and distribution of caloric intake for different meals in several children's groups [8].

The relevance of this article is determined by the considerable role of nutrition in the life of preschool children, which affects the state of health in subsequent years. At preschool age, active intellectual and physical development is necessary to prepare the child for a long and challenging schooling period. With any deviation from the optimal composition of nutrients and caloric content, both functional and pathological problems may arise. Violating the principles of healthy nutrition in children contributes to an increase in chronic diseases and disruption of protective adaptation mechanisms [2].

This article aims to highlight the topic of children's nutrition in preschool institutions and identify existing shortcomings.

MATERIALS AND METHODS

A literary search has been conducted in the Google Scholar and PubMed databases to write this work. Mainly, articles that are in the public domain were considered. First of all, they represented the interests of the work of recent years (since 2019). The following keywords have been used:

PubMed: "Nutritional assessment of preschool children" – 1221 results;

Google Scholar: "Nutrition of preschool children" – 760 results (free full texts).

Also, in many cases, highly informative articles were used and referenced in selected publications, accompanied by a deepening of the temporary search. The primary selection was based on the title of the articles. The secondary selection was based on the abstracts, and the tertiary selection was based on the articles' content.

Forty references represent the references list: 11 are local, 28 are foreign articles, and 1 is an Internet source.

RESULTS AND DISCUSSION

Criteria for assessing the diet

The main problem with the nutrition of preschool children is the lack of a wide range of vitamins and trace elements in the diet. The most acute problem is the lack of vitamins B and D in almost a third of the examined children. A lack of calcium, magnesium, iodine and zinc is often found [9]. The connection of the lack of nutrients

with several diseases encourages us to look for ways to assess the actual nutrition of children in preschool institutions.

The literature mentions various criteria for assessing preschool children's nutrition quality. In foreign sources, the assessment of children's dietary intake is carried out according to such parameters as food groups of consumed products (fruits, vegetables, etc.), the energy intensity of food (calories), macronutrients (proteins, fats, carbohydrates), micronutrients (vitamins, minerals), as well as nutrition quality indicators (diet diversity, healthy nutrition index) [10]. Growth, body composition, muscle mass, cerebral blood flow, and haemoglobin levels were also measured while studying the effect of beneficial supplements of omega-3 fatty acids and polyphenols on the diet of children under seven years of age [11]. Russian publications evaluated the caloric content of food and food groups of products [8, 12]. The assessment of the diet can be carried out using the DAPA Measurement Toolkit website (www.measurement-toolkit.org), which is a free web resource for researchers (and independent users) who want to evaluate diet, as well as physical activity and anthropometric markers [13]. In Poland, the computer program Diet 6D was developed, which makes it possible to calculate energy consumption and 89 different nutrients in the diet. The program contains a database of food composition based on Polish tables containing information about the nutritional composition of various food components [14].

Nutrition assessment of preschool children in different regions

The study of these publications shows that nutritional deviations in preschool children are multidirectional, depending on the region of the world, income level, choice of children's institution, and the style of nutrition instilled by parents. One study found that an authoritative feeding style is the most protective (healthy) style, while an indulgent feeding style was associated with negative consequences for the child's health [4].

In a study by S.M. Robson et al., indicators of the quality of children's nutrition were primarily associated with the corresponding indicators in parents. Thus, the average energy consumption of parents (1763±524 kcal) was significantly associated ($b=0.30$, $p<0.001$) with the average daily energy consumption of a child (1751±431 kcal) [6].

In a survey of parents in Grodno, 77.1% indicated that they know about sound nutrition principles in children, and 50.6% correctly represent the composition of dishes for breakfast, lunch and dinner. Only 59% of parents forbade their children to consume junk food, including chips, fast food, and carbonated drinks [15].

In preschool institutions of St. Petersburg, deviations from the optimal diet were noted, such as the content of carbohydrates - lower, and proteins – higher than the established norms, which can contribute to disorders such as fermentopathy, intoxication, changes in the metabolism of other nutrients [8].

Almost half of the hospitalised children (48.3%) in the Spanish clinic had a risk of malnutrition, and 48.2% had an average risk of malnutrition according to the STAMP screening scale [16].

A survey of children in India showed that children 3-6 years old consumed insufficient nutrients (less than 60% of the recommended intake), associated with family income, birth order, and the presence of brothers and sisters. Stunting and wasting were more common in girls while being underweight was more common among boys [17]. The prevalence of obesity among Sri Lankan children was also very high [18].

