

EVALUATION OF NUTRITION MANNER AND NUTRITIONAL STATUS OF PRE-SCHOOL CHILDREN*

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Background. The aim of the study was to evaluate the nutritional status and nutrition manner of children attending preschools located in Szczecin.

Material and methods. The study was carried out in autumn 2008. The survey covered 105 children at the age 4-6 years. Information on home food intake was collected by parents, on the same days, the authors noted the kind and quantity of food eaten by the child in the preschool.

Results. The results revealed that the nutritional status of more than half of the children was appropriate; however, one out of five children exhibited overweight or obesity. The analysed menus revealed that most nutrients were oversupplied in relation to the requirements. The intake of total protein, animal proteins, copper, as well as vitamins A, B₂, and B₆, exceeded the recommended levels more than twice. Other B-group vitamins, vitamin C, phosphorus, magnesium, and sodium were supplied in a considerable surplus too. On the other hand, more than a half of the children received diets with insufficient amounts of calcium, potassium, iron and cholesterol.

Conclusions. The dietary shortcomings we found may have a negative impact on the physical and mental development of the children and may increase a risk of diseases in their future adult life.

Key words: nutrition manner, nutritional status, pre-school children

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INTRODUCTION

Proper nutrition is the foundation of good health and wellbeing. This statement seems especially crucial in relation to children, whose growing and developing bodies make them particularly susceptible to improper diet. Children demonstrate particular susceptibility to nutritional deficiencies during growth [Kozłowska-Wojciechowska and Makarewicz-Wujec 2005]. Excessive intake of energy and nutrients, however, can also have a negative impact on the health [Szponar et al. 2003]. Dietary patterns imposed on children can significantly affect not only their physical and mental development, but also form the eating habits that persist over their entire adult life [Gawęcki et al. 2005]. Proper nutrition of children, therefore, is crucial both for their optimal growth during the childhood and in terms of their health when they grow up [O’dea 2003].

The nutrition of children at the age 4-6 heavily depends on whether they attend a pre-school care institution and, if so, on the quality of meals offered there. The latter often raises serious concerns [Gawęcki et al. 2005, Gronowska-Senger et al. 1998, Pudło et al. 2000]. The authors who study child nutrition in preschools usually evaluate the energy and nutritional value of the meals offered to children in their preschools. Rare are the reports, however, that deal with the entire daily ration actually consumed by pre-school children, including food eaten at home.

The aim of the study was to evaluate the nutritional status and nutrition manner of children attending preschools, in the West Pomeranian province of Poland.

MATERIAL AND METHODS

The study was carried out during autumn 2008 in three preschools in the city of Szczecin. In all, of the schools located in Szczecin 105 children were studied, aged 4-6 years (4-year old – 38 children, 5-year old – 35 children, 6-year old – 32 children). Girls constituted 48.7% of the examined group, and boys 51.3%.

The parents of the children were handed out a total of 197 copies of the constructed questionnaire, of which 105 returned correctly filled (53% return). Following parental consent, the children were subjected to anthropometric measurements.

The data included information on what the children actually ate during 24 hours. The notes were taken three times. Information on home food intake was collected by parents, who had been asked to note the kind and amount of food consumed by the child on three previously assigned days of the week. On the same days, the authors noted the kind and quantity of food eaten by the child in the preschool. The questionnaires were coded in order to allow us to sum up the intake of food by each child over a whole day.

The amounts of food were estimated using the “Photo album of foods and meals” [Szponar et al. 2000]. The dietary patterns were analysed basing on the daily intake of the components calculated as the mean from three 24-hour surveys for each child. Energy and nutritional value of the daily rations, calculated using the *Dietetyk 2006 Prof.* software, were next compared with the nutrition standards for children at age 4-6 years. Most components were consumed at the recommended levels, except for calcium, potassium, and sodium, which were supplied at a sufficient level. Animal proteins were assumed to represent 2/3 of the total protein ration, and that cholesterol be consumed up to 300 mg [Jarosz and Bułhak-Jachymczyk 2008].

We also calculated the percentage of children that consumed below 90% or above 110% of the recommended ration of energy and nutrients.

