Milk and dairy products in adolescent diet according to sex and living area

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Summary

The aim of this study was to determine the portion of the milk and dairy products as source of energy, macronutrients and calcium in average daily diet of adolescents according to sex and living area. A group of four hundred and forty one adolescents (46 % from rural, and 54 % from urban area in Croatia), both sexes, between 15 to 18 years of age, who attended high school represented the study subject. Weight and height were determined using standard techniques and following the norms of the WHO. Food frequency questionnaire (FFQ) for mass and frequency as well as energy and nutritional components of dairy products intake were used. The results indicated that adolescents in urban area consumed statistically significant ($p<0.05$) higher amount of milk and dairy products. Higher intake of energy, protein and calcium from milk and dairy products among adolescents in urban area was also observed. Average intake of calcium according to recommendation (RDA) is adequate for sex and age among subjects in urban are. Lower calcium intake was observed among the girls. In terms of food types, higher fat content dairy products were consumed among adolescents in both living areas, while according to sex, girls mostly consumed less fat milk and dairy products. According to body mass index (BMI) adolescents in both living areas were nourished well.

Key words: milk and dairy products, adolescents, sex, living area

Introduction

Adolescence is a period of increase in nutrient requirements due to intense physical growth and development what makes adolescents very sensitive to an

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inadequate nutrition (Whitney E.N. & Rolfes S.R., 1999). Healthful eating habits can best be achieved by consumption of a varied moderate diet that includes food from each of the major food groups as illustrated by the US Department of Agriculture Food Guide Pyramid (US Dept of Agriculture). Milk and diary products are recommended because of high calcium content, high quality proteins, well balanced macronutrient content and beneficial effects of fermented diary products on human health (Hagemeister *et.al.*, 1990; Hitchinks A.D. and McDonough, 1989.; Parodi, 1997.). It is very difficult to meet calcium needs without a source of milk in the diet and it is advisable that 60 % of RDA for calcium is diary calcium (Infante and Tormo, 2000.). Failure to meet calcium requirements in adolescence can impede the achievement of maximal skeletal growth and bone mineralization, increasing the risk of developing osteoporosis later in life (Matkovic and Ilich, 1993.). Some studies have shown that inadequate calcium intake is consequence of a decline in milk consumption and substantial increase in soft drinks consumption (Johnson, 2000.). Also high protein intake often reported in adolescent diets can cause increment in renal excretion of calcium (Heaney,1993.; Parizkova, 2000.).

The aim of this study was to evaluate the consumption of milk and dairy products in daily diet among urban and rural adolescents.

Materials and methods

The investigation was carried out among 238 urban and 203 rural adolescents aged 15-18 years (Table 1). Mean age was 15.8 ± 0.69 and 16.1 ± 0.64 in urban and rural area respectively. Both genders participated (33.8 % boys and 66.2 % girls). Subjects were recruited from secondary schools from Zagreb (the capital – urban area) and Istria (rural area). School principals approved the study protocol.

The monitoring of food consumption was performed using food frequency questionnaire (FFQ). The method was found to be useful in measuring intakes for a variety of nutrients and also in measuring calcium intake (Pao and Cypel, 1990.; Cavadini,1999.; Angbratt and Moller, 1999.). The questionnaire contained 83 food items with available range of consumption frequency from “once a month” to “once or more than once a day” and was open-ended to indulge the assessment of consumption of foods that were not listed. The portion sizes were based on typical or natural portion consumed

(e.g. slice, piece, cup, glass, etc.). When a typical or natural portion size was uncertain, portion size was declared as small, medium or large. To determine the weight of consumed food predefined measures for all foods and portion sizes were provided (Colić, 1987.). Nutritive value of consumed food was calculated using the food composition tables (Kulier, 1990.). Nutrient intakes were observed with regard to recommended dietary allowances (RDA) (The National Academy of Science 1989.; Regulation of the health accuracy of food, 1994.).

Table 1: Subjects defined by age and gender
Tablica 1: Ispitanici s obzirom na dob i spol

Parameters Parametri	Urban area Urbana sredina	Rural area Ruralna sredina
Age (years)/Dob (godine)		
Boys/Dječaci	15.9±0.74	16.3±0.64
Girls/Djevojčice	15.7±0.64	16.0±0.63
Number (n) / Broj (n)		
Boys/Dječaci	60	178
Girls/Djevojčice	89	114

The survey was performed in a form of personal interview in schools. Qualified interviewers used pictures and dish models to clarify portion sizes. Fulfilment of each questionnaire approximately required 80 minutes. Anthropometric study included measurements of body height, weight and fat tissue, and was performed in morning hours. Height was measured on the portable stadiometer to the nearest 0.5 cm with subjects standing without shoes, heels together and head in horizontal Frankfurter plane. Body weight was measured on the electronic scale, with subjects only lightly dressed (Tanita Corp., Tokyo, Japan). Body mass index (BMI, kg/m^2) was calculated with regard to gender. A statistical analysis was performed with StatSoft. Inc. Version 5.1, including F-test as well (Fisher and Yates, 1957.).