The diet's nutritional value was assessed in kindergartens in the Wroclaw region of Poland [14]. The study evaluated the energy and nutritional value of the children's diet in four randomly selected kindergartens. Scientists assessed the energy value of the dishes and the content of nutrients in them, including proteins, fats, carbohydrates (including glucose, fructose, sucrose, lactose, starch), fibre, minerals (sodium, potassium, calcium, magnesium, iron, zinc, copper, manganese), vitamins (B1, B1, A, C, D, E), cholesterol, fatty acids (saturated,

monounsaturated (MUFA), polyunsaturated (PUFA)). A specialised computer program Diet 6D was used to determine the exact composition. The calculations considered losses arising during processing (including heat treatment). For the energy value of proteins, fats, carbohydrates, calcium and glands, losses were determined as 10%, and vitamins A and C were equivalent to 20% and 55%, respectively. All values were summed up for the 10-day menu. The results were compared with the current standards and recommendations for children 4-6 years old. This study was conducted in different seasons of the year. For children 4-6 years old with a body weight of 19 kg with moderate physical activity, the daily energy requirement under the standards was 1400 kcal. However, regarding children's nutrition at home, 75% of the specified value was taken as a guideline (see Table 1).

TABLE 1: Normal values of energy consumption and nutrients in absolute daily value and in the form of 75% of the time spent in kindergarten [Orkusz, 460]

Energy and nutrients	**Norm**	**75% of the daily norm**
Energy (kcal)	1400	1050
Protein (g)	21	15,8
Fats (g)	47	35,3
Carbohydrates (g)	227,5	170,6
Sodium (mg)	1000	750
Potassium (mg)	1100	825
Calcium (mg)	1000	750
Phosphorus (mg)	500	375
Magnesium (mg)	130*/250**	97,5*/187,5**
Iron (mg)	10	7,5
Zinc (mg)	5*/10**	3,8*/7,5**
Copper (mg)	0,4*/2,0**	0,3*/1,5**
Manganese (mg)	1,5	1,1
Vitamin B1 (mg)	0,6	0,5
Vitamin B2 (mg)	0,6	0,5
Niacin (mg)	8,0	6,0
Vitamin C (mg)	50,0	37,5
Vitamin A (mcg)	450*/1100**	337,5*/825**
Vitamin E (mg)	6,0	4,5
Vitamin B6 (mg)	0,6*/7,0**	0,5*/5,3**
Vitamin D (mcg)	15	11,3
Glucose (g)	10% energy value	26,3
Sucrose (g)		
Fructose (g)		
Dietary fibre (g)	14	10,5
Cholesterol (mg)	300	225
Triglycerides of fatty acids (g)	15,6	11,7
PUFAs omega-3 (g)	1,0	0,8
PUFAs omega-6 (g)	6,2	4,7
Salt (g)	2,5	1,9

Note: * - recommended dietary allowance; ** - acceptable upper consumption level

The study's results revealed that significant discrepancies between kindergartens were observed in such indicators as the energy intensity of food and the content of most nutrients (except copper, manganese, cholesterol, PUFA h-3). The seasonal factor was insignificant. Attention was drawn to the excessive protein content in children's diets, which was several

times higher than the daily norm. This deviation needs correction since the excess protein in the diet increases the risk of kidney stones, liver dysfunction, cancer, coronary sclerosis and obesity [19, 20]. In addition, the children's diet was too low in omega-3 and omega-6 polyunsaturated fatty acids. PUFA deficiency leads to increased production of pro-inflammatory cytokines, oxidative stress and an imbalance in the formation and work of neurotransmitters. Autistic disorder in children is accompanied by a deficiency of PUFA, which requires its replacement [21]. Omega-3 PUFA supplements in children's diets contribute to the anti-cancer effect [22]. In all menus, the salt content increased, increasing the risk of hypertension, cardiovascular diseases, and stomach cancer in later life [23, 24, 25]. In one of the kindergartens, the children's diet was excessive in carbohydrates, fructose (due to sweets and soft drinks) and fat. Such a deviation can contribute to obesity, diabetes mellitus, and cardiometabolic disorders [26, 27]. The calcium content in children was reduced, possibly due to a lack of calcium in the diet and an excess of phosphorus. It is necessary to fill this nutrient deficiency to prevent rickets. The energy balance in the diet of children was adequate [14]. The considered example shows that deviations from the optimal food composition and the rooting of incorrect eating habits can lead to various metabolic disorders and chronic diseases throughout later life.

The results of assessing the nutrition of preschool children vary greatly depending on the region of the world. Thus, an assessment of the food of children under five years of age in rural communities in South Africa showed that the diet has a high content of carbohydrates, low amounts of fibre, trace elements, and vitamin A against the background of growth retardation and body weight deficiency, which requires appropriate measures to eliminate the existing shortage of nutrients. [28]

Sometimes the assessment of nutrition is highly specialised. A study of the content of calcium and vitamin D in Polish children aged 4-6 years, based on the results of the analysis of the 10-day menu, revealed a decrease in these components in the diet: the content of calcium was 416 mg, and vitamin D was 1.47 mg [29].

The study of the nutrition of preschool children in Bangladesh was based on data from a seven-day semiquantitative questionnaire of the frequency of meals (7-d SQFFQ) filled in by an interviewer. In parallel, data were obtained through a survey of mothers, and both methods of securing information demonstrated a good correlation [30].

