

Consumption of milk products, calcium and vitamin D by Estonian children in 1996 and 2002

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Abstract

Background: Dairy products are major contributors of dietary calcium owing to their high calcium content, high bioavailability of calcium and frequency of consumption.

Objectives: The aim of this paper was to compare the consumption of milk products, calcium and vitamin D among a group of 3–4-year-old Estonian children in 1996 and the same children in 2002 when they were 9–11 years old.

Design: The analysis was based on 3-day dietary record data collected from children and their parents. The intakes of calcium and vitamin D were compared with the Estonian recommended daily intakes based on the Nordic Nutrition Recommendations. Nutrient analysis was done using the Finnish Micro-Nutrica programme adapted for nutrient surveys in Estonia.

Results: The mean calcium intake in both rural and urban children was above the recommended daily intake (RDI) at 3–4 years of age, while it was close to the RDI at 9–11 years of age. The mean calcium density was lower at 9–11 years of age than at 3–4 years of age. Milk and dairy products were the primary sources of calcium: in 1996 milk as a beverage contributed 66% of calcium in the diets of rural children and 44% in those of urban children. In 2002 the calcium contribution by milk as a beverage was lower (50% in rural and 39% in urban children). The mean intakes of vitamin D did not meet the RDI in either age group in either period and were below 50% of recommended levels.

Conclusions: The mean calcium density in diets of 3–4-year-olds (476 mg 1000 kcal⁻¹) was higher than that of 9–11-year-olds (422 mg 1000 kcal⁻¹), but the intake of foods prepared with milk declined in both areas from 1996 to 2002. The intake of vitamin D was very low in 1996 and continued to be low 6 years later. More effective nutritional educational efforts are needed to emphasize the importance of adequate calcium and vitamin D intake. Strategies including milk fortification in Estonia should be considered.

Keywords: *calcium and vitamin D intake; children's nutrition; Micro-Nutrica*

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Introduction

Dairy products are major contributors of dietary calcium because of their high calcium content, high bioavailability of calcium and frequency of consumption. However, milk consumption patterns have changed markedly over the past few decades. In the USA between 1977 and 1994 milk consumption declined by 24% among boys and 32% among girls aged 6–13 years (1). There have also been changes in the type of milk products that children consume. The total consumption of milk products by German children over the age of 4 years has

remained stable, although sources have changed. Reduced milk consumption has been compensated for by the increased consumption of yoghurt. There was also a change in the percentage of low-fat milk products in German children's menus, which increased to nearly 25% of milk products (2). A similar trend has occurred in Finland, so that skimmed and reduced-fat milk are the most popular at present (3).

Vitamin D metabolites play a critical role in bone formation. Fatty fish is one of the best natural sources of vitamin D, but fish is not commonly

eaten in quantities adequate to meet the need for vitamin D, except in a few countries such as Japan where vitamin D intake was $7.1 \mu\text{g day}^{-1}$ per person. Fish products contribute 91% to the total Japanese vitamin D intake (4). In the Baltic republics fish intake is modest (22 kg per person per year in Estonia, 21 kg in Latvia and only 16 kg in Lithuania) and so cannot be relied on as an adequate source of vitamin D (5).

A Swedish survey of 15-year-old adolescents found that the mean intake of vitamin D was below the nutritional recommendations (6). One option to ensure vitamin D sources is the fortification of milk with vitamin D. In Finland, for example, vitamin D intake by adolescents increased from 3.7 to 6.6 μg per day after milk fortification. (7).

About 75% of 3–6-year-old children in Estonia attend kindergarten. Analysis of kindergarten menus showed that calcium levels are 120–160% of the Estonian recommendations, provided mainly by dairy products, but that vitamin D content is very low, at 20–40% of recommended daily intake (RDI) (8).

Methods

The aim of this paper was to compare the consumption of milk products, calcium and vitamin D among a group of 3–4-year-old Estonian children in 1996 and the same children in 2002 when they were 9–11 years old. The survey in 1996 was carried out in May and June, and in 2002 from June to August.

Food and nutrient intake is based on 3-day dietary record data collected from children and/or their parents. Children and/or parents were taught how to fill in the records during the initial survey interview. Portion sizes were suggested, to be written down in household measures (spoonful, decilitre, diameters or lengths in centimetres, etc.), and in grams only if this was written on the eaten item's package and the whole item was eaten. Afterwards, these household measures were weighed for every food item and grams were used for menu input. Completed diaries were reviewed by the interviewer and questions were clarified with the parents by telephone. Parents signed an informed consent form before participation in the study.

