

Food consumption and nutrient intakes with a special focus on milk product consumption in early pubertal girls in Central Finland

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Abstract

Objective: To evaluate the current status of dietary intakes in early pubertal girls with a special focus on milk products.

Design: Cross-sectional data using 3-day food records.

Subjects: Eight hundred and sixty girls, aged 10–12 years, at Tanner maturation stage I–III.

Results: The mean consumption of milk products (620 g day^{-1}) was similar to that of a Finnish study in the 1980s, while the consumption of non-milk drinks (403 g day^{-1}) had increased. Twelve per cent of the girls had a dairy-restricted diet and consumed significantly less milk products than girls with a non-restricted diet (465 vs. 644 g day^{-1} , $P < 0.001$). Girls with low milk product consumption had the highest non-milk drinks consumption ($P < 0.001$). The mean energy intake was 7.1 MJ day^{-1} . No major changes were found in the sources of nutrients. The shares of energy for nutrients were close to recommendations except for saturated fat (13.9 vs. 10% of energy) and carbohydrates (51.5 vs. 55–60% of energy). The mean calcium intake (1117 mg day^{-1}) was above the recommendation, while the vitamin D intake ($3.1 \mu\text{g day}^{-1}$) of 88% of the girls was below the recommendation.

Conclusions: The diet quality of early pubertal girls is close to the recommendations and has improved with respect to fat compared with the 1980s. Consumption of milk products is high although the consumption of non-milk drinks has increased. We found a subgroup of girls who compensate their low milk product consumption with a higher consumption of non-milk drinks. Following a dairy-restricted diet is the main reason for low consumption of milk products.

Keywords
Milk product consumption
Dietary intakes
Pubertal girls
Nutrition education

Childhood is a time when basic healthy eating habits can be established. The maintenance of healthy eating patterns and an adequate diet is important during puberty. The diet of children and adolescents has changed during past decades in Finland, like in other Western countries^{1–3}. The latest studies on dietary habits of adolescents in Finland indicate that only 13% of pupils eat their entire school meal although they are served a well-planned, varied meal (e.g. warm dish, salad, bread and milk), which is even free of charge. Over 60% of teenage girls drink water instead of milk at school⁴. The consumption of different kinds of snacks, especially soft drinks and candy, during the school day has increased and there is a decreasing trend for having dinner with the family on school days^{5,6}. These findings cause concern among nutrition educators.

Earlier studies on Finnish children mostly focused on the prevention of heart disease and specifically on the quality of fat in the diet^{7–9}. The present study is a part of Calex (calcium and exercise) study which aims to prevent osteoporosis. Therefore we focused on the consumption

of milk products and intakes of calcium and vitamin D with the purposes of (1) evaluating the current food consumption, nutrient intakes and sources of nutrients in prepubertal and early pubertal Finnish girls and (2) comparing the results with common Nordic nutrition recommendations and earlier Finnish studies for the same age group.

Materials and methods

Study design

The subjects were 10–12-year-old volunteers who took part in the screening phase of a large intervention study during autumn 1999 and 2000 to evaluate the effect of calcium and vitamin D supplementation on bone growth. First we contacted class teachers teaching 4th to 6th grades in 61 schools in the city of Jyväskylä and the surrounding area in Central Finland (96% of schools). The teachers asked pupils voluntarily to take home an informed consent form and instructions for both the parents and children on how to fill in the questionnaires and food

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records. Of the 1854 girls who took the materials home, 1163 (63%) co-signed the informed consent with their parents and agreed to participate in the study. The study protocol was approved by the ethical committees of the University of Jyväskylä, the Hospital of Central Finland and the Finnish National Agency of Medicines.

Subjects

Of the 1163 girls who agreed to participate in the study, 1043 filled in the screening identification forms and food records. Among them, 80 girls did not have Tanner stage information or the stage was > III (four girls), 10 girls were under (< 10 years) or over (\geq 13 years) the target age, and 89 girls did not have either weight or height information or had incomplete food records. Thus the final dataset in this report includes 860 girls ($n = 479$ in the year 1999, and $n = 381$ in the year 2000).