Results and discussion

Daily energy intake was within recommended values in both urban and rural areas (Table 2). The lowest energy intake, although still satisfying (90,1 % RDA), had the girls from rural area. Significant difference was observed between urban and rural area, where higher energy intake had urban

adolescents (Table 2). In both urban and rural areas, females had lower energy intake than males what is often reported (Brown, 1990.).

Table 2: Daily energy, protein and calcium intake (x ± sd) (%RDA)
Tablica 2: Dnevni unos energije, proteina i kalcija (x ± sd) (%RDA)

Parameters Parametri	Urban area Urbana sredina	Rural area Ruralna sredina
Energy intake/ Unos energije*		
Boys / Dječaci	130.2±46.75	99.8±34.18
Girls / Djevojčice	118.1±44.81	90.1±44.81
Protein intake / Unos proteina*		
Boys / Dječaci	243.1±81.11	116.9±54.19
Girls / Djevojčice	206.8±79.90	158.2±65.87
Calcium intake / Unos kalcija*		
Boys / Dječaci	160.8±60.6	89.6±32.83
Girls / Djevojčice	101.7±48.91	72.6±26.96

* difference between urban and rural area assessed by F-test; p<0,05

Protein intake, as reported in similar studies, in both urban and rural areas was higher than recommended, and significantly higher in urban area and in average higher in males than females (Table 2) (Brown, 1990.; Colić Barić, *et al*., 2000.). High protein intake can have adverse affect on renal calcium excretion (Teegarden, 1999.).

Table 3: Energy, protein and fat intake by milk and dairy products (x ± sd) (% of daily energy)
Table 3: Unos enrgije, proteina i masti mlijekom i mliječnim proizvodima (x ± sd) (% cjelodnevnog unosa)

Parameters Parametri	Urban area Urbana sredina	Rural area Ruralna sredina
ENERGY/ENERGIJA		
Boys / Dječaci	18.2±8.28	16.1±7.73
Girls / Djevojčice	18.6±8.30	18.3±7.62
Protein/ Proteini*		
Boys / Dječaci	34.6±14.01	26.5±11.13
Girls / Djevojčice	33.8±13.16	30.8±12.14
Fat / Masti		
Boys / Dječaci	22.0±12.55	17.7±8.74
Girls / Djevojčice	21.6±11.21	21.5±10.75

* difference between urban and rural area assessed by F-test; p<0,05

Average daily calcium intake in urban area exceeded 100 % RDA, while in rural area calcium intake was under recommended values, especially in girls (72.6 % RDA) (Table 2). Also among urban adolescents, girls had lower calcium intake than boys, as observed in similar study (Table 2) (Colić Barić *et al.*, 2000a). Since adolescence is a period when peak bone mass is formed, low calcium intake among girls represents a potential health problem for osteoporosis in the postmenopausal years (Matkovic and Ilich, 1993.).

Higher intake of phosphorus, vitamin A, B_1 and B_2 by milk and dairy products was observed among adolescents in urban area.

Table 4: Consumption frequency of milk and dairy products (% subjects)
Tablica 4: Učestalost unosa mlijeka i mliječnih proizvoda (% ispitanika)

Parameters Parametri	Urban area Urbana sredina		Rural area Ruralna sredina	
	Boys Dječaci	Girls Djevojčice	Boys Dječaci	Girls Djevojčice
Milk/Mlijeko				
1x/day / dan	69	59	61	47
3-6 x/week / tjedan	25	24	20	26
1-2x/week / tjedan	6	12	16	14
< 1x/week / tjedan	0	5	3	13
Yogurt/Jogurt				
1x/day / dan	31	17	6	18
3-6 x/week / tjedan	8	25	20	21
1-2x/week / tjedan	39	44	37	39
< 1x/week / tjedan	22	17	37	22
Cheese/Sir				
1x/day / dan	21	6	41	16
3-6 x/week / tjedan	43	25	8	6
1-2x/week / tjedan	29	44	16	24
< 1x/week / tjedan	7	25	35	54
Puding/Puding				
1x/day / dan	0	8	4	0
3-6 x/week / tjedan	0	0	2	2
1-2x/week / tjedan	40	58	35	26
< 1x/week / tjedan	60	34	59	72

Milk and diary products provided from 16.1 to 18.6 % of daily energy intake, can be considered favourable when compared with recommended 20 % (Table 3). Dairy protein intake (% of daily intake) was significantly higher in urban than rural area, as well as total daily protein intake (Tables 2 and 3).

Fat intake by milk and diary products was very similar in girls from both living areas (21.5 and 21.6 % of daily intake in rural and urban area, respectively) (Table 3). Daily fat intake for the boys from urban area, provided from dairy foods, was higher than in rural area (22.0 vs. 17.7 %) (Table 3). Dairy fat is mostly saturated but can be considered better than other fat of animal origin (Parodi, 1997.).

