

Energy and macronutrients intake of children attending kindergartens in Kosovo (full day program-8 hours)

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Abstract. *Aim:* Understanding preschool children's food consumption in kindergartens may be one possibility to find out whether preschool children's energy is adequate. The aim of the study was to evaluate the energy and macronutrient intake by children kindergartens in Kosovo. *Methods:* Preschool children (n = 469) aged 1<7 participated in three days' dietary intake assessment through food measuring in kindergartens. The software Prodi was used to convert food items to constituent nutrients. The Anderson-Darling test was used to test if the dataset comes from a normal distribution. In contrast, Fisher's and unpaired Student's *t*- test were used to see that data follow a normal probability distribution, the variances of the populations are equal, and the samples are independent. Analysis of Variance (ANOVA) was used to test the differences between means of energy and macronutrients among treatments (kindergartens). *Results:* The children obtained more than 50% of their daily energy requirements. The energy intake across the five kindergartens showed significant differences (between 292±31.7 kcal and 1126± 201 kcal). Apart from differences in the energy level, an imbalanced share of energy from was observed from each macronutrient. Overall, children in our study met the recommended daily carbohydrate intake already during their 8 hours stay in kindergarten. The average protein intake by 1<4 old boys and girls exceeded the daily reference values for protein intake. The mean percentage of energy intake from fat was around 27 % of daily reference values. *Conclusions:* The energy intake across the five kindergartens showed significant differences and it was observed that there was an imbalanced share of energy from each macronutrient. There is a need for development of uniform dietary legal standards of nutrition in kindergartens in Kosovo

Key words: Energy intake, macronutrients, dietary assessment, child nutrition, nutrient intake

Introduction

The percentage of pre-school age children attending public kindergartens in Kosovo is very low (less than 10%). There is a high demand by families to send their children to public kindergartens, but the number of public kindergartens in Kosovo is very limited and the State lacks budget for construction of more public kindergartens, preventing many children from attending such pre-school institutions. According to the Kosovo education statistics (1), the number of public kindergartens was 52

with about 6,000 children enrolled. During recent years, the private kindergartens are eligible to operate, but there is no official data about such kindergartens. Although the focus of this assessment were public kindergartens, the investigation covered four randomly selected public kindergartens (Prishtinë; Ferizaj; Kamenicë and Obiliq), as well as one private kindergarten situated in Prishtinë. A balanced diet and knowledge of children's intake of energy and macronutrients is important for normal growth as well as for nutritional interventions to prevent childhood malnutrition (2). Different studies indicate

that the role of proper diet and promotion of healthy eating in childhood is not sufficiently considered (3, 4). The studies in preschool institutions may be important in the prevention of obesity and reduction of meal energy density (5,6). Some studies show that the intake of certain food groups such as fruit and vegetables are below the minimum recommendations, while the intake of energy – dense and low-nutritious foods, which are discouraged within a healthy diet (like snacks and sugared drinks), are high (7). Furthermore, there are many studies which show that dietary intake of assessed children contained more energy from protein and saturated fat and less energy from carbohydrates and unsaturated fats, recommending development of healthy eating programs as a part of obesity prevention programs for children (8-11). Additionally, the data from surveys of children in the US and several European countries showed that children who consume low energy density foods have more healthful diets than children who consume high energy density foods (12,13). The other studies have shown also a nutrition paradox such that children can be overweight or obese and still be deficient in certain important nutrients due to consumption of low-quality food (14). Different studies usually evaluate kindergarten menus in the frame of National Health Programs or Food-Based Dietary Guidelines in order to determine the proportion of children meeting such guidelines. In the USA for instance, children in full-day programs should receive foods that meet at least half to two thirds of the child's daily nutrition needs, while in Estonia, kindergartens provide three meals a day and food served should cover 80-85% of a child's daily energy requirements (15-17). Children in Kosovo spend 8 hours a day in kindergartens. The meals served include breakfast, lunch, and afternoon snack, which is why food served during the mentioned meals has a crucial impact on children's daily dietary intake. Kindergartens also play a significant role in influencing eating behaviors of young children. Actually, there are no recommendations in Kosovo about how much food a child should receive in a full day program in order to meet his/her needs. On the other side, there has been no data on energy and macronutrient intake of preschool-aged Kosovar children until now. Two studies in Kosovo showed that the prevalence of overweight and obese children is evident and that children, while at kindergartens, consume diets, which are deficient in several

