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Calculations on the energy and nutrient content of kindergarten menus in Estonia

T. Pitsi, T. Liebert and R. Vokk

Department of Food Processing, Tallinn Technical University, Estonia

Abstract

Objective: To evaluate kindergarten menus in the frame of the National Health Programme for Children in Estonia in order to guarantee optimal food intake for children.
Design: Five kindergarten menus were calculated in Tallinn and in a rural area in Estonia from February 1999 to December 2001, including both Russian and Estonian kindergartens with more than 700 children. The study was conducted using a Micro-Nutrica programme, the database with 700 foodstuffs and 900 ready-to-eat meals, with 56 characteristics of nutrients.
Results: Estonian kindergarten menus provided the recommended amount of food energy. The percentage of energy derived from saturated fatty acids was too high and that from polyunsaturated fatty acids too low. There was an insufficient content of vitamins C and D and dietary fibre in all kindergarten menus, and the content of other micronutrients differed from menu to menu.
Conclusions: The energy content of menus on different days should be balanced. There is a need to alter the balance of carbohydrates and fats in favour of increasing starch and lowering saturated fats. Insufficient amount of vitamins C and D in meals should be supplemented by adding casseroles, fruit juices and fish dishes. A correction should be made in favour of calcium and iron, and for a lower sodium content.

Keywords: *children's nutrition*; *daily kindergarten menus*; *energy and nutrient content*; *Micro-Nutrica*

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Introduction

Food serves as a construction material, as well as a source of energy for the body. Satisfying the body's needs for nutrients and energy is the basis for evaluating the nutritional value of food. Although children need the same nutrients as adults, the needs per kilogram body weight are much larger, as it is necessary to synthesize new tissues. The calculation of needs per kilogram body weight shows that a 5-year-old child needs over three times more iron and vitamin D, almost three times more vitamins C and B_{12} and nearly twice as much vitamin B_1 and calcium than a 25-year-old man (1).

A 3-year-old child needs approximately 5.5 MJ (1300 kcal) per day and a 6-year-old 7 MJ (1700 kcal) per day. Children require less energy than adults but the same amount of some nutrients, which means that a child's menu must have a higher nutrient density.

The average needs for energy and nutrients according to age (as well as the limits) are presented in Estonian Nutrition Recommendations based on Nordic Nutrition Recommendations, 1996 (1). Nutrient recommendations are given in the Regulation of the Minister of Social Affairs of Estonia, "Health protection requirement for catering facilities in pre-school and school institutions" (2).

The Estonian Child and Nutrition Survey carried out to study the health and nutritional status of urban and rural preschoolers showed that the mean energy intake of rural children was 628 kJ (150 kcal) lower than that of their urban counterparts (3). The diet of many urban and rural children was deficient in iron, calcium and vitamins D and C. Anaemia was noted in approximately 30% of children but remained masked owing to a lack of dietary assessment in this age group (3, 4). The evaluation of kindergarten menus provides additional informa-

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tion about preschool children's nutrition. Kindergarten menus are not to be underestimated, as a total of 40 440 children aged between 3 and 6 years, i.e. 77.1% of all children of this age group, attended state-owned kindergarten in Estonia in 2000. Separate kindergartens for Russian-speaking children make up to 30% of these, and the children's eating habits differ slightly.

The evaluation of kindergarten menus was carried out as a part of the National Health Programme for Children and Adolescents (1996–2005). It aims to improve the quality of kindergarten food and to enhance the health education of children and their parents. Healthy eating patterns in childhood promote optimal health and prevent some health problems in later years.

The aim of this study was to evaluate the energy and nutrition content of Estonian and Russian kindergarten menus in urban and rural areas and to compare the content of energy and nutrients with the Estonian Nutrition Recommendations. The results will serve as material for recommending healthy food choices to enhance the quality of children's meals.

Kindergartens usually provide three meals a day: breakfast, lunch and a light meal in the afternoon, with an interval of 3–4 h between them. Food served in kindergartens ought to cover 80–85% of a child's daily energy requirement: breakfast should cover 30–35%, lunch 40–45% and the light meal about 20–25% of daily energy requirements. Thus, kindergarten food should contain approximately 5.2–6.1 MJ (1240–1460 kcal) for children aged 3–6 years (2). The dietary fibre content in kindergarten menus was also calculated because of its special importance in childhood (5).