Anthropometric measurements

Girls underwent a physical examination conducted by a public health nurse. The physical maturation status was determined by the developmental patterns of the breasts and pubic hair according to the Tanner grading system. If there was a disagreement between the breast and pubic hair development, the final decision was made based on the breast development.

Weight and height were self-reported in 1999, and measured in 2000 with the subjects wearing school clothing and no shoes, and 1 kg was deducted from the weight for clothes. The self-reported versus measured weight differed significantly only in the girls at age 10 (34.7 vs. 36.0 kg, $P = 0.049$) and no differences were found in height.

Food records

Three consecutive days' food records were completed by the children with their parents' help (two weekdays and one weekend day or in reversed order). The food records contained time of eating, items and portion of food. The families were given written instructions and an example of how to record food consumption with help of a portion guidebook. Details of all foods and drinks, including the type and commercial brand name, were entered in the records. In addition, the type of diet (if restricted) was

asked as a separate question. During the coding process, nutrition students checked the food records.

Analysis of nutrient intakes

Dietary intakes were analysed using the Micro-Nutrica software (version 2.5) developed and maintained by the Social Insurance Institution of Finland. Daily food consumption as foodstuff ingredients was calculated for the following main food groups: cereals, vegetables (including potatoes), fruits (including berries and whole fruit juices), milk products (including cheese), meat, fish, eggs, fats (including butter, margarines and oil), non-milk drinks (including cola drinks, other soft drinks, ready-to-drink juices, coffee and tea) and sweets (including sugar, candy and chocolate). We updated the original Micro-Nutrica database with foodstuffs that had been fortified with calcium (e.g. juices).

For this report, we chose energy and 18 nutrients that we considered indicators for the quality of diet or important nutrients for bone health. Nutrient losses caused by food processing were not taken into account and the intakes of nutrients from supplements were not included. We compared the nutrient intakes with national nutrition recommendations based on the common Nordic Nutrition Recommendations^{10,11}.

Statistical analyses

SPSS version 11.0 for Windows (SPSS Inc., Chicago, IL, USA) was used. All data were checked for normality using the Kolmogorov–Smirnov test. Descriptive statistics are used to present the anthropometric and nutrient data. The independent samples *t*-test was used to compare differences between two groups. One-way analysis of variance followed by the Bonferroni *post hoc* test was used to compare differences between the quartiles of foods consumed. A *P*-value of < 0.05 was considered significant.

Results

Anthropometric and dietary characteristics of the study subjects

Physical characteristics of the subjects in different age groups are given in Table 1. In this study, 12% of the children reported following a dairy product-restricted diet (different stages of lactose intolerance, milk allergy and

Table 1 Tanner maturation stage, weight, height and body mass index (BMI) of the study subjects according to age group. Values are mean (standard deviation) unless indicated otherwise

	All girls ($n = 860$)	≥ 10 to < 11 years ($n = 470$)	≥ 11 to < 12 years ($n = 241$)	≥ 12 to < 13 years ($n = 149$)
Age (years)	11.0 (0.9)	10.4 (0.3)	11.4 (0.4)	12.3 (0.3)
Tanner stage				
I/II/III (n)	419/367/74	332/137/1	71/143/27	16/87/46
I/II/III (%)	49/43/8	71/29/0	29/60/11	11/58/31
Weight (kg)	38.2 (8.3)	35.6 (7.4)	39.9 (8.1)	43.7 (8.3)
Height (cm)	145.7 (8.3)	141.7 (6.6)	148.6 (7.2)	153.9 (6.4)
BMI (kg m^{-2})	18.1 (2.8)	18.0 (2.8)	18.0 (2.7)	18.4 (2.9)

aversion to milk). Three per cent reported food allergies and only six girls a vegetarian diet.