micronutrients. The anthropometric results showed that the mean z-scores for weight-for-age, height-for-age, weight-for-height, and BMI-for-age largely was within 0.0 and 1.0., while 8.9% were overweight and 27.3% of preschool-aged children had a possible risk of being overweight. On the other side, the intake of several micronutrients in kindergartens was below recommendations (iodine, iron, folic, thiamine, riboflavin and vitamin C), while sodium intake percentage was much higher (for 1<4 old children was 291% and for 4<7 years old children was about 306%) than the recommended daily intake (18,19). There is also a study in Kosovo, which showed that the dietary pattern was low in whole grain products, fruits, and vegetables, and high in soft drinks and sweet and salty food. Fruit and vegetable intakes were far lower than the recommended levels. It was recommended to start, as soon as possible, an assessment of child development patterns in the country and develop national programs and dietary guidelines on recommended dietary intakes, eating styles and behaviors, structuring of meals, as well as necessary dietary patterns, which will help normal growth of children and minimize the risk of nutritional deficiencies and diseases (20). The purpose of the present study was to assess the energy and macronutrients intake of preschool children (1<4 and 4<7 years old children), attending public and private kindergartens in Kosovo (full day programme – 8 hours), and compare these intakes with recommendations for children of this age. Discovering the energy and macronutrient intakes of children in Kosovo's kindergartens will be useful in providing information on possible areas to improve kindergarten menus. It is expected that the energy and the macronutrient intake of preschool children in Kosovo is not in line with international references for the energy and macronutrients intake of preschool children (1<4 and 4<7 years old children).

1. Methods

1.1 General information

All registered children from the randomly selected kindergartens were eligible to participate in the assessment. The inclusion criteria for the recruited subjects were: a) children registered and attending

the selected kindergarten, and b) children between 1 and 7 years of age. This research was a part of a larger study on nutrition status of children attending kindergartens in Kosovo. The data on anthropometrics, micronutrient intake and dietary habits and food intake frequency of preschool children have been already published (18-20). Since there is no Ethic Review Committee in Kosovo, this study was approved by the Ministry of Education, Science and Technology of Kosovo, which has issued a consent letter, inviting Municipal Education Directors as well as the Kindergarten Directors to support this study as the first nutritional assessment research in preschool settings of Kosovo. Public kindergartens were randomly selected and directors of selected kindergartens have supported this study. No statistics about the number of registered and licensed private kindergartens were available, so we decided to include only one private kindergarten in order to get insights on energy and nutrient intake and compare with intake in public kindergartens. We are conscious that the number of samples from kindergartens is small to draw accurate comparison and conclusion, but we believe that these data can be used during future research in the field of food intake (energy & macronutrients). The concept and the objective of the study were explained to the parents and teachers through group meetings as well as through distribution of an information letter to each parent personally. Apart from group meetings (informative meetings), each parent was approached personally during distribution. In addition, an information poster about the start and period of the study was placed on the entrance door of each kindergarten prior to the beginning of the research. The compliance with STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) has been addressed in this study.

1.2. Data collection

The weighted dietary record method was chosen for this study considering that multiple days of records provide a valid measure of intake for most nutrients and is a more useful method for the assessment of intake of a variety of nutrients. The preparation of all meals, as well as recipe content, was also accurately

followed, measured, and recorded. All food and drink consumed in kindergartens by each child, for a period of three consecutive days (working week days), were measured and recorded, and wasted food and leftovers had been measured and subtracted from the record correctly. Seca 856 Digital Scale with the fine 1 g graduation was used for weighting foods and leftovers. The data were recorded by a principal investigator who was supported by trained nurses in conducting the measurements for the duration of the survey. The principal investigator stayed in the kindergartens for the duration of the survey.

1.3. Dietary assessment

The completed records were analysed using “Prodi software” (Nutri-Science GmbH, Freiburg, Germany; version 5.9) which was used to convert food items to the constituent nutrients. The intake of energy and macronutrients from foods and drinks was calculated based on consumption, energy, and nutrient content of each food item from the food composition database. Since Kosovo does not have its own software for calculation of food composition, we used PRODI software. The preparation of all meals and the recipe content were accurately measured and recorded. We agree that there is a limitation since PRODI does not contain the database for some specific dishes. To calculate food composition data for some Kosovo’s dishes, we used recipe-calculation procedures using data on ingredients. The energy and nutrient contents of commercial foods, processed foods, snack foods and foods prepared in kindergartens were estimated using recipe simulation and labelled ingredients. Energy was expressed as a full day programme – 8 hours intake (breakfast, lunch, and snack) in kilocalories and mega-joules. The macronutrients intake was expressed in grams/full day programme-8 hours intake (breakfast, lunch, and snack), and as a percentage of the energy intake. The energy conversion factors used for protein, fat, and carbohydrate were 4 kcal/g, 9 kcal/g and 4 kcal/g respectively. The energy from each macronutrient energy source was divided by the total energy intake and multiplied by 100 to produce the percentage contribution.

1.4. Comparison with reference intake

Since Kosovo does not have the Dietary Guidelines for preschool-aged children, the obtained results from this study were compared with the D-A-CH reference values (nutritional guidelines for Germany, Switzerland and Austria) as these recommendations consider gender-specific and age-specific values (1<4 years old and 4<7 years old children), for energy and macronutrients considered in this research (21). The D-A-CH dietary references are used as reference values in many studies, including studies conducted in South-East Europe and in Balkan Countries.