Methods

Two kindergarten menus (calculated over 40 days: a period for changing menus) in Saaremaa (a rural area) and three kindergarten menus (19 days) in Tallinn (capital of Estonia): an Estonian and Russian kindergarten in Mustamäe and an Estonian one in Lasnamäe, were studied between February 1999 and December 2001, during the same season. These kindergartens were randomly selected by regional and ethnic principles from the preschool institutions evaluated in the frame of National Health Programme for Children and Teenagers. The menus were collected in the form of food calculation sheets. Portion sizes were approximately the same in all the kindergartens. The study was conducted using a Micro-Nutrica programme. The Finnish programme and database were purchased from Finland for unified nutrition surveys in Estonia in 1995. The Micro-Nutrica database modified for Estonia consists of 700 foodstuffs and 900 ready-to-eat meals, with 56 characteristics on nutrients (6).

Results

Daily energy and nutrient recommendations for children of 4–6 years according to the Estonian Nutrition Recommendations are presented in Table 1.

Table 1. Energy and nutrient recommendations[a] for kindergarten daily menus (1) according to Estonian nutrition recommendations

Energy and nutrients	4–6 years
Energy (kJ/kcal)	5481/1305
Energy (BR) (kJ/kcal)	1638/390
Energy (L) (kJ/kcal)	2478/590
Energy (LM) (kJ/kcal)	1365/325
Protein (*E*%)	10–15
Fat (*E*%)	26–30
Carbohydrate (*E*%)	56–60
SFA (*E*%)	10
MUFA (*E*%)	10–12
PUFA (*E*%)	6–8
Cholesterol (mg)	200–240
Fibre (g)	16.4
Vitamin A (μg-ekv)	320
Vitamin D (μg)	8
Vitamin E (mg)	5.6
Vitamin B_1 (mg)	0.56
Vitamin B_2 (mg)	0.88
Niacin (mg-ekv)	9.68
Vitamin B_6 (mg)	0.72
Vitamin B_{12} (μg)	0.64
Folic acid (μg)	104
Pantothenic acid (mg)	3.2
Biotin (μg)	20
Vitamin C (mg)	36
Sodium (mg)	560
Potassium (mg)	880
Calcium (mg)	480
Magnesium (mg)	96
Phosphor (mg)	360
Iron (mg)	4.4
Zinc (mg)	5.2
Copper (μg)	455–1200
Iodine (μg)	55–95
Selenium (μg)	19.2

[a] Calculated as 80% of daily needs.

BR: breakfast; L: lunch; LM: light meal.

Table 2. Energy content, percentage of energy (*E*%) from the energy-yielding nutrients and content of fibre and selected nutrients in the menus