Food consumption

The daily consumptions of foodstuffs by the main food groups are presented in Fig. 1. On average, the girls consumed 464 g of milk and 27 g of cheese per day. During the food record period, 12% of the girls did not drink milk at all. Of the milk consumers, 54% used 'light milk' (1.5% fat) and 30% used fat-free milk. Seven per cent of the girls used lactose-reduced milks, and 3% used only sour milk. About 60% of the girls reported consuming

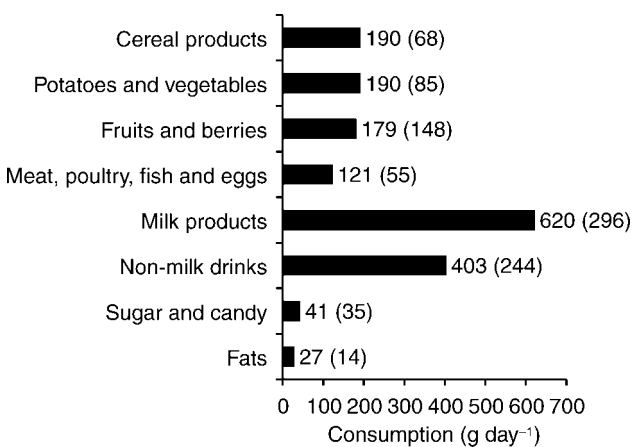


Fig. 1 Mean food consumption by the main food groups (standard deviation in parentheses)

different sweetened sour milk products (e.g. yoghurts) and 50% reported drinking chocolate and eating ice cream at least once during the 3 days.

Girls who reported following a diet restricted for dairy products consumed less milk products than those who had an unrestricted diet (465 vs. 644 g day⁻¹, $P < 0.001$). The average consumption of different kinds of non-milk drinks was 403 g day⁻¹; the cut-off point for the highest quartile was 543 g day⁻¹ and that for the lowest was 219 g day⁻¹. Soft drinks and ready-to-drink juices were the most popular, and only 30% of the children drunk coffee or tea. In addition, we found that girls in the lowest quartile of milk products (≤ 404 g day⁻¹) consumed more non-milk drinks (490 vs. 352 g day⁻¹, $P < 0.001$) than girls in the highest quartile (≥ 801 g day⁻¹).

Energy and nutrient intakes

The mean intakes of energy and nutrients are presented in Tables 2 and 3, and compared with the recommendations. The energy intake distribution was similar to the energy intake reference values of the Finnish recommendations for this age group¹⁰. Energy intake increased slightly with age from 7.0 to 7.4 MJ day⁻¹ (1680 to 1760 kcal day⁻¹, $P = 0.075$). A great majority of the girls (88%) had vitamin D intake below the recommended level (milk drinks were not fortified with vitamin D at the time). The corresponding figures for vitamin E and folate were 82% and 73%, respectively. Similarly, over 60% of the girls had low magnesium and potassium intakes, and 90% had iron

Table 2 Intakes of energy, energy-yielding nutrients and fibre, and comparison with the Finnish recommendations¹⁰

Nutrient and units	Recommendation	Mean (SD)	95% confidence interval	
			Lower	Upper
Energy				
MJ	8.4	7.1 (1.6)	7.0	7.2
kcal	2010	1700 (381)	1675	1725
Protein				
g		66 (17)	65	67
% energy	10–15	15.7 (2.7)	15.5	15.9
Fat				
g		60 (19)	59	61
% energy	≤ 30	31.5 (5.6)	31.1	31.9
SFA				
% energy	< 10	13.9 (2.9)	13.7	14.0
MUFA				
% energy	10–15	9.8 (2.2)	9.6	9.9
PUFA				
% energy	5–10	4.5 (1.6)	4.4	4.6
Carbohydrates				
g		218 (53)	214	222
% energy	55–60	51.5 (6.1)	51	52
Sucrose				
g		38 (18)	37	39
% energy	< 10	8.9 (3.4)	8.6	9.1
Fibre				
g		15.2 (5.0)	14.9	15.5
g MJ ⁻¹	3	2.2 (0.7)	2.1	2.2

SD – standard deviation; SFA – saturated fatty acids; MUFA – monounsaturated fatty acids; PUFA – polyunsaturated fatty acids.