1.5. Statistical analyses

The mean and the standard deviation were used to determine the central tendency and the dispersion of the data. Before proceeding with the statistical tests of differences between and among the groups, the Anderson-Darling (AD) test was used to test whether the dataset comes from a normal distribution. The mathematical expression of AD statistic is presented as in the following equation:

$$AD = -n - \frac{1}{n} \sum_{i=1}^n (2i-1) \ln F(X_i) + \ln(1 - F(X_{n-i+1}))$$

Where n stands for the sample size, $F(X_i)$ indicates cumulative distribution function for the specified distribution and i is the i^{th} sample when the data is sorted in ascending order. The Anderson-Darling test offered us evidence to say that the sample drawn from a population is normally distributed and, hence, we can hold **(on)** with the assumptions set when using Fisher's and T-test, e.g. the data is **continuous** (not discrete), the data follow normal probability distribution, the variances of the populations are equal and the samples are independent. In our study, all quantitative variables proved to be normally distributed at $P \leq 0.05$. Analysis of Variance (ANOVA) is used to test the differences between means of energy macronutrients among 5 treatments (kindergartens) for boys of age 1<4 and 4<7 and girls of age 1<4 and 4<7. The Fisher's test determined if significant differences exist between the 5

(kindergartens) sample means. Two sample t-tests are used to compare and see if there is significant difference between two treatments in our case means of energy macronutrients between public and private kindergartens for both boys of age 1<4 and 4<7 and girls 1<4 and 4<7, and the tested null hypothesis is expressed as $H_0: \mu_1 - \mu_2 = \delta_0$ while the alternative $H_1: \mu_1 - \mu_2 \neq \delta_0$. All tests were set at $P \leq 0.05$ level of significance and the statistical package Minitab version 17 was used for the statistical analyses of the data set.

2. Results

2.1. General characteristics of kindergarten

The study included 469 children, or more than 90% of registered children, in five selected kindergartens (87 children from a private kindergarten and 382 children from public kindergartens) participated in 3 days' dietary intake assessment through food measuring in kindergartens. In terms of gender, 256 were boys and 213 were girls. Data are presented for 237 pre-school children (ages 1<4 years) and 232 pre-school children (ages 4<7 years). In four out of five of the kindergartens, the food was cooked in the kindergarten's kitchen while, in one, the food was prepared elsewhere and distributed to the children as ready-to-eat food.

2.2. Energy and macronutrient intake

This study examined the energy and macronutrient intake data (full day programme – 8 hours) in 469 children (256 boys and 213 girls). Data are presented for 237 pre-school children (ages 1<4 years) and 232 pre-school children (ages 4<7 years). Because the D-A-CH reference values for energy and macronutrient intake vary according to age, children were stratified into two age groups – children aged 1<4 years and children aged 4<7 years. Energy and macronutrients intakes for both age groups are shown in Table 1, stratified by two age groups, by gender and by kindergartens. The estimated lowest energy intake of 292 kcal (26%) in 1<4 years old boys and 383 kcal (36%) in 1<4 years old girls was shown in kindergarten of Kamenicë. The estimated highest mean energy intake of

Table 1. Estimated energy and macronutrients intakes consumed by 1<4 and 4<7 years old children during the 8-h daily attendance at kindergartens in Kosovo.