	Lasnamäe (T) *N* = 19 days	**1. Saaremaa (SKG1)** *n* = 40 days	**2. Saaremaa (SKG2)** *n* = 40 days	**Mustamäe Estonian (EKG)** *n* = 19 days	**Mustamäe Russian (RKG)** *n* = 19 days
Energy (kJ/kcal)	5473±130/1308±31	5711±167/1365±40	5389±172/1288±41	6393±243/1528±58	6360±176/1520±42
Protein (*E*%)	13.5±0.4	13.0±0.5	12.6±0.4	13.4±0.4	14.4±0.5
Fat (*E*%)	33.8±1.2	28.5±1.2	33.6±1.1	32.6±0.9	29.0±1.0
SFA (*E*%)	15.9±0.6	13.0±0.6	15.4±0.5	17.8±0.5	12.1±0.6
MUFA (*E*%)	9.7±0.5	7.7±0.3	9.3±0.4	9.1±0.4	8.9±0.3
PUFA (*E*%)	5.3±0.3	5.7±0.7	6.4±0.5	3.2±0.2	5.7±0.5
Carbohydrate (*E*%)	52.8±1.2	58.6±1.2	53.8±1.1	53.9±1.0	56.6±1.0
Cholesterol (mg)	173±13	171±21	198±22	233±32	209±28
Fibre (g)	10.7±0.4	12.4±0.4	11.1±0.6	12.8±0.6	19.4±0.9
Vitamin A (RE)	1022±429	2671±1297	3000±1482	2085±1333	680±77
Vitamin D (μg)	1.2±0.1	1.1±0.2	0.9±0.1	1.6±0.3	1.9±0.3
Vitamin E (mg)	5.4±0.3	7.6±1.1	7.9±0.8	3.9±0.2	7.5±0.8
Vitamin B_1 (mg)	0.5±0.0	0.5±0.0	0.6±0.0	0.7±0.0	0.6±0.0
Vitamin B_2 (mg)	0.9±0.1	0.9±0.1	1.0±0.1	1.1±0.1	0.8±0.0
Niacin (mg-ekv)	11.9±0.4	14.9±0.8	14.2±1.1	15.6±1.2	16.7±0.8
Vitamin B_6 (mg)	0.7±0.0	0.8±0.1	0.8±0.1	1.0±0.1	1.1±0.1
Vitamin B_{12} (μg)	5.0±2.1	12.9±6.3	14.2±7.3	10.9±6.4	3.8±0.4
Folic acid (μg)	101±6	118±12	122±16	140±15	135±6
Pantothenic acid (mg)	2.6±0.1	–[a]	–	2.7±0.4	3.0±0.1
Biotin (μg)	11.0±0.7	–	–	13.0±1.7	14.2±1.2
Vitamin C (mg)	34.0±5.0	27.3±3.0	20.3±2.2	31.0±3.2	27.9±3.2
Sodium (mg)	1705±73	1542±103	1566±109	1723±90	2712±108
Potassium (mg)	1904±50	2163±84	1906±96	2228±91	2457±82
Calcium (mg)	630±23	596±36	553±41	724±29	574±39
Magnesium (mg)	179±6	215±12	169±9	210±13	257±12
Phosphor (mg)	875±20	957±46	860±42	1050±41	1097±38
Iron (mg)	7.5±0.2	9.3±0.6	8.6±0.6	8.8±0.8	10.8±0.5
Zinc (mg)	6.5±0.2	7.3±0.4	6.4±0.4	7.3±0.5	9.1±0.3
Copper (μg)	853±147	1497±440	1489±495	1300±450	1090±40
Iodine (μg)	165±7	176±13	164±9	151±13	231±19
Selenium (μg)	39.5±1.4	44.4±2.7	42.1±2.4	47.3±3.6	53.6±3.3

Data are shown as mean±SD.

[a] No data available.

Average (mean±SD) energy and nutrient contents from Saaremaa and Tallinn kindergarten menus (Table 2) were compared with the norms calculated as 80% of daily recommendations.

The energy content of the menus in Lasnamäe's kindergarten (T) varied from 3845 to 7004 kJ (919 to 1674 kcal) on different days. Breakfast, lunch and a light meal contained 1389, 2469 and 1615 kJ (332, 590 and 386 kcal), respectively. Figure 1 illustrates the average content of energy of different meals compared with the recommendations.

On different days the energy content varied from 4510 to 7326 kJ (1078 to 1751 kcal) and from 3962 to 7280 kJ (947 to 1740 kcal), in the two rural kindergartens (SKG1 and SKG2, respectively). In the Saaremaa kindergarten SKG1, breakfast, lunch and a light meal provided 1460, 2690 and 1561 kJ (349, 643 and 373 kcal) energy and in SKG2 1318, 2636 and 1435 kJ (315, 630 and 343 kcal).

The average energy contents of the menu in Mustamäe's Estonian (EKG) and Russian (RKG) kindergarten are shown in Table 2. Breakfast, lunch and a light meal contained on average 1716, 2893 and 1784 kJ (410 kcal, 691 kcal and 426 kcal) in EKG, and 1803, 3017 and 1540 kJ (431, 721 and 368 kcal) in RKG.

Figure 2 illustrates the energy derived from protein, fat (saturated, monounsaturated, polyunsaturated fatty acids and other fats) and carbohydrates in the kindergarten menus.