Table 3 Intakes of vitamins and minerals, and comparison with the Finnish recommendations¹⁰

Nutrient and units		Recommendation	Mean (SD)	95% confidence interval	
				Lower	Upper
Vitamin A	RE	800	942 (1411)	848	1037
Vitamin D	µg	5	3.1 (1.9)	3.0	3.2
Vitamin E	TE	8	6.1 (2.3)	5.9	6.2
Thiamin	mg	1.0	1.1 (0.3)	1.1	1.1
Riboflavin	mg	1.2	1.9 (0.7)	1.9	2.0
Folate	µg	240	212 (61)	208	216
Vitamin C	mg	50	86 (51)	83	90
Calcium	mg	900	1117 (420)	1089	1146
Magnesium	mg	280	262 (64)	258	267
Phosphorus	mg	700	1346 (356)	1322	1370
Potassium	mg	3100	2846 (715)	2798	2894
Iron	mg	12–18	9.0 (2.5)	8.8	9.2
Zinc	mg	8	10.6 (3.8)	10.4	10.9

SD – standard deviation; RE – retinol equivalents; TE – tocopherol equivalents.

intake below the recommendations. After adjusting for energy, all of these vitamins and iron (mean for vitamin D, $0.4 \mu\text{g MJ}^{-1}$; vitamin E, 0.9 tocopherol equivalents MJ^{-1} ; folate, $30 \mu\text{g MJ}^{-1}$; iron, 1.3mg MJ^{-1}) remained below the recommended levels.

Sources of nutrients

The most important sources of energy in the girls' diet were cereals and milk products, both supplying a quarter of the total intake. Milk products yielded 29% of the total fat intake, while 32% came from edible fats. The major part of saturated fatty acids (SFA) came from milk products (42%), whereas margarines and oils were the most important sources of polyunsaturated fatty acids (42%). Milk products were also the main source of protein (39%). Cereals supplied about 40% of the total carbohydrates, but also milk products were a remarkable source of carbohydrates supplying alone 17% of the total sucrose intake.

Milk and milk products were the most important source of calcium (81%). Milk products were also a major source of riboflavin, and a remarkable source of magnesium, phosphorus, potassium and zinc (63%, 29%, 47%, 33% and 33%, respectively). Vegetables and cereals were equal sources of folate in the diet, both accounting for a quarter of the intake, but milk products yielded nearly as big a share (21%). Cereals were the main source of fibre (61%), thiamin (31%), iron (44%) and magnesium (31%). Nearly 80% of vitamin C intake came from vegetables and fruits. Dietary fats were the major sources of vitamins D and E (45% and 33%, respectively). Fish alone accounted for 24% of the vitamin D intake for those girls who ate fish. Half of the girls did not eat fish at all during the food record period.

Discussion

We found that the most noticeable differences in diet compared with the report of the 1980s were in the consumptions of fats and non-milk drinks⁷. The total

consumption of non-milk drinks has nearly doubled. No major differences were found in total consumption of milk products *per se* and, as a consequence, calcium intake was at the same level as reported earlier. Furthermore, no major changes were found in the sources of nutrients. However, a great many of the children in our study consumed sweetened milk products, which is partly due to their expanded availability over the last 20 years. The total consumption of cereals, as well as of meat, fish and eggs, remained at a similar level as in the early 1980s. Unlike adults, whose consumption of vegetables and fruits has been reported to have increased during the past two decades, girls of the present study consumed a similar amount of vegetables compared with their counterparts in the early 1980s, while fruit consumption decreased slightly^{7,12}. Any conclusion about the adequacy of different food groups consumed cannot be stated because of the lack national food-based recommendations.