Kindergarten	Public - Ferizaj	Public - Prishtinë	Public - Obiliq	Public - Kamenicë	Private - Prishtine	Public - Ferizaj	Public - Prishtinë	Public - Obiliq	Public - Kamenicë	Public - Prishtinë	Public - Obiliq	Public - Kamenicë	Private - Prishtinë	Fisher's test (p-value)
Age and sex	1<4 Years Boys (n=44)	1<4 Years Boys (n=32)	1<4 Years Boys (n=13)	1<4 Years Boys (n=7)	1<4 Years Boys (n=28)	1<4 Years Girls (n=41)	1<4 Years Girls (n=22)	1<4 Years Girls (n=16)	1<4 Years Girls (n=6)	1<4 Years Girls (n=28)	1<4 Years Girls (n=28)	1<4 Years Girls (n=6)	1<4 Years Girls (n=28)	Fisher's test (p-value)
Energy/macronutrients	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Energy (kJ)	3348 (322)	1712 (140)	2502 (120)	1223 (133)	3434 (269)	2960 (340)	1662.1 (70.7)	2336 (150)	1603 (482)	3519 (411)	18.94 (0.001)			
Energy (kcal)	800.4 (76.9)	409.4 (33.5)	597.9 (28.7)	292 (31.7)	821.1 (64.2)	707.7 (81.3)	397.2 (16.8)	558.2 (35.7)	383 (115)	841.5 (98.3)	18.97 (0.001)			
Carbohydrate (g)	120.2 (11.9)	61.8 (3.5)	83.7 (2.6)	45.93 (4.8)	105.5 (8.3)	108 (12.9)	58.9 (3.2)	77.8 (3.9)	59.5 (18.7)	107.8 (10.8)	13.69 (0.001)			
Protein (g)	30.4 (2.10)	15.1 (0.8)	22.9 (3.0)	9.3 (1.2)	25.1 (1.8)	27.5 (1.4)	15.3 (1.9)	21.5 (2.1)	12.4 (4.8)	25.8 (2.9)	15.44 (0.001)			
Fat (g)	21.0 (2.49)	10.8 (2.4)	18.2 (3.0)	7.5 (1.0)	32.3 (2.5)	17.6 (2.7)	10.7 (1.2)	17.1 (2.8)	10.2 (2.9)	33.2 (5.0)	25.78 (0.001)			
Fibre (g)	7.1 (0.6)	3.8 (0.3)	5.5 (1.2)	1.3 (0.2)	8.2 (1.3)	6.4 (0.8)	3.9 (0.3)	4.8 (1.0)	2.0 (1.2)	8.3 (1.7)	14.07 (0.001)			
PUFA (g)	1.2 (0.1)	1.7 (0.4)	0.8 (0.06)	1.3 (0.2)	1.2 (0.3)	1.0 (0.2)	1.8 (0.6)	0.8 (0.06)	2.0 (1.2)	1.3 (0.5)	5.49 (0.013)			
SFA (g)	4.0 (0.4)	2.1 (0.6)	4.5 (1.7)	3.1 (0.6)	2.3 (0.7)	3.0 (0.6)	2.3 (0.5)	4.2 (1.6)	4.1 (1.6)	2.5 (1.0)	1.76 (0.213)			
Age and sex	4<7 Years Boys (n=58)	4<7 Years Boys (n=32)	4<7 Years Boys (n=18)	4<7 Years Boys (n=6)	4<7 Years Boys (n=18)	4<7 Years Girls (n=51)	4<7 Years Girls (n=26)	4<7 Years Girls (n=9)	4<7 Years Girls (n=1)	4<7 Years Girls (n=13)	Fisher's test (p-value)			
Energy/macronutrients	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)			
Energy (kJ)	4700 (554)	2183 (160)	2554 (479)	2056 (524)	4033 (443)	4711 (841)	2142 (150)	2634 (139)	2054.5*	3966 (213)	17.87 (0.001)			
Energy (kcal)	1124 (132)	522.0 (38.2)	610 (114)	491 (125.1)	964 (106)	1126 (201)	512.1 (35.8)	629.4 (33.2)	490.8*	948.2 (51.0)	17.88 (0.001)			
Carbohydrate (g)	168.3 (20.4)	82.00 (4.6)	85.5 (13.7)	72.5 (16.1)	122.2 (11.5)	166.5 (28.5)	79.5 (7.3)	84.7 (5.2)	74.3*	122.1 (8.2)	16.84 (0.001)			
Protein (g)	39.9 (4.4)	21.4 (2.1)	29.7 (7.5)	19.7 (7.1)	30.9 (3.1)	41.1 (7.8)	20.9 (1.3)	31.9 (0.9)	18.6*	29.3 (1.1)	11.47 (0.004)			
Fat (g)	31.0 (3.6)	11.4 (1.1)	15.6 (3.2)	13.0 (3.1)	38.1 (5.3)	31.6 (6.0)	11.8 (0.8)	17.3 (1.0)	12.7*	37.1 (2.3)	33.08 (0.001)			
Fibre (g)	9.8 (1.3)	5.2 (0.1)	7.4 (1.2)	2.9 (1.021)	10.9 (1.5)	9.5 (1.6)	5.00 (0.4)	6.9 (0.8)	2.9*	10.5 (0.7)	17.45 (0.001)			
PUFA (g)	1.6 (0.06)	1.9 (0.4)	0.9 (0.3)	0.5 (0.1)	2.1 (0.3)	1.7 (0.3)	2.2 (0.2)	1.0 (0.0)	0.5*	2.0 (0.1)	10.61 (0.005)			
SFA (g)	4.6 (0.2)	2.1 (0.2)	2.5 (0.7)	3.7 (0.4)	2.6 (0.9)	5.1 (1.1)	2.0 (0.1)	2.5 (0.07)	3.5*	2.4 (0.8)	12.05 (0.004)			

*For the municipality of Kamenice only one girl was in the group of age 4-7. Therefore, girl of this group of age for Kamenica was not included in the analysis of ANOVA.