In Lasnamäe's (T) kindergarten menus, proteins provided 13.5% and carbohydrates 52.8% of energy on average, which is close to the recommended limits. Fats provided 33.8% of energy, which is

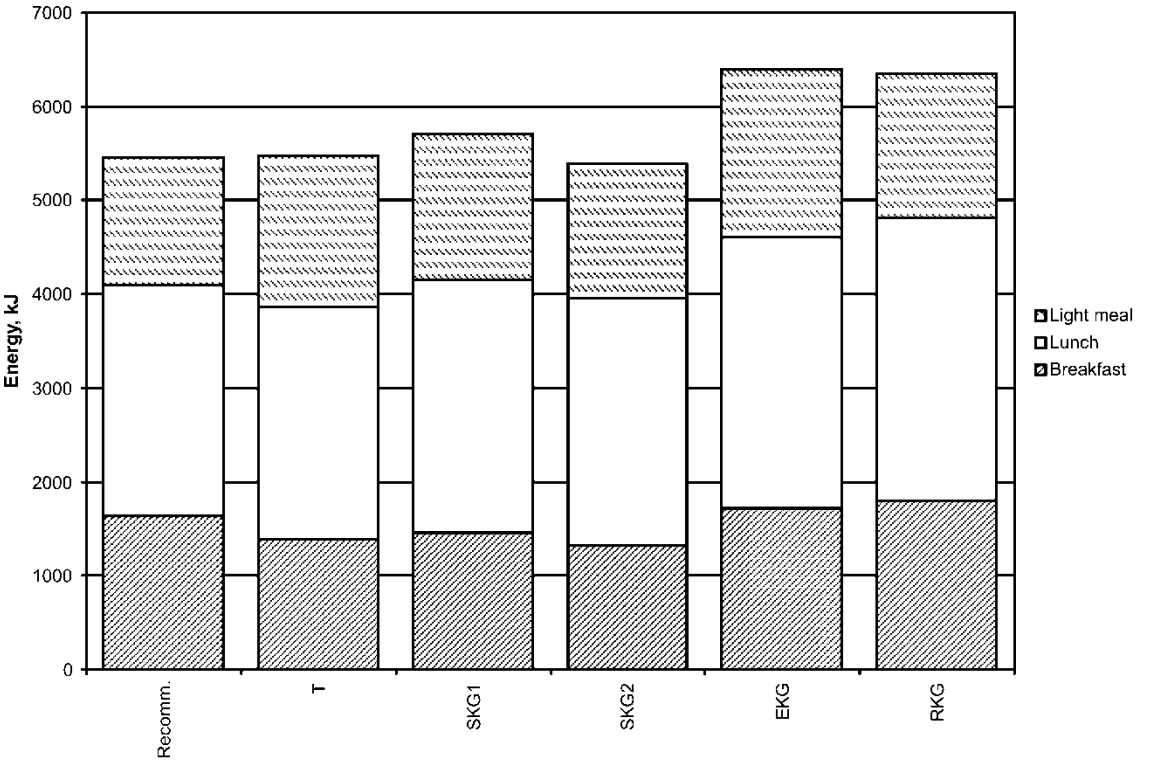

Fig. 1. Energy recommendations (1) and average energy content of different meals according to kindergarten menus.
T: Lasnamäe; SKG1: Saaremaa 1; SKG2: Saaremaa 2; EKG: Mustamäe Estonian; RKG: Mustamäe Russian.

rather high. The consumption of food energy from main nutrients on different days was unsatisfactory. For example, the proportion of carbohydrates in food energy on different days varied from 34.4 to