The anthropometrics were carried out according to the recommendations issued by the Department of Child and Adolescent Development of the Mother and Child Institute in Warsaw, Poland [Palczewska and Szilágyi-Pągowska 2002]. Body weight was measured in the morning using a verified medical scale with precision to 100 g. The children were weighed wearing light-weight clothes. The height was measured using a triangle and a measuring tape stuck vertically to the wall. The resulting data were used to calculate the body mass index (BMI). The nutritional status was interpreted according to centile charts of BMI [Palczewska and Niedźwiecka 1999].

RESULTS AND DISCUSSION

The nutritional status, which is determined on – among other factors – body weight in regard to sex, age, and height, belongs to the parameters that reveal whether the diet provides an adequate nutrition for the body. Analysing the nutritional status of the children according to centile charts of BMI we observed that more than a half of them had a normal weight, corresponding to the age and height (Table 1). Underweight was observed in 9% of the children, whereas nearly 20% of the children were overweight. The literature reports various data on the incidence of anomalous body weight among children in Poland. Epidemiological data, however, shows that the percentage of overweight or obese children is constantly increasing, especially in large urban areas of the western part of Poland [Krawczyński et al. 2001]. Obese children are characterised by accelerated growth and early pubescence, and the risk of obesity in an adult who suffered obesity as a child is high [Rapacka et al. 2005]. Juvenile obesity also represents a risk factor of acquisition of civilisation diseases in the adult life and promotes nutritional disorders during adolescence. It has been demonstrated that the patients diagnosed to suffer from *bulimia nervosa* often used to be obese children [Fairburn et al. 1997].

The large percentage of children with overweight or obesity may be a consequence of the fact that parents often repeat at home the meals that the child has already eaten at school (Table 2).

Table 1. Nutritional status according to centile charts of BMI of examined pre-school children, n = 105

| Centyl | Nutritional status | Childrens, % n = 105 |
|--------|--------------------------|-------------------------|
| < 3 | considerable underweight | 3.81 |
| 3-10 | underweight | 4.76 |
| 10-25 | leanness | 13.31 |
| 25-75 | correct body mass | 55.22 |
| 75-90 | tendency to overweight | 4.76 |
| 90-97 | overweight | 11.42 |
| > 97 | obesity | 6.67 |

Table 2. Frequency of consumption of meals at home, by examined pre-school children, n = 105

| Source of information | Frequency | Breakfast % | Dinner % | Supper % | Between-meals eating % |
|-----------------------|-----------|----------------|-------------|-------------|---------------------------|
| Questionnaire | daily | 31.4 | 49.5 | 95.2 | 54.3 |
| | sometimes | 40.0 | 46.7 | 4.8 | 40.0 |
| | never | 28.6 | 3.8 | 0.0 | 5.7 |
| Menu | daily | 47.6 | 46.6 | 78.0 | 71.4 |
| | sometimes | 22.0 | 40.1 | 20.1 | 26.7 |
| | never | 30.4 | 13.3 | 1.9 | 1.9 |

It is assumed that serving the breakfast before leaving home can be of advantage to the child; however, a second midday meal during the day may easily result in overfeeding, leading in consequence to excessive weight or obesity. Breakfast eaten at home prevents hypoglycemia and enhances resistance to cold, which in turn is important for prevention of infections. Pre-school age is a good time to easily shape behavior patterns and habits in a growing child, also those related to diet and nutrition which become habitual and persist throughout the adult life [Friedrich and Rukojć 2001]. Therefore, serving a regular breakfast to the child every morning before leaving home forms a habit to eat this meal, which will be valuable during a later time of the primary school.

Overweight and obesity were also correlated with between-meals eating, which was observed in nearly all the children (Table 2). The snacks eaten by the children usually comprised sweets, fruit, as well as sweet dairy products. The presence of sweets in the diet was reflected by a large portion of sucrose in the daily energy ration (Table 3).