821.1 kcal (73%) in 1<4 years old boys and 841.5 kcal (80%) in 1<4 years girls was shown in the private kindergarten of Prishtina. Both the 4<7 years old boys and girls attending public kindergarten in Ferizaj had the highest estimated energy intake, 1124 kcal (80%) in boys and 1126 kcal (86%) in girls. The estimated lowest energy intake in 4<7 years old boys was shown in the kindergarten of Kamenicë, 491 kcal (35%), while the estimated lowest energy intake in 4<7 years old girls, 512.1 kcal (39%) was in the public kindergarten of Prishtina. The 1<4 years old boys and girls attending public kindergarten in Ferizaj had the highest mean intake of carbohydrate, 120 g respectively 108 g. The lowest carbohydrate intake in 1<4 years old boys and girls was in the private kindergarten of Prishtina, 105.5 g in boys and 107.8 g in girls. The highest carbohydrate mean intake in 4<7 years old boys was in public kindergarten in Ferizaj, 168.3 g, while the highest carbohydrate mean intake in 4<7 years old girls was shown in private kindergarten in Prishtina, 122 g. The lowest carbohydrate mean intake in 4<7 years old boys was in the private kindergarten of Prishtina, 122 g and the lowest mean intake in 4<7 years old girls was shown in the kindergarten of Obiliq, 84.7 g. The protein mean intake in 1<4 years old boys and girls attending public kindergartens ranged between 9.3 g in the public kindergarten of Kamenicë and 30.4 g in the kindergarten of Ferizaj. The protein mean intake in 4<7 years old boys and girls ranged between 19.7 g in the public kindergarten of Kamenicë (boys) and 41.1 g in the public kindergarten of Ferizaj (girls). The highest fat mean intake in 1<4 and 4<7 years old boys and girls was 33.2 g in 1<4 years old girls and 38.1 g in 4<7 years old boys attending private kindergarten in Prishtina. In contrast, the lowest fat mean intake in 1<4 and 4<7 years old boys and girls was 11.4 g in 4<7 years old boys attending public kindergarten in Prishtina. The SFA mean intake in 1<4 old boys and girls ranged between 2.1 g in 1<4 years old boys attending Public kindergarten in Prishtina and 4.5 g in 1<4 years old boys attending Public kindergarten in Obiliq. The SFA mean intake in 4<7 years old boys and girls ranged between 2 g in public kindergarten in Prishtina and 5.1 g in public kindergarten in Ferizaj. The lowest mean intake of PUFA was 0.46 g in 4<7 years old boys in kindergarten of Kamenicë, while the

highest mean intake of PUFA was 2.16 g in 4<7 old girls attending public kindergarten in Prishtina. Apart from kindergarten in Kamenicë, where fibre intake in 1<4 and 4<7 years old boys and girls was around 5 g/1000 kcalories, fibre intake in 1<4 and 4<7 years old boys and girls from other kindergartens was around 10 g in 1000 kcalories. Table 2 presents the mean intake of energy and macronutrients in 1<4 and 4<7 years old children during the 8-h daily attendance at all kindergartens in Kosovo compared to the reference intake values. The energy mean intake of 1<4 years old boys during their 8 hours stay in kindergartens was 584 kcal \pm 221 or 49 % of the daily recommended energy intake for boys (1200 kcal), and 578 kcal (\pm 195) or 52 % of the daily recommended energy intake for girls (1100 kcal). On the other side, the energy intake of the age group 4<7 years old children was 742 kcal (\pm 279) or 53% for boys and 792 kcal (\pm 282) or 61% for girls of the daily recommended energy intake. The percentage of the total energy intake derived from carbohydrates was around 57% of the reference intake for both 1<4 and 4<7 years old boys and girls. The protein mean intake was about 20.5 g, approximately the same in 1<4 old boys and girls. On the other side, protein mean intake in 4<7 years old boys was 28.3 g (\pm 8.8), while the protein mean intake in 4<7 years old girls was 29.7 g (\pm 8.9). The percentage of the total energy intake derived from fat was around 27.5 % in 1<4 years old boys and girls and 4<7 years old girls, while fat intake in 4<7 years old boys was 26.4 % of the daily reference intake. The mean percentage of energy derived from SFA (saturated fatty acids) was 5 % in 1<4 old boys and girls and around 3.5 % of daily reference intake in 4<7 years old boys and girls. The mean percentage of energy derived from PUFA (Polyunsaturated fatty acids) was less than 2% of daily reference intake. Table 3 shows the mean values of energy and macronutrient intakes in the public and private kindergartens. Statistical analyses have shown significant differences ($p \leq 0.05$) in terms of energy, carbohydrate, and protein and fat intakes between 1<4 years old boys and girls attending public and private kindergartens. Highly significant differences ($p \leq 0.001$) were observed in terms of fat and energy intakes between 1<4 and 4<7 years old boys attending public and those attending private kindergartens. Statistical tests do not

Table 2. Intake of energy and macronutrients in 1<4 and 4<7 years old children during the 8-h daily attendance at kindergartens in Kosovo compared to the reference intake values.