Energy intake was about 10% lower in this study compared with reports from the 1980s^{7,13}. Our finding is in line with some other Finnish studies on the same age group and older children^{9,14}. The lower energy intake in this study can be explained by the lower consumption of fat than the levels reported earlier and there has been an overall decrease in the fat content of commonly used foodstuffs (e.g. milk and meat products, bread spreads). We also found a favourable shift in the quality of fat compared with the 1980s, which indicates improved fat quality of the foodstuffs consumed (e.g. bread spreads)^{7,13}.

Milk products and the whole diet

The role of milk products as a source of different nutrients in the diet is similar to that in the earlier report⁷. On the other hand, milk products still yielded a great part of SFA despite their decreased fat content during the past 20 years.

We found in many cases that a modified diet based on intolerance, food allergy or aversion was the reason to

restrict milk product consumption. Still, the modified diets could not fully explain the reduced dairy product consumption in this subgroup. There is a wide assortment of alternative milk products for lactose-reduced diets in Finland. This indicates that changes in eating habits might be the real reason for reduction of milk product consumption. We also found a subgroup whose low milk product consumption was associated with a high consumption of non-milk drinks. These findings provide a challenge for nutrition educators to design effective ways to reverse the trend towards increasing consumption of soft drinks and different kinds of juices. At the same time, we need to maintain the favourable changes that have occurred in the content and quality of fat in the diet. Promoting the consumption of fat-free milk products and vegetable fats will keep the fatty acid content in balance. Fortification of liquid milk products with vitamin D, which was commenced in the year 2003 in Finland, might increase the intake of vitamin D to the recommended level in milk drinkers. Those children who avoid liquid milk products should be guided to use vitamin D supplements in the dark wintertime.

Methodological aspects of the study

Our study has some limitations especially with regard to the non-responders. The children and parents who agreed to participate in this study might be more conscious or concerned about health and nutrition than the non-responders. In a Swedish study of schoolchildren, the non-participants differed significantly from the participants with respect to sociodemographic, lifestyle and dietary factors¹⁵. In a selected subgroup ($n = 258$) we evaluated the welfare of the children's families by a separate questionnaire. We found the socio-economic status of these families to be similar to that of average Finnish families with children (personal communication). We found that subjects in excluded data were significantly younger, less matured and smaller than the girls in the included data ($P < 0.001-0.06$). This is mainly due to the exclusion criterion of age used. Although the exclusion did not affect the main results, this fact should be taken into account when interpreting our results.

Underreporting is a common cause of bias in dietary surveys using food records and underestimation of energy intake is associated with obesity in adults^{16,17}. This may also hold true for children, especially for those who feel that they should be on a diet or are overweight. In our data, especially fat used on bread and added sugar may have been underreported. It is also possible that the low intakes of several nutrients are due to the low total consumption of food. To avoid the biases and possible effects of underreporting, we adjusted the nutrients to energy in our analyses.

In this study all food records were collected near the weekend. This might result in overestimation of the consumption of soft drinks owing to the fact that children

drink more soft drinks during the weekend than on weekdays. On the other hand, the method of recording food consumption over three consecutive days can induce a decline in the food items reported over the recording period¹⁵. However, the 3-day food record has been evaluated as the best overall choice compared with other dietary methods in the study of 9–10-year-old girls¹⁸.

Conclusions

Our results indicate that the most notable differences in food consumption are reduced fat and increased non-milk drink intakes compared with the study conducted in the 1980s in Finland. Milk products turned out to be the main sources of many nutrients. The average milk product consumption is still high and therefore the mean calcium intake is adequate. However, there seems to be a subgroup that compensates their low consumption of milk products with a higher consumption of non-milk drinks. Overall, the mean quality of the diet of the children as evaluated by the shares of nutrients to energy is close to the recommendations, except for saturated fat and carbohydrates. Special focus should be given to those early pubertal girls who have modified diets or restrict their consumption of milk products.

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