Table 3. Percentage contribution of main nutrients to energy intake in diets of examined pre-school children in the term of interview, n = 105

| Component | Consumed % | Recommended % |
|-----------------|---------------|------------------|
| Proteins | 14.0 | 12-14 |
| Fats | 35.7 | 30-35 |
| Carbohydrates | 50.3 | 51-58 |
| in this sucrose | 16.0 | 10 |

According to Kozłowska-Wojciechowska and Makarewicz-Wujec [2005], 96.7% of children like sweets. Frequent eating of candies, however, can have a negative impact on the child's health, not only in terms of obesity. Sweets are often consumed at the expense of other, nutritionally valuable food items and may lead to deficiencies in vitamins and minerals, especially in iron and calcium [Socha et al. 2002]. High consumption of sweets also increases the risk of dental caries in children [Bruzda-Zwiech et al. 2005, Creedon and O'Mullane 2001, Maciel et al. 2001].

A high level of sucrose in the diet may also result from serving sugar-rich cereal meals or dairy products, which in parents' awareness do not belong to the category "sweets" and are treated as nutritious, valuable food items recommended for children.

Daily food rations of the children were composed of the meals served at the pre-school and those eaten at home. The mean total intake of most nutritional components in the diet considerably exceeded the standards (Table 4). The consumed amounts of total protein, animal proteins, copper, vitamins A, B₂, and B₆ exceeded the recommended levels more than twice. Other B-group vitamins, vitamin C, phosphorus, magnesium, and sodium were supplied in a considerable surplus too.

The high protein supply is particularly dangerous. Despite their importance for the growth and development of the child, proteins should not be consumed in such high

Table 4. Content of energy and main nutrition components in daily food rations of examined pre-school children in the term of interview, n = 105

| Component | Intake $\bar{x} \pm SD$ | Norm | Percentage of norm |
|------------------------------|----------------------------|-------|--------------------|
| Energy, kcal | 1 615 \pm 361 | 1 400 | 115 |
| Total protein, g | 56.5 \pm 11.21 | 21.0 | 269 |
| Animal protein, g | 40.2 \pm 9.24 | 14.0 | 287 |
| Total fats, g | 64.1 \pm 17.41 | 50.0 | 127 |
| Cholesterol, mg | 263 \pm 75.2 | 300 | 88 |
| Assimilable carbohydrates, g | 203 \pm 45.0 | 130 | 156 |
| Sodium, mg | 1 392 \pm 328 | 1 000 | 139 |
| Potassium, mg | 2 732 \pm 611 | 3 100 | 88 |
| Calcium, mg | 554 \pm 164 | 700 | 79 |
| Phosphorus, mg | 968 \pm 201 | 500 | 194 |
| Ca/P | 0.44 \pm 0.082 | 1.20 | |
| Magnesium, mg | 215 \pm 56.9 | 130 | 165 |
| Iron, mg | 8.42 \pm 1.850 | 10.00 | 84 |
| Zinc, mg | 6.63 \pm 1.583 | 5.00 | 133 |
| Copper, mg | 0.94 \pm 0.211 | 0.40 | 235 |
| Vitamin A, μ g | 1 214 \pm 782 | 450 | 270 |
| Vitamin E, mg | 7.53 \pm 2.704 | 6.00 | 125 |
| Vitamin C, mg | 75.8 \pm 52.01 | 50.0 | 152 |
| Vitamin B ₁ , mg | 0.88 \pm 0.221 | 0.60 | 147 |
| Vitamin B ₂ , mg | 1.41 \pm 0.360 | 0.60 | 235 |
| Vitamin B ₆ , mg | 1.51 \pm 0.293 | 0.60 | 252 |
| Vitamin PP, mg | 12.5 \pm 2.71 | 8.0 | 156 |

amounts. An excess may lead to acidification of the system and can burden the liver and kidneys, forced to excrete additional amounts of nitrogen compounds [Weatherholtz et al. 1969]. A long-lasting excessive intake of proteins may contribute to metabolic diseases at an older age, also through an increased synthesis of homocysteine, whose high concentrations later provoke sclerotic processes [Kokocińska et al. 2005].

Excessive consumption of proteins is a very common dietary fault, observed among numerous groups of people [Szponar et al. 2003], including pre-school children [Sochacka-Tatara et al. 2008].