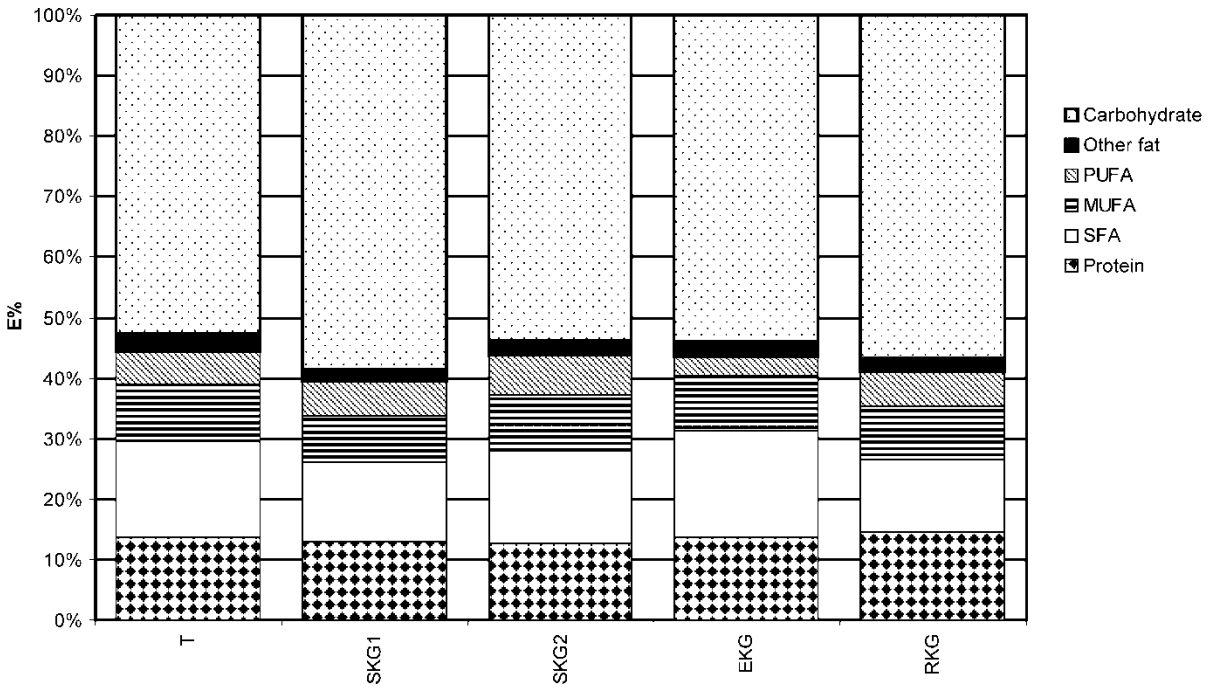

Fig. 2. Protein, fat [saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA) and other fat] and carbohydrate content in food according to kindergarten menus.
T: Lasnamäe; SKG1: Saaremaa 1; SKG2: Saaremaa 2; EKG: Mustamäe Estonian; RKG: Mustamäe Russian.

70.0% and that of fats from 17.5 to 53.9%. The percentage of saturated fatty acids was high and that of polyunsaturated fatty acids too low. The average cholesterol content was 173 mg and fibre content was 10.7 g, which is 65% of the recommended value.

In the Saaremaa kindergarten SKG1, the average percentages of food energy derived from protein, fat and carbohydrates were close to the recommendations. The percentage of food energy derived from saturated fatty acids was too high and that from polyunsaturated fatty acids too low. The average cholesterol content was 171 mg and the average fibre content 12.4 g.

In the second Saaremaa kindergarten (SKG2), the content of energy derived from fat was slightly too high and the content of energy derived from carbohydrates a little too low. The content of saturated fatty acids was too high and the content of polyunsaturated fatty acids too low. The average cholesterol content was 198 mg and the average fibre content 11.3 g.

In Mustamäe's Estonian kindergarten (EKG), protein provided on average 13.5%, fats 32.6% and carbohydrates 53.9% of energy. Saturated fatty acids gave on average 17.8%, monounsaturated fatty acids 9.1% and polyunsaturated fatty acids 3.2% of energy. In Mustamäe's Russian kindergarten (RKG), protein covered on average 14.4%, fats 29.0% and carbohydrates 56.6% of energy. Saturated fatty acids amounted to 12.1%, monounsaturated fatty acids 8.9% and polyunsaturated fatty acids 5.7% of energy. Thus, in the Russian kindergarten the energy distribution between nutrients was more suitable.