The analysis is based on data gathered during the Estonian Small Child Health and Nutrition Survey carried out in 1996 (9) and a follow-up Child Health and Nutrition Survey done in 2002. The subjects

were children from the central region of the city of Tallinn, the capital of Estonia (considered urban children), and Viljandi county, in southern Estonia (considered rural children). In 1996 the target group included 114 urban and 163 rural children, aged 3–4 years. Children were invited to participate in the study by either their paediatricians (rural children) or their family doctors (urban children). All Estonian children of the appropriate age were recruited in both areas; however, only one child per family was included. The participation rate was 51% for urban and 61% for rural children.

In the follow-up study 2002 74 urban and 75 rural 9–11-year-old children were examined. An attempt was made to reach all participating children from the 1996 study by telephone. Fifty-one urban children (62%) and 73 rural children (65%) from the original study also participated in 2002. Those who did not participate in the follow-up study were unavailable for a variety of reasons, including being unreachable, having moved away or being away on a summer camp. Others were not interested. This analysis also includes the data from 9–11-year-old children not in the original sample (1996) who participated in the second round in 2002.

Only children with a complete 3-day food diary were included in this analysis. The analysis includes data from 82 urban and 112 rural children (in 1996) and 57 urban and 47 rural children (in 2002). In the latter analysis group 18 urban and 11 rural children had not participated in 1996.

It can be assumed that there was no substantive difference in the food-related behaviour of the children between those who participated in both years and those who only took part in 2002.

The intakes of calcium and vitamin D were compared with the (RDIs for both age groups (10, 11). Calcium intake was calculated per 1000 kcal (4200 kJ). Nutrient analysis was done using the Finnish Micro-Nutrica programme, adapted for nutrient surveys in Estonia (12).

Results

Mean daily intake of milk and milk products is shown in Table 1. Total intake is similar in both groups in both periods, but choices changed considerably. Intake of foods made with milk declined in both areas (urban: $p < 0.023$; rural: $p < 0.003$). Rural children in the 2002 survey (9–11-year-olds) drank more milk than the urban children ($p < 0.003$). Intake of fermented fluid milk products

Table 1. Consumption of milk products (g) by urban and rural children in 1996 and 2002

	1996		2002	
	Urban	Rural	Urban	Rural
Milk as a beverage:				
>3.5% fat	47	182	20	163
2.5% fat	131	19	169	48
Skimmed milk	3	0	5.8	0
Milk in prepared foods	79	156	57	106
Sour milk products	96	30	90	52
Cheese, curd	44	15	43	16
Ice-cream, puddings	22	20	42	44

(yoghurt, kefir) was higher in both areas in 2002 (9–11-year-olds) ($p < 0.0001$). Intake of cheese and curd was also higher in both areas in 2002 (urban: $p < 0.022$; rural: $p < 0.001$).

Mean calcium intake of urban children in 1996 was 701 ± 28 mg and that of rural children was 659 ± 24 mg per day (Table 2) (12). Mean calcium daily intake of urban children was 775 ± 41 mg (97% RDI) and that of rural children was 757 ± 44 mg (95% RDI). Twenty seven per cent of 9–11-year-old

children consumed 400–599 mg, 25% 600–799 mg and 23% 800–1000 mg of calcium. Mean calcium intake varied from 399 ± 18 mg 1000 kcal^{-1} (9–11-year-old rural children, 2002) to 492 ± 15 mg 1000 kcal^{-1} (3–4-year-old urban children, 1996).

Table 1 shows the intake of different types of milk. Reduced-fat milk (2.5% fat) was the most popular in urban areas in both periods. Intake of whole milk was lower in 2002 in urban areas ($p < 0.028$) than it had been in 1996. Although in rural areas whole milk was more popular, the consumption of reduced-fat milk increased from 1996 to 2002 ($p < 0.05$).

Calcium sources in the diets of children are shown in Fig. 1. Milk and dairy products were the primary sources of calcium. In 1996 (3–4 years old) milk as a beverage contributed 66% of calcium in the diets of rural children and 44% in those of urban children. In 2002 (9–11 years old) milk and dairy products were still the main sources of calcium, but the proportion of calcium contributed by milk as a beverage was lower (rural: 50%; urban: 39%). Vegetables and fruit contributed 6–11% and other foods 13–15% of the dietary calcium.