Sodium is another dietary component supplied to the studied children in excess. Sodium increases water retention in the system and represents one of the factors underlying adult-age arterial hypertension. It should be stressed that dietary habits formed during childhood persist throughout the entire life [Gronowska-Senger 2007]; hence, exposure to salt food in childhood may result in a preference of the taste of salt observed at a later age.

If we analyse the menus of the studied pre-school children, we will find deficiencies in the diet. Daily supply of cholesterol, potassium, iron, and calcium did not meet the recommended levels (Table 4). More than a half of the children did not receive the full amount recommended by the standards (Table 5).

Similar calcium deficiencies in the diets were found by Charzewska and Weker [2006], who studied daily rations of 4-year-old children in various regions of Poland. A strong dietary calcium deficiency during an intensive growth of the skeletal system may lead to rickets as well as to attaining a low final weight of the bone tissue, which in turn may result in osteopenia, early osteoporosis, or an increased risk of fractures at an older age [Ołtarzewski et al. 2003]. These disorders are also provoked by an improper calcium-to-phosphorus ratio, observed in the studied diets, as well as the excessive intake of sodium (Table 4), since sodium enhances urinary excretion of calcium [Kleeman et al. 1964], especially at a low-calcium diet [Nordin and Policy 1987].

Potassium deficiencies in the diet of the studied children probably results from a low consumption of wholegrain cereal products and vegetables, which are among the food items usually disliked by children [Cooke et al. 2004, Kolarzyk et al. 2008]. Low level of potassium leads to acidification of the organism, slows down cellular oxidation, and hamper the neuromuscular response [Ciborowska and Rudnicka 2007]. In terms of hypertension, low potassium can have as negative impact as an excess of sodium [WHO 1999].

It should be noted that even small iron deficiencies lead to reduced physical fitness and disorders in the immunological system. In children, they also degrade the cognitive abilities and hamper learning processes due to impaired the metabolism of neurotransmitters and oxygen transport and accumulation in the central nervous system [Walter 1994]. Heavier and long-lasting iron deficiencies lead to hemoglobin synthesis disorders, anemia, and damage of mucous membranes, which in consequence impairs absorption of the other components of the diet [Leszczyńska et al. 2007, Sochacka-Tatara et al. 2008].

The deficiencies observed may have resulted from food preferences of the children as well as from an uncritical imposition of adult dietary habits upon the children.

Szczepaniak et al. [2002] observed that children like meat and cured meat products, especially ham, loin, and sausages, whereas those meat products that contain visible fat in places belong to those disliked. Also the children studied preferred lean meat products; however, these did not occur in the diet in sufficient amounts, which is reflected by iron deficiencies.

Table 5. Percentages of pre-school children with insufficient, optimum or too much consumption of energy and main nutrition components in daily food rations in the term of interview, n = 105

| Component | Realisation of norm | | |
|------------------------------|---------------------|---------|--------|
| | < 90% | 90-110% | > 110% |
| Energy, kcal | 8.6 | 28.6 | 62.8 |
| Total protein, g | 0.0 | 0.0 | 100.0 |
| Animal protein, g | 0.0 | 0.0 | 100.0 |
| Total fats, g | 8.6 | 21.9 | 69.5 |
| Cholesterol, mg | 50.5 | 16.2 | 33.3 |
| Assimilable carbohydrates, g | 0.0 | 2.9 | 97.1 |
| Sodium, mg | 5.7 | 10.5 | 83.8 |
| Potassium, mg | 57.1 | 22.8 | 20.1 |
| Calcium, mg | 69.6 | 20.9 | 9.5 |
| Phosphorus, mg | 0.0 | 0.0 | 100.0 |
| Magnesium, mg | 0.0 | 2.9 | 97.1 |
| Iron, mg | 52.5 | 24.7 | 22.8 |
| Zink, mg | 1.9 | 19.0 | 79.1 |
| Copper, mg | 0.0 | 0.0 | 100.0 |
| Vitamin A, µg | 6.7 | 5.7 | 87.6 |
| Vitamin E, mg | 14.3 | 24.7 | 61.0 |
| Vitamin C, mg | 12.4 | 16.2 | 71.4 |
| Vitamin B ₁ , mg | 1.9 | 10.5 | 87.6 |
| Vitamin B ₂ , mg | 0.0 | 0.0 | 100.0 |
| Vitamin B ₆ , mg | 0.0 | 0.0 | 100.0 |
| Vitamin PP, mg | 3.8 | 12.4 | 83.8 |

