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ENERGY AND NUTRITIONAL VALUE OF THE MEALS IN KINDERGARTENS IN NIŠ (SERBIA)

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ABSTRACT

Background. It is well known that high-energy diet, rich in fat and carbohydrates, increases the risk of obesity. Preschool age is an important period to acquire the eating habits continued later in adulthood. Therefore, evaluation of child nutrition in kindergartens is especially important in the prevention of future obesity.

Objectives. To determine the energy value and energy density of meals consumed by children in kindergartens in Niš (Serbia), including the different types of food, in respect to a probable risk of obesity.

Material and methods. The study had been conducted in the years 1998-2012. Three-hundred samples of the meals were gathered and analysed, and the amount of selected food groups used to prepare the meals in kindergartens was calculated (weight, protein, fat and carbohydrate content) in the accredited laboratory of the Public Health Institute in Niš according to the ISO 17025 recommendation.

Results. The mean energy value of meals was 978.9 kcal (range: 810 – 1144 kcal). The energy density was low (mean: 1.02 kcal/g, range: 0.92 – 1.42 kcal/g) and decreased over the years, what would imply a reduction in the risk of obesity. The intake of same high-energy food products, such as fats and oils as well as sweets (13,9% and 7,3%, respectively) was higher compared to low-energy foods (fruits – 5.2% and vegetables – 10.8%).

Conclusions. The results of our study indicate that children in kindergarten in Niš, in general, were properly nourished in total energy content. The energy value and energy density of the meals consumed did not pose a risk of developing obesity. However, the distribution of food groups differentiated by the energy density level was unfavourable; the deficit of low-energy foods was observed. Planning the child nutrition in kindergartens, with laboratory control of meals, may be an effective strategy in adequate energy intake and prevention of obesity. Providing the higher amount of low-energy foods (fruits and vegetables) in meals in kindergartens is recommended.

Key words: *energy intake, diet, children, kindergarten, Serbia*

STRESZCZENIE

Wprowadzenie. Wiadomo, że wysokoenergetyczna dieta, bogata w tłuszcz i węglowodany, zwiększa ryzyko otyłości. Wiek przedszkolny jest ważnym okresem nabywania nawyków odżywiania się kontynuowanych później w wieku dorosłym. Dlatego też ocena żywienia dzieci w przedszkolu jest szczególnie ważna w zapobieganiu przyszłej otyłości.

Cel badań. Określenie wartości energetycznej i gęstości energii posiłków spożywanych przez dzieci w przedszkolach w Niš (Serbia), z uwzględnieniem różnych typów żywności, w odniesieniu do potencjalnego ryzyka otyłości.

Materiał i metody. Badania prowadzono w latach 1998-2012. Zgromadzono i przeanalizowano 300 próbek posiłków. Obliczono ilość wybranych grup żywności użytej do przygotowania posiłków w przedszkolach (zawartość białka, tłuszczu i węglowodanów). Analizę wykonano w laboratorium Instytutu Zdrowia Publicznego w Niš, akredytowanym zgodnie z normą ISO 17025.

Wyniki. Średnia wartość posiłków wynosiła 978,9 kcal (zakres: 810 – 1144 kcal). Gęstość energii była niska (średnia: 1.02 kcal/g, zakres: 0.92 – 1.42 kcal/g) i obniżała się w miarę upływu lat, co mogłoby pociągać za sobą zmniejszenie ryzyka otyłości. Spożycie niektórych produktów żywności takich, jak tłuszcze i oleje, jak również słodycze (odpowiednio: 13,9% i 7,3%) było wyższe w porównaniu z żywnością niskoenergetyczną (owoce – 5,2% i warzywa – 10,8%).

Wnioski. Wyniki naszych badań wskazują, że dzieci w przedszkolach w Niš, ogólnie rzecz biorąc, żywione były prawidłowo w zakresie całkowitej zawartości energii. Wartość energetyczna i gęstość energii spożywanych posiłków nie stwarzała ryzyka rozwinięcia się otyłości, Jednakże, rozkład grup żywności różniących się poziomem gęstości energii był niekorzystny; zaobserwowano niedobór żywności niskoenergetycznej. Planowanie żywienia dzieci, z laboratoryjną kontrolą posiłków, może być efektywną strategią odpowiedniego spożycia energii i zapobiegania otyłości. Zalecono dostarczanie większej ilości żywności niskoenergetycznej (owoce i warzywa).

Słowa kluczowe*: spożycie energii, odżywianie się, dzieci, przedszkole, Serbia*

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INTRODUCTION

The up to date results of a number of the studies indicate that the prevalence of obesity in preschoolers is the high [8, 17], but little attention is paid to the role of diet in obesity prevention in preschool children [18]. *Larson's* at al review of 42 international studies on state nutritional policy in childhood suggested that promoting healthy eating as well as physical activity in child care settings are considered to less extent [19]. Therefore, the kindergarten intervention studies are needed to help in prevention of obesity in preschool children [16, 24, 25], The evidences were provided that a reduction in the meal energy density significantly decreases the energy intake in preschool children [3, 20-22], however, it should be remembered that children choose the energy-dense foods that were able to give them pleasant feelings of fullness [15]. *Duffey* and *Papkin* reported that probably reason for increasing the energy intake are: energy density of meals, portion size and number of eating/drinking occasions [10]. All these components of the diet may be successfully controlled in kindergartens.