The average cholesterol content in both kindergartens was close to recommendations. There was a low content of dietary fibre. The content of micronutrients in the kindergarten menus is shown in Table 2. There was an insufficient amount of vitamins D and C in all kindergarten menus. In addition, Lasnamäe's kindergarten menus contained too little of vitamins E, B_1, B_6, folic acid, pantothenic acid and biotin. In the first Saaremaa kindergarten, the menu also had insufficient vitamin B_1.

In both of Mustamäe's kindergarten menus the calculation showed a potential deficiency of pantothenic acid and biotin. The Estonian kindergarten menus did not contain enough vitamin E and the Russian kindergarten menus did not provide a sufficient amount of vitamin B_2. All kindergarten menus met the requirements for all essential minerals. The only exception was calcium intake, because older children did not drink enough milk.

Discussion

The average energy content of different kindergarten menus was near to recommendations. The range of energy content of the menus on different days (e.g. in Lasnamäe's kindergarten) was unsatisfactory, varying from 3196 to 6017 kJ (764 to 1438 kcal). In kindergartens, lunch usually consists of soup or meat with supplements. On 'soup days', the energy content of the menus was usually too low and should be balanced with energy-rich desserts. Some correction is needed in the energy distribution of different meals. For example, the average energy content of lunches and light meals was too high in almost all kindergartens, but the energy content of breakfast was too low in Saaremaa's and Lasnamäe's kindergartens. The sodium content of food was remarkably higher in the Russian kindergarten than in the Estonian kindergartens, even though the sodium content was about four-fold higher than the recommendation in the Estonian kindergartens.

Although the average distribution of energy between main nutrients was close to the recommendations, it was quite unsatisfactory on some days. The content of saturated fatty acids was too high and the content of polyunsaturated fatty acids too low in all kindergarten menus. It has been shown by British nutritionists that there is a particularly marked fall in vitamin C intake as saturated fat intake increases (7). The present menu calculations showed that the vitamin C content was too low in all menus. Therefore, more plant products such as vegetable and fruits should be added to the menus; this would also increase the dietary fibre content, which is very important in childhood (5).

In composing menus, more attention should be paid to vitamins. The menus provided only 11–24% of the recommended amount of vitamin D. This should be corrected by the addition of more fish dishes. Dietary supplements and fortified food products are not commonly used in kindergartens in Estonia.

In the UK it was reported that one in five preschool children have iron-deficiency anaemia and calcium intakes are similarly inadequate (8). The present menu calculations did not show any insufficient content of essential minerals. Moreover,

in kindergarten menus the content of iron was 150–245% and the content of calcium 120–166% of the recommended values. However, because of the low content of vitamin D provided, calcium might not to be fully absorbed and utilized. Nevertheless, a preschool-based survey carried out in Sweden showed that there may be reasons to limit preschool children's daily milk and fermented milk intake to 0.5 litre (9).

Kindergarten menus are more balanced than Estonian school lunch menus (10, 11). The energy content of menus on different days should be balanced, and insufficient amounts of vitamins D and C recovered by adding more fish dishes, casseroles and fruit juices.

Nutrition education for children and parents, increasing the nutrient density of the daily diet, and encouraging increased physical activity level are useful strategies in assuring a balance of nutrients to support optimum growth and avoid obesity (12). Within the framework of the National Health Programme for Children and Teenagers a special catering manual with recommendations dedicated to children's food in kindergartens (65 day menus) has been published (13). The prepared catering manual gives the recommendations for a better choice of food. Kindergartens can compile their own list of daily menus, taking account of cost. This allows children to be provided with balanced food, irrespective of their social background. Dietary adequacy with respect to different nutrient parameters of provided food is also related to socio-economic factors, as shown in different countries (4, 14–16). Watt et al. (16) pointed out that their findings emphasize the need for a range of public health policies that focus on the social and economic determinants of food choice within families. Therefore, in Estonia emphasis should be placed on the use of local fruit and vegetables at reasonable prices. In future, the optimal balancing of kindergarten menus to analyse simultaneously all the food groups presented in daily menus should provide a useful visual tool for elucidating how foods are related in the diet.

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Raivo Vokk
Department of Food Processing, Tallinn Technical University, Ehitajate tee 5, Tallinn 19086, Estonia
Fax: +372 6202950
E-mail: raivov@hotmail.com