	Kosovo boys and girls 1<4 years		Reference intake values 1<4 years		Kosovo boys and girls 4<7 years		Reference intake values 4<7 years	
	boys (n=124)	girls (n=113)	boys	girls	boys (n=132)	girls (n=100)	boys	girls
Energy intake*, kJ/8 hours	2444 (±923)	2416 (±817)	4700**	4400**	3105 (±1166)	3315 (±1181)	6400**	5800**
Energy intake* kcal/8 hours	584 (±221)	578 (±195)	1200**	1100**	742 (±279)	792 (±282)	1400**	1300**
Carbohydrates, g/8 hours %E*	83.4 (±28.8) 57.1% (±19.7)	82.4 (±24.6) 57% (±17)	45-55% of energy intake**	45-55% of energy intake**	106.1 (±38.6) 57.2% (±20.8)	112.3 (±39.5) 56.7% (±19.9)	45-55% of energy intake**	45-55% of energy intake**
Protein g/8 hours %E*	20.57 (±7.9) 14% (±5.4)	20.49 (±6.5) 14.2% (±4.5)	14 ^a	14 ^a	28.3 (±8.8) 15.3% (±4.7)	29.7 (±8.9) 15% (±4.5)	18 ^a	18 ^a
Fat g/8 hours %E*	17.97 (±9.2) 27.7% (±14.2)	17.75 (±9.0) 27.6% (±14)	30-40% of energy intake**	30-40% of energy intake**	21.80 (±11.5) 26.4% (±13.9)	24.10 (±11.4) 27.4% (±12.9)	30-35% of energy intake**	30-35% of energy intake**
Fibre g/8 hours g/1000 kcal*	5.17 (±2.6) 8.85 (±4.4)	5.07 (±2.4) 8.77 (±4.1)	10g/1000kcal**	10g/1000kcal**	7.24 (±3.17) 9.75 (±4.27)	7.65 (±2.8) 9.65 (±3.5)	10g/1000kcal**	10g/1000kcal**
PUFA g/8 hours %E*	1.067 (±0.5) 1.64% (±0.8)	1.047 (±0.6) 1.63% (±0.9)	about 7% of energy intake**	about 7% of energy intake**	1.400 (±0.7) 1.69% (±0.8)	1.667 (±0.6) 1.89% (±0.6)	About 7% of energy intake**	About 7% of energy intake**
SFA g/8 hours %E*	3.21 (±1.2) 4.99% (±1.9)	3.21 (±1.3) 4.99% (±2.0)	maximal 10% of energy intake**	maximal 10% of energy intake**	3.11 (±1.1) 3.77% (±1.3)	3.11 (±1.4) 3.5% (±1.6)	maximal 10% of energy intake**	maximal 10% of energy intake**

Values are means ± SD

* = Energy and macronutrient intake during the 8-h daily attendance at kindergartens

^aD-A-CH recommendations for the age group of 1<4 and 4<7 years; values for sexes are common or separated [21].

** Reference intake values (daily recommendations)

Table 3. The mean values of macronutrient intakes in percentage of energy intake in the public and private kindergartens.

	1<4 Years Public Boys (n=96)^a	1<4 Years Private Boys (n=28)		1<4 Years Public Girls (n= 85)	1<4 Years Private Girls(n=28)	
Energy/ macronutrients	Mean (SD)	Mean (SD)	T-value (p-value)	Mean (SD)	Mean (SD)	T-value (p-value)
Energy (kJ)	2196 (±859)	3434 (±269)	-4.23 (0.001)	2140 (±635)	3519 (±411)	-4.60 (0.010)
Energy (kcal)	525 (±205)	821.1 (±64.2)	-4.24 (0.001)	512 (±152)	841.5 (±98.3)	-4.60 (0.010)
Carbohydrate (E%)	77.9 (±29.6)	105.5 (±8.3)	-2.81 (0.016)	76.1 (±23.1)	107.8 (±10.8)	-3.49 (0.010)
Protein (E%)	19.4 (±8.5)	25.1 (±1.7)	-2.15 (0.053)	19.2 (±6.6)	25.8 (±2.9)	-2.64 (0.030)
Fat (E%)	14.4 (±6.0)	32.3 (±2.5)	-7.85 (0.000)	13.9 (±4.2)	33.2 (±5.0)	-6.14 (0.026)
	4<7 Years Public Boys (n=114)^a	4<7 Years Private Boys (n=18)		4<7 Years Public Girls (n= 87)^a	4<7 Years Private Girls(n=13)	
Energy/ macronutrients	Mean (SD)	Mean (SD)	T-value (p-value)	Mean (SD)	Mean (SD)	T-value (p-value)
Energy (kJ)	2873 (±1184)	4033 (±443)	-2.72 (0.024)	3098 (±1301)	3966 (±213)	-1.92 (0.086)
Energy (kcal)	687 (±283)	964 (±106)	-2.72 (0.024)	741 (±311)	948.2 (±51.0)	-1.93 (0.086)
Carbohydrate (E%)	102.1 (±42.3)	122.2 (±11.5)	-1.45 (0.173)	109.1 (±45.6)	122.1 (±8.2)	-0.82 (0.436)
Protein (E%)	27.7 (±9.7)	30.9 (±3.10)	-0.98 (0.349)	29.8 (±10.5)	29.3 (±1.10)	0.14 (0.894)
Fat (E%)	17.7 (±8.5)	38.1 (±5.29)	-5.20 (0.003)	19.7 (±9.6)	37.1 (±2.3)	-4.99 (0.001)

show significant differences in terms of carbohydrate and protein intakes between 4<7 years old boys and girls attending public kindergartens and the boys and girls of the same age attending private kindergarten.