The aim of the study was to examine the value of kindergartens meals, measured by energy value, energy density, and distribution of low- and high-energy food groups, whether they may affect the development of obesity in children.

MATERIAL AND METHODS

The study had been conducted in the years 1998-2012 in kindergartens in Niš, Serbia. The nutrition of children, who reside in kindergartens, is planned by a nutritionist, physician and nurse, and consists of three meals: breakfast, lunch and snack. Accordingly to the Serbian Book of Regulations (SBR), the kindergarten meals must provided at least 90% (1600 kcal) of the daily energy requirements of children, if they spend 12 hours in kindergarten [5]. The macronutrient contents in the energy intake should have the following distribution: protein 10-15%, carbohydrates 50-60% and fats 25-30%.

The material for analysis was collected as follows: four time per year during five random days the one sample of each meal ingredients was collected from serving on the dinning room table in front of a child, and 300 samples (20 annually) of kindergarten meals were gathered. The collected samples of meals in duplicate were transported to the accredited laboratory of the Institute of Public Health in Niš. The ingredients (i.e. milk, tea, bread, cooked food, salads, fruits, justice, etc.) were weighed separately and the level of moisture, protein, carbohydrates, fat and ash was determined [1]. The analyses were done in accordance to the ISO 17025 recommendations.

Descriptive statistics (mean, standard deviation), linear trends of energy density (defined as energy value in kilocalories (kcal) divided by weight in grams (g), and percentage distribution of food groups was calculated using the Microsoft Excel software.

RESULTS

Mean energy value (kcal), weight (g) and energy density (g) are shown in Table 1. The mean content of energy was 978.9 kcal (range: 810 – 1144 kcal), mean weigh of meals – 991.5 g (range: 823 – 1153.4 g), and energy density – 1.02 kcal/g (range: 0.92 – 1.42 kcal/g).

Table 1. Mean energy intake, weight of food intake and energy density of kindergarten meals in Niš in the 1998-2012 period

Variable	Mean ± SD	Min-max	Recommended values
Meal energy (kcal)	978.9± 121.8	810-1144	1600
Meal weight (g)	991.5± 95.3	823-1153.4	-
Energy density (kcal/g)	1.02± 0.13	0.92 – 1.42	-

Table 2 shows the macronutrient contents (protein, fat and carbohydrates) in the analysed meals. The share of macronutrients, protein (14.7%), fat (30.6%) and carbohydrates (54.7%), in the total energy intake were in accordance with the national recommendations.

Table 2. Macronutrients (protein, fats and carbohydrate) contents of kindergarten meals in Niš in the 1998-2012 period

Macronutrients	Mean ± SD (g)	Energy from macro-nutrients (kcal)	% of total energy intake (kcal)	Recom-mended % of total energy intake (kcal)
Protein	35.0 ± 4.8	143.5	14.7	10-15
Fats	32.2± 6.3	299.5	30.6	25-30
Carbohydrates	130.6± 14.3	535.5	54.7	55-60

Figure 1 shows that the linear trends of the mean energy density of the meals in kindergartens decreased significantly in the 1998-2012 period. It would imply a reduction in obesity in childhood due to improper diet. Nevertheless, the greater contribution in energy density of child meals, unfortunately, was noted for the high--energy foods, such as fats, oil and sweets, compared to those of low-energy, i.e. fruits and vegetables (Figure 2).

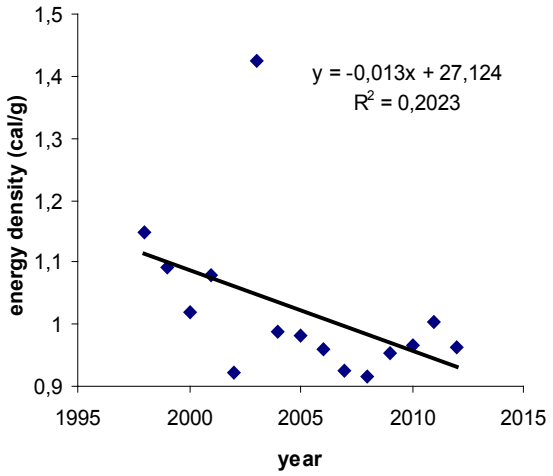

Fig. 1. Trends of mean energy density of kindergarten meals (kcal/g) in Niš in the 1998-2012 period

DISSCUSSION

Many countries have regulations concerning the recommended level of energy intake in child nutrition, but the agreement between the energy value of child nourishment in kindergartens and the national and world recommendations has rarely been the object of research. Our study confirmed that feeding of kindergarten children in Niš, in general, was proper in total energy content. The energy value of meals did not exceed the level recommended by SBR, and energy density was low and decreased over the years. The maximum energy values presented in the table 1 were lower than the recommended values and were adequate to the time spent by children in the kindergartens, usually shorter than 12 hours. Compared to our results, the Brazilian children in day-care centers consumed meals of lower energy value than required [14]. The children meals had the energy value higher than required due to fat and protein in Poland [13], and higher due to fat in kindergartens of six cities in China [28]. In the 1998 – 1993 period, in 10 out of 24 kindergartens in Zagreb (Croatia), at least one of the analysed parameters of meals (energy value, protein, fat, carbohydrate content) did not meet the national recommendations [6].