Table 2. Intakes of dietary energy, vitamin D and calcium by urban and rural children in 1996 and 2002

	n	Energy (kcal day^{-1})					Vitamin D ($\mu\text{g day}^{-1}$)					Recommendation (10, 11)
		Mean	SE	Med.	Min.	Max.	Mean	SE	Med.	Min.	Max.	
1996												
3–4 years	194	1422	26	1382	796	2788	2.0	0.1	1.6	0.1	7.9	
Urban	82	1428	38	1402	796	2788	1.6	0.1	1.4	0.4	5.7	5
Rural	112	1417	34	1313	881	2613	2.4	0.1	1.9	0.1	7.9	
2002												
9–11 years	104	1832	42	1788	861	3105	1.9	0.1	1.7	0.3	6.3	
Urban	57	1768	49	1776	861	2490	1.8	0.1	1.6	0.3	6.3	5
Rural	47	1909	70	1823	979	3105	2.1	0.1	1.9	0.5	5.6	
	n	Calcium ($\text{mg } 1000 \text{ kcal}^{-1} \text{ energy}$)					Calcium (mg day^{-1})					Recommendation (10, 11)
		Mean	SE	Med.	Min.	Max.	Mean	SE	Med.	Min.	Max.	
1996												
3–4 years	194	476	10	476	199	868	677	18	633	249	1498	
Urban	82	492	15	493	199	855	701	28	667	270	1498	600
Rural	112	465	13	458	200	868	659	24	614	249	1308	
2002												
9–11 years	104	422	14	414	159	774	767	30	732	291	1729	
Urban	57	441	20	436	186	774	775	41	729	317	1461	800
Rural	47	399	18	396	159	688	757	44	770	291	1729	

1 kcal = 4.2 MJ.

Med.: median; Min.: minimum; Max.: maximum.

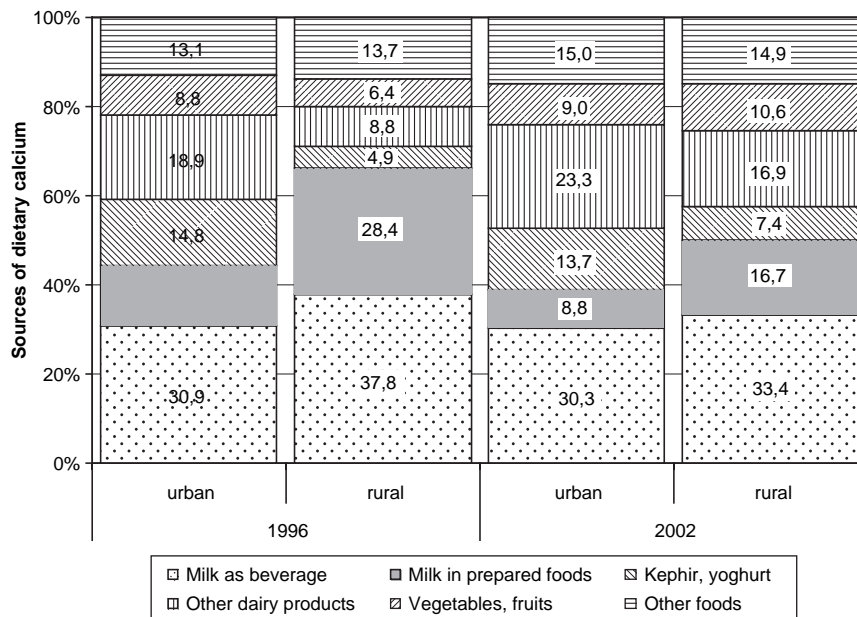


Fig. 1. Sources (%) of dietary calcium.

The mean intakes of vitamin D did not meet the RDI in either age group in either period (Table 2) and were below 50% of recommended levels. The 3–4-year-old urban children (1996) had the lowest intake of vitamin D ($1.6 \pm 0.1 \mu\text{g day}^{-1}$), while the 3–4-year-old rural children (1996) had the highest intake of vitamin D ($2.4 \pm 0.1 \mu\text{g day}^{-1}$).

Dietary sources of vitamin D are shown in Fig. 2. Foods from the meat–poultry–eggs group were the highest contributors (28–39% of total vitamin D

intake). Added fats (margarine) contributed 25–34% and milk products only 12–15%. In 1996 fish and fish products were the source of 33% of the vitamin D in rural children and 19% in urban children. Six years later this had dropped to 7% and 19%, respectively.