3. Discussion

The purpose of the present study was to assess the energy and macronutrients intake of preschool children (1<7 years old children), attending public and private kindergartens in Kosovo (full day programme – 8 hours). This study assessed energy and macronutrient contents of breakfasts, lunches and snacks consumed by pre-school aged children in kindergartens of Kosovo and compared those values with aged based references. To our knowledge, there are no other studies or reports of dietary intake in pre-school aged children in Kosovo for comparison of the findings from this study and for assessing how dietary intake has changed recently. This study is a part of a larger study on nutritional status of preschool aged children, thus it was possible to validate some

of the findings related to children's overweight and possible risk of being overweight. Even though our focus was on energy and macronutrients intake, we observed that children, when at public and private kindergartens (8 hours intake - breakfast, lunch and snack) in general, consume more food with high energy density and less nutrient-rich diet. Serving of specific processed food and sugar – sweetened beverages such as sugar-sweetened tea, chocolate cream, marmalade, biscuits, muffins, chicken pate, white bread and fruit-flavored drinks might have contributed towards the intake of empty calories. There are studies, which have assessed dietary sources of energy and nutrient intake and showed that bread and sweet snacks belong to the top ten sources of energy and main macronutrients and that empty calories come mostly from foods with high energy density (22,23).

Comparing five kindergartens, the intakes of energy (kJ, kcal), carbohydrates (g), protein (g), fat (g), fibre (g), PUFA (g) and SFA (g) have shown high significant differences amongst boys in both age groups (1<4 years and 4<7 years) as well as amongst girls in both age groups (1<4 years and 4<7 years) (p=0.001

and 0.037 respectively). The energy intake across the five kindergartens showed significant differences (between 292 ± 31.7 kcal and 1126 ± 201 kcal). The lowest energy intake was shown in the kindergarten of Kamenicë where daily energy requirement was covered only 26% in 1<4 years old boys and 36% in 1<4 years old girls. The estimated lowest energy intake in 4<7 years old girls was in the public kindergarten of Prishtina covering 39% of daily energy requirements, while the lowest energy intake in 4<7 years old boys was shown again in the kindergarten of Kamenicë covering only 35% of daily requirements.

The highest mean energy intake of 821.1 kcal or 73% of the daily energy requirement in 1<4 years old boys and 841.5 kcal or 80% of the daily energy requirement in 1<4 years girls was shown in the private kindergarten of Prishtina. Both the 4<7 years old boys and girls attending public kindergarten in Ferizaj had the highest estimated energy intake, 1124 kcal or 80% of the daily energy requirements in boys and 1126 kcal or 86% of daily energy requirements in girls. These huge differences should be a serious concern considering that, theoretically, it is almost impossible that children fulfill remaining daily energy requirements away from kindergartens. Comparing kindergartens, we tried to show differences between selected kindergartens (we assume that differences may be similar between other kindergartens, which did not participate in this study. We assume also that the main reason for such differences is that kindergartens in Kosovo lack dietary reference intake standards in preschool menus, which should advise on the structuring of meals for preschool aged children as well as advise on energy, macronutrients and micronutrients to be included in the diets. We consider these findings/differences (even though not representing all kindergartens in Kosovo) important and expect the government to mobilize and work on dietary guidelines. In many countries, children in full-day programs should receive foods that meet at least half to two thirds of a child's daily nutrition needs and there are studies, which show that children in full-time childcare obtain up to 75% or more of their daily energy requirements (15,24,25). For maintaining a healthy body mass, an adequate supply of energy is crucial (26), thus the findings of this study may be informative for nutrition policy that should ensure

adequate nutrition in preschool institutions of Kosovo for proper development of 1<7 years old children.

The summarized findings for all 469 examined children (256 boys and 213 girls) showed that the energy mean intake of 1<4 years old children during their 8 hours' stay in kindergartens was 584 ± 221 kcal for boys and 578 ± 195 kcal for girls (49 % for boys and 52 % of the daily recommended energy intake for girls). The energy intake in 4<7 years old children was between 742 ± 279 kcal for boys and 792 ± 282 kcal for girls (53 % respectively 60 % of the daily recommended energy intake). In general, the children attending five assessed kindergartens obtained little bit more than 50% (compared to D-A-CH reference energy values) of their daily energy requirements, leaving almost half to be consumed away from kindergartens.

Comparisons with studies from other countries are difficult because countries have different dietary intake references for preschool aged children and the duration of staying at the kindergartens is different. The intake references differ by definition and recommended intake levels differ between countries. The next comparison difficulty is also due to differences in dietary assessment methods as well as in the statistical procedures. Our results for 1<4 years old children are similar to some other studies that have shown that the energy intake of preschool aged children while in kindergartens is around 500 to 600 kcal (27-29). Apart from differences in the energy level, it was observed that imbalanced share of energy from each macronutrient and huge macronutrient intake differences between kindergartens. The lowest intake of carbohydrates in 1<4 years and 4<7 years old children was around 50 grams, while the highest intake was around 168 grams, while mean protein intake ranged between 9.3 g and 41 g. An enormous difference between kindergartens was shown in fat intake, which ranged between 11.4 g and 38.1 g. Overall, the mean carbohydrate intake in 1<4 and 4<7 years old boys and girls (469 examined children) during their 8 hours stay in kindergartens was around 57% (between 51 and 61% of total recommended energy intake). Children in our study met the carbohydrate intake recommended in D-A-CH reference values for those two mentioned age groups of children (45-55% of energy intake) during their 8 hours stay