Regarding the macronutrients in the child nutrition, the Dietary Reference Intake (DRI) recommends the diet of children aged over 4 years covering: protein 5-20%, carbohydrates 45-65% and fat 30-40% [12]. It should be noted that the SBR recommendations propose a much lower percentage of fat (25 – 30%), and this regulation, established 20 years ago, needs to be changed [5]. The results of our study showed that proportion of selected macronutrients (protein, fat, carbohydrates) in meals of children in kindergarten in Niš met the criteria for both DRI and SBR recommendations.

The proper selection of children diet with taking into account the calorie contents of different food products is the subject of a numerous studies. Our investigations found the unfavourable structure of food products differentiated by the level of the energy density in the meals consumed by the kindergarten children in Niš, inconsistent with the Food Guide Pyramid, were fruit and vegetables present the important part of children diet [29]. The distribution of high- and low-energy foods in nutrition of preschool children in care centers varied from country to country, and even between the regions in the same country. The results of the study of 40 child-care centers in New York City indicated that it is necessary to improve the dietary intake of vegetables and foods rich in vitamin E, which was not provided to children in sufficient quantity by preparing meals [11]. In contrast, the children from 20 child-care centers in North Carolina consumed the recommended amount of low-energy foods (whole grains, fruits and vegetables), but also excessive amount of saturated fat and added sugar [2]. Compared with other regions of the world, the Scandinavian children attending daycare centers seem to have the most balanced diet in terms of high- and low-energy foods [23].

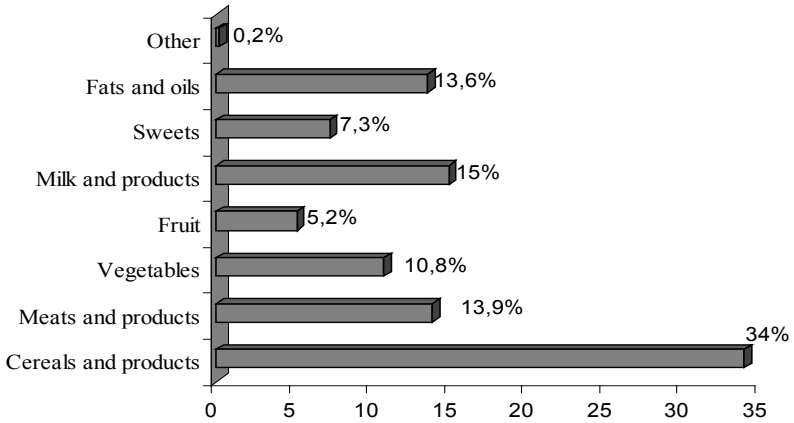

Fig. 2. Distribution (%) of food groups in kindergarten meals in Niš in the 1998-2012 period.

Children in kindergartens formed dietary behaviours developing the preference for certain types of food. The result of the study conducted in Mexico among children aged 3-4 years reported that, in general, children preferred high-energy foods, but those of public daycares were more likely to prefer healthy food of low-energy [7]. Preventing the unhealthy eating habits in preschool children is very important, because a minimum of 400 g fruits and vegetables per day is recommended for protection against the chronic diseases, such as cardiovascular diseases, cancer, diabetes and obesity [29, 30]. The American Dietetic Association obligated the staff of child care settings to promote healthy eating habits in children [26].

The present study has same limitations. The research focused on the children's diet only in kindergartens. However, it is necessary to know the influence of children's diet at home in terms of energy and macronutrient intake on their future habits. The children in Brazil received proportionally more energy, proteins and lipids in their meals at home than in the kindergarten [4]. The study conducted in Texas found that the child nourishing at home did not compensate the energy intake due to a low amount of grain and vegetable consuming in the care centers [27]. The role of parents in forming in their children the habits of proper nutrition is essential, but the healthy diet of preschoolers in kindergarten is also important.

CONCLUSIONS

The findings of our long-term investigations allow us to recognise the trends and current state of nutrition quality of children in kindergartens in Niš with regards to the adequacy of energy intake. In particular, the study showed that:

1. Children in kindergartens were properly nourished in the total energy intake. The mean energy value of meals did not exceed the level statutory recommended. The energy density of meals was low and decreased over the years, what would imply a reduction of the risk of obesity.
2. The distribution of food groups differentiated by the energy density level was unfavourable. The deficit of low-energy foods was observed. Planning the child nutrition in kindergartens, with laboratory control of meals, may be an effective strategy in adequate energy intake. Providing the higher amount of low--energy foods (fruits and vegetables) in kindergarten meals is recommended.

Conflict of interest

The authors declare no conflict of interest

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