An indirect way to assess the actual nutrition of children may be nutritional risk screening. At the University of Cairo (Egypt), the nutritional risk was evaluated using STRONGkids (Screening Tool for Risk on Nutritional Status and Growth), and 37.8% had a high risk, and 42.6% of children had an average risk. 62.4% of children were underweight, and 57.85 suffered from exhaustion. The authors concluded that STRONGkids is an effective tool for detecting children vulnerable to malnutrition [31].

Korean preschool children were tested using a specially designed FFQ. (food frequency questionnaire). The questionnaire considered the list of products based on their nutritional energy contribution and 13 nutrients. According to the survey results, the percentage of coverage with energy, proteins, fats and carbohydrates was 89.2%, 88.4%, 88.2% and 89.4%, respectively. The FFQ. questionnaire can determine target groups' nutritional needs, plan nutrition education and develop strategies for improving the diet [32].

The eating behaviour of preschoolers was studied using the nutrition coefficient (NQ-P) in South Korea. The analysis showed a significant difference in the frequency of processed meat consumption depending on the region and fast food depending on age, area and weight ($p<0.05$). NQ-P scores were higher in the group where parents consciously approached children's nutrition. The authors consider the results to be suboptimal and believe that it is necessary to develop individual nutrition training programs following gender, age, region, and weight status, as well as the degree of awareness of parents regarding health to improve eating behaviour [33].

Testing of the new FFQ (Food Frequency Questionnaires) for epidemiological studies has been recently conducted in China. The study involved 326 children aged 2-6 years from three cities in Northwest China. The questionnaire included 67 items and implied obtaining semiquantitative indicators. In addition to FFQ, data from a 3-day diary of consumed foods were evaluated in parallel. These two methods demonstrated a positive correlation (Spearman's correlation coefficient varied in the 0.222-0.832). At the same time, the reliability of FFQ was higher than the diary data. The authors of the work concluded the high reliability and moderate validity of the FFQ questionnaire for determining the nature of the nutrition of preschool children [34].

Nutrition assessment concerning dental caries was conducted in 690 Vietnamese children 2-5 years old. The quality of drinking water was a serious problem for children's health. 7.2% of children consumed water from natural sources, and their lack of body weight was 1.45 times higher than that of the leading group. 44.6% of children regularly consumed high-carb sweets: in these children, the risk of being overweight and obese was 1.45 times higher than in those who did not have such a habit. The overall frequency of dental caries in preschoolers was 71.3%, which increased with malnutrition [35].

Ways to monitor and adjust nutrition in children

The revealed nutritional deficiencies require appropriate adjustments, which should be carried out at the level of the children's institution and work with parents, but also involves interaction with the child himself. Although a preschool-age child is still poorly aware of the need for a sensible diet, healthy skills can be instilled indirectly or directly in a playful way [36]. The development of correct stereotypes allows for the prevention of many chronic diseases. It is all the more relevant because most children have incorrectly formed stereotypes of food choices by the beginning of school education [37]. The competence approach in preschool education implies creating a wide range of competencies, including health-saving and the right direction for food selection [38].

To improve the quality of baby food, collections of Technical standards are compiled, including balanced menus for different age groups and instructions on using the collection. In addition, electronic databases of technical documentation are being developed, which are structured according to product types and meet the requirements of SanPiN and GOST [39]. The basic rules of catering in children's institutions are regulated by the SanPiN document 2.3/2.4.3590-20 from 27.10.2020. The rules stipulate not only the distribution of calories by meals but also the composition of the menu, the availability of hot dishes, storage conditions of food and ready-made food, the drinking regime and many other issues [40].

CONCLUSION

Assessment of children's diet is essential to preventing many diseases, and various age and clinical nutrition recommendations are developed on its basis. Preschool children, as a rule, spend about eight or more hours of daytime in kindergarten when they are most active. Therefore, nutrition at this time should take into account energy consumption and meet the need for macronutrients and micronutrients to provide everything necessary for the normal development of the child's body. During preschool education, a child develops habits that determine health and well-being for the rest of his life. For this reason, the task of specialists developing recommendations includes, among other things, creating healthy nutrition stereotypes so that the child continues to adhere to them as he grows up.

FINAL CONCLUSIONS

1) Dietary deviations have a multidirectional character depending on the region of the world, income level, preferences of the children's institution, the style of nutrition of parents and the child's food choice.

2) The arsenal of tools for assessing children's nutrition is diverse. It includes numerous questionnaires, diaries, direct measurement of the diet and determination of its composition under

the recommended tables, judgment of the frequency of meals, consideration of food processing technologies and indirect methods (nutritional status, height, body weight, laboratory tests).

3) Both lack and excess of nutrients can adversely affect the child's health and lead to the development of chronic pathology.

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