in kindergarten. Although this study was not focused on the dietary intake of children away from kindergartens, it is expected that consumption value of carbohydrates increase when they are away. There are studies, which have found a greater consumption of sweets when children are away compared to the intake at the childcare centers. (30-32). There is also a study, which reported that children consume more calories than recommended away from kindergartens and these calories appear to come from energy-dense, nutrient-poor foods, namely sweet and salty snacks and sugar sweetened beverages (33). The links between carbohydrate intake and risk factors or diseases are limited (34), but there are studies which inversely relate a high carbohydrate intake with body fat and childhood obesity, dental caries etc. (35-37). The mean protein intake was around 20.5 g/8 hours (between 9.3±1.2 g and 30.4 ±2.1 g) in 1<4 old boys and girls and around 29 g/8 hours (between 12.4±4.8 g and 27.5 ±1.4 g) in 4<7 old boys and girls. In four out of five kindergartens, the average protein intake by 1<4 old boys and girls exceeded the daily reference values for protein intake (14 g/day), while in three out of five kindergartens, the 4<7 years boys and girls exceeded the daily reference values for protein intake (18 g/day). These results show that the recommendations for total protein intake were already fulfilled during the 8 hours stay of children in kindergartens. Mean energy intake from protein for children who participated in this study was similar to that reported in other studies (38,39). There are studies, which show high protein intake to be associated with different diseases such as hypertension, diabetes, obesity etc., but there are other studies, which showed that high intake of proteins, might help reduce weight and improve bone health (40,41). According to the cohort study in the Netherlands, a higher intake of proteins was associated with greater height, weight and BMI in children up to 9 years old (42). In our study, the mean percentage of energy intake from fat was around 27.5 % in 1<4 years old boys and girls and 4<7 years old girls, while fat intake in 4<7 years old boys was 26.4 % of the daily reference intake. This means that children, while at kindergartens, almost met the minimum daily reference values for energy intake from fat recommended for two age groups in

D-A-CH reference values (30-40% of energy intake for 1<4 years old children and 30-35% of energy intake for 4<7 years old children). This study shows that children while at kindergartens obtained between 3.5% and 5% of energy from SFA (D-A-CH reference energy intake from SFA is maximal 10%) and less than 2% from PUFA (D-A-CH reference energy intake from PUFA is about 7%). Adequate intake of total fat and fatty acids is considered important in meeting energy needs in childhood, while reduced intake of saturated fatty acids (SFA) and, in particular, reduced intake of polyunsaturated fatty acids (PUFA), are associated with problems in children's development and many functions in their organs (43). Low SFA is associated with reduced LDL cholesterol, blood pressure and, on the other side, PUFA are involved in cell membranes, neural, and immune functions (44,45). This study showed lower intake of saturated and unsaturated fatty acids intakes by Kosovo children in comparison with findings from EU and USA (46-49). Low PUFA intake by preschool-age children indicates that the energy balance and optimal nutrient intake is not in place and, therefore, influences the maintenance of healthy weight and optimal good health. The observed shortages in intake of fat and over-consumption of protein may be associated with inadequate share of significant food product groups, but also with insufficient supply of food products in the kindergartens menus. The main strength of this study lies in the fact that it provides, for the first time, valuable information about the energy and macronutrient intakes in kindergartens of Kosovo. The next strength of this study is that it indicates the need to look more closely into the nutritional quality of menus offered in kindergartens of Kosovo. This study has several limitations. The survey covered only energy and macronutrients intake by preschool children during their stay in kindergartens and not the intake away from kindergartens. Even though we believe that these results present the average energy and macronutrient intake by current kindergartens menus, further studies should assess the energy and macronutrients intake away from kindergartens. The Limited number of assessed children is the next limitation, because they may not reflect the general energy and macronutrient intake by all

preschool aged children in Kosovo. Further research should include an assessment of current energy and macronutrient intake in public and private kindergartens throughout Kosovo. Despite these limitations, to the best of our knowledge, this is the first study that has assessed energy and macronutrient intake by children attending kindergartens in Kosovo.

4. Conclusions

In conclusion, our findings provide useful information on energy and macronutrient intake by preschool-aged children during their stay in kindergartens. It was observed that meals, which are served in public and private kindergartens, do not follow recommendations for promotion of balanced healthy diets. The energy intake across the five kindergartens showed significant differences and it was observed that there was an imbalanced share of energy from each macronutrient. The dietary intake of children when in kindergartens contained more energy from protein and carbohydrates and less from fat. Our study highlights the need for uniform dietary legal standards of nutrition in kindergartens, based on recommendations for the age groups, which should be developed in Kosovo. Employment of dieticians in kindergartens would be a good start to improve the quality of menus served in kindergartens. Further research is needed to identify the health status and dietary quality of kindergarten meals as well as studies, which would assess the health effects of children's dietary pattern.

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