It also became apparent during the study that the children generally disliked dairy products served in the nursery schools. These were usually in the form of milk and milk drinks, as well as rennet cheeses. This corresponds to the results reported by Kozłowska-Wojciechowska and Makarewicz-Wujec [2005], according to which as few as 5% of children declared milk and milk drinks as their favourite drinks. Also Kolarzyk et al. [2008] observed that milk is the least preferable dairy product within the group of pre-school children.

The results of the survey suggest that the children selected their preferable food items from those served in the preschool. Moreover, the parents prepared home meals according to the preferences of their children rather than in conformity with dietary recommendations. A report by the Public Opinion Research Center [Zwyczaże... 2006]

demonstrates that nearly 60% of respondents share the opinion that it is important that a child receives its preferable food items and likes the meal.

None of the diets were deficient in terms of vitamins B₂ and B₆. Deficiencies of other vitamins affected a very small number of children. In this context, it should be reconsidered whether healthy children should receive so commonly applied supplements of vitamins and fish-liver oil, the latter containing – besides unsaturated fatty acids – considerable amounts of vitamin A.

CONCLUSIONS

Analysis of the results allowed drawing the following conclusions:

1. BMI-based nutritional status was appropriate in more than a half of the examined children; however, one in five children exhibited excessive body weight or obesity.
2. The mean intake of most nutritive components exceeded the recommended levels. The consumed amounts of total protein, animal proteins, copper, vitamins A, B₂, and B₆ exceeded the recommended levels more than twice. Other B-group vitamins, vitamin C, phosphorus, magnesium, and sodium were supplied in a considerable surplus too.
3. Daily rations of more than half of the children were deficient in calcium, potassium, iron, and cholesterol.
4. The observed deficiencies may have resulted from food preferences of the children and from an uncritical imposition of adult dietary habits upon the children.
5. It is suggested that dietary instruction should be provided to both parents of pre-school children and the workers of preschools responsible for nutrition.

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OCENA SPOSOBU ŻYWIENIA I STANU ODŻYWIENIA DZIECI W WIEKU PRZEDSZKOLNYM

Wstęp. Celem badań była ocena stanu odżywienia i sposobu żywienia dzieci uczęszczających do wybranych przedszkoli w Szczecinie.

Materiał i metody. Badania przeprowadzono w okresie jesiennym 2008 roku w trzech szczecińskich przedszkolach. Objęły one ogółem 105 dzieci w wieku 4-6 lat. Dane dotyczące żywienia dzieci w domu w okresie badania uzyskano od rodziców, w tym samym czasie zapisywano także rodzaj i ilość żywności spożytej przez dziecko w przedszkolu.

Wyniki. Analizując uzyskane wyniki, stwierdzono, że prawidłowy był stan odżywienia ponad połowy badanych dzieci, ale co piąte badane dziecko charakteryzowało się nadwagą lub otyłością. W analizowanych jadłospisach nadmierna była średnia realizacja normy

większości składników odżywczych. Ponad dwukrotnie zostały przekroczone zalecenia dotyczące spożycia białka ogółem i białka zwierzęcego, miedzi, witaminy A oraz witamin B₂ i B₆. Znaczne nadmiary dotyczyły też innych witamin z grupy B, witaminy C oraz fosforu, magnezu i sodu. Natomiast analizowane racje pokarmowe ponad połowy badanych dzieci charakteryzowały się niedoborami wapnia, potasu, żelaza oraz cholesterolu.

Wnioski. Obserwowane nieprawidłowości mogą wpływać na pogorszenie rozwoju fizycznego i umysłowego badanych dzieci oraz zwiększać ryzyko wystąpienia chorób w wieku dorosłym.

Słowa kluczowe: sposób żywienia, stan odżywienia, dzieci w wieku przedszkolnym

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