Discussion

In 1996 the mean calcium intake by 3–4-year-old children exceeded the RDI for this age group. In

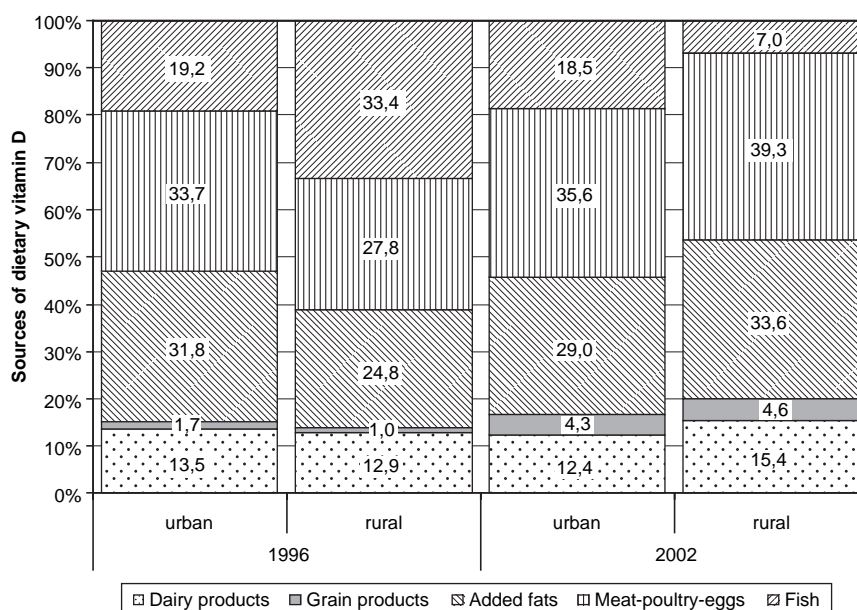


Fig. 2. Sources (%) of dietary vitamin D.

2002 the mean intake of dietary calcium for the children at age of 9–11 years did not meet the RDI. The dietary intake of 60% of 9–11-year-old children failed to meet the RDI.

The mean calcium density in diets of 3–4-year-olds was higher (476 ± 10 mg 1000 kcal⁻¹) than that in 9–11-year-olds (422 ± 14 mg 1000 kcal⁻¹) ($p < 0.009$). This difference may be partially explained by the fact that older children tend to eat away from home more frequently. Eating away from home may influence calcium intake through the greater availability of alternate beverage options. US survey data indicate that the calcium density of food consumed outside the home was 343 mg 1000 kcal⁻¹, compared with food consumed at home (425 mg 1000 kcal⁻¹) and at school (689 mg 1000 kcal⁻¹) (1). By comparison, the calcium density of Estonian kindergarten meals is lower, ranging from 378 to 481 mg 1000 kcal⁻¹ (8).

Examination of dietary sources of calcium showed that 80% is contributed by milk and dairy products. Children drank almost the same amount of milk when they were 9–11 years old as they had at 3–4 years old. However, the intake of foods prepared with milk declined in both areas between 1996 and 2002. The increased intake of other, more expensive, milk products (cheese, yoghurt, etc.) in 2002 was partly a reflection of an increase in living standards.

The type of milk consumed had also changed in 2002. In 1996 91% of rural children and 26% of urban children drank unprocessed whole milk (average fat content 4.2%). In 2002 this had decreased to 77% and 10%, respectively. During the period when low-fat and fat-free milk products were becoming very popular in other countries (5, 6), rural Estonian children did not drink milk with a fat content of less than 2.5%. Skimmed milk was also not popular among urban children. There is only one producer of skimmed milk in the Estonian market, the selling amounts are not remarkable and it is sold only in some supermarkets. There is practically no price differences between skimmed milk and milk with 2.5% fat content.

The vitamin D intake of children in the survey was very low, on average 40% of RDI, and the median intake was even lower. The main sources of vitamin D were meat, poultry, eggs and added fats (vitamin D-fortified margarine). Fish, a source of naturally occurring vitamin D, is not consumed

frequently by children in Estonia. In fact, it is difficult to meet the recommended level of vitamin D without fortification of foods or the use of supplements. The Fortification of Food in Europe Conference (Copenhagen, Denmark, June 2004) concluded that fortification can be a useful tool in increasing vitamin D intake. Fortified foods are minimally available in Estonia, the main vitamin D-fortified food being margarine (7.5 µg vitamin D per 100 g), but not all types of margarine on the market are fortified.

The results of this study indicate that the intake of food sources of calcium and vitamin D of surveyed children were not dramatically different at 9–11 years of age than they had been at 3–4 years, although there were some shifts in the types consumed. The intake of milk as a beverage remained almost the same and kefir use increased at the expense of milk used in food preparation. The average intake of calcium, although somewhat greater, was not enough to meet the requirement for more than half of the children at 9–11 years of age. The intake of vitamin D was very low in 1996 and continued to be low 6 years later. More effective nutrition educational efforts are needed to emphasize the importance of adequate calcium and vitamin D intake, as well as to encourage the intake of major food sources of calcium and vitamin D. Strategies, including milk fortification, as in Finland (7), should be considered.

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