Table 5: Antropometric characheristic of subjects ($x \pm sd$)
Tablica 5: Antropometrijske osobitosti ispitanika ($x \pm sd$)

Parameters Parametri	Urban area Urbana sredina	Rural area Ruralna sredina
Weight/Tjelesna masa (kg)		
Boys / Dječaci	66.9±11.54	72.4±9.65
Girls / Djevojčice	58.2±7.53	60.7±7.77
Height/Tjelesna visina (cm)		
Boys / Dječaci	177.4±5.80	178.8±5.07
Girls / Djevojčice	167.2±6.15	162.3±7.22
Body mass indeks (BMI) (kg/m^2)/ Indeks mase tijela (BMI) (kg/m^2)		
Boys / Dječaci	21.0±3.11	22.6±2.84
Girls / Djevojčice	20.8±2.27	22.0±2.20

The amount of milk consumed is 99 and 94 % for rural and urban population, respectively. Milk intake at a younger age may contribute to similar habits of milk intake later in life (Teegarden et al., 1996.; Elbon et al., 1996.). Skipping breakfast was observed in 1.0 % of urban population while all subjects from rural area reported regular daily breakfast consumption. Higher breakfast skipping in urban area probably caused lower percent of milk consumers, as milk is the most common breakfast food. No allergy or lactose intolerance has been reported for milk-protein consumption.

Milk and diary products are the best calcium sources. Some studies have shown that calcium supplements are inappropriate due to calcium interaction with iron, thus decreasing iron absorption (Allen and Wood, 1994.).

Calcium intake by cheese and fermented diary products was similar in both living areas. In rural area milk provided less calcium than non-diary foods; in urban area it was *vice versa.*

In Table 4 consumption frequencies of milk (milk or cocoa drink), yoghurt (plain yoghurt, fruit yoghurt or acid milk), cheese (all types) and pudding are shown. Because of low butter consumption, it was not presented separately but is included in "cheese". Forty seven percent of girls from rural area consumed milk daily what is less when compared with urban adolescents and rural boys (Table 4). This explains the lowest observed calcium intake among rural girls (Table 2). Yoghurt is mostly consumed 1-2 times per week in both urban and rural area (Table 4). Cheese and pudding were more often consumed among urban than rural adolescents (Table 4).

Some studies have shown that inadequate calcium intake is consequence of a decline in milk and substantial increase in soft drinks consumption (7).

When anthropometric parameters were compared between urban and rural adolescents, no significant difference was observed, although in rural area BMI in average were higher than in urban area (Table 5).

Conclusions

The results indicated that adolescents in urban area consumed statistically significant higher amount of milk and dairy products. Higher intake of energy, protein and calcium from milk and dairy products among adolescents in urban area was also observed. Lower calcium intake was observed among the girls. Milk was the most common diary food consumed.

In terms of food types, higher fat content dairy products were consumed among adolescents in both living areas, but according to sex, girls mostly consumed less fat milk and dairy products. According to BMI adolescents in both living areas were nourished well.

ZASTUPLJENOST MLIJEKA I MLIJEČNIH PROIZVODA U PREHRANI ADOLESCENATA S OBZIROM NA SPOL I SREDINU U KOJOJ ŽIVE

Sažetak

Cilj ovog rada bio je utvrditi udjel mlijeka i mliječnih proizvoda, kao izvor energije, makronutrijenta i kalcija u prehrani adolescenata s obzirom na spol i sredinu u kojoj žive. Ispitanike je činila skupina od 441 srednjoškolskog učenika (46 % iz ruralne i 54 % iz urbane sredine u Hrvatskoj), oba spola, dobi 15-18 godina. Tjelesna masa i visina ispitanika utvrđena je standardnom tehnikom utvrđenom od WHO. Upitnik o učestalosti i vrsti konzumiranja (FFQ) namirnica iz skupine mlijeka i mliječnih proizvoda, korišten je i za utvrđivanje mase konzumiranih namirnica. Na osnovi dobivenih podataka utvrđena je zastupljenost, te energetska i prehrambena vrijednost namirnica iz navedene skupine, u strukturi cjelodnevnih obroka. Rezultati ukazuju na statistički značajniji ($p<0,05$) udjel mlijeka i mliječnih proizvoda u prehrani adolescenata iz urbane sredine. Stoga je utvrđen i značajniji unos energije, proteina i kacija iz navedene skupine namirica u istoj populacijskoj skupini. Prosječni unos kalcija, s obzirom na preporučeni dnevni unos (RDA) adekvatan je u adolescenata iz urbane sredine s obizom na dob i spol. Ipak, niži unos kalcija utvrđen je među ispitanicima ženskog spola. Rezultati ukazuju na značajniju zastupljenost namirnica s većim udjelom masti u prehrani svih ispitanika. Utvrđena je međutim razlika u odabiru namirnica s obzirom na spol, pa djevojke konzumiraju proizvode s manje masti. Prema indeksu mase tijela (BMI) svi ispitanici su adekvatno uhranjeni.

Ključne riječi: *mlijeko i mliječni proizvodi, adolescenti, spol, sredina u kojoj se živi*

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