

UDC 614.31:613.2

ISSN 1330–9862

original scientific paper

(FTB–1028)

## Dietary Habits and Nutritional Status of Adolescents

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Received: March 3, 2000

Accepted: May 17, 2000

### Summary

A person selects foods for a variety of reasons. Whatever those reasons may be, food choice influences human health. The most vulnerable populations are teenagers and adolescents who make many food choices for themselves.

The aim of the study was to assess the quality of adolescents daily diet and some nutritional habits (number of meals, frequency of consuming foods) using Food Frequency Questionnaire designed for this purpose as well as additional questions on habits (smoking and alcohol consumption). The sample included 233 adolescents aged from 15 to 17 years. Few different tables, as well as one containing chemical contents of local dishes, were used to determine the quantity of energy, proteins, total fats, carbohydrates, fatty acids, cholesterol and alcohol intake. Body mass index (BMI), centiles of weight *vs.* height, and body fat composition, were taken into consideration. The differences between sexes were analysed using statistical F-test and a correlation between the anthropometric and dietetic data (correlation coefficients) were calculated. With respect to the average daily food intake, the results showed that adolescents consume higher levels of total and saturated fats and cholesterol, and lower levels of carbohydrates. They were also deficient in their consumption of vegetables and fruits, while an excessive amount of sweets and soft beverages was also consumed. According to BMI 82 % of adolescents were nourished well, while body fat was higher in comparison to referent values. The differences between the sexes were found with regard to the mean quantity of food intakes (meat and meat products, milk and dairy products, vegetables, fruits), energy distribution, consumed alcohol, smoking habit, body fat, as well as in the number of over- and undernourished adolescents.

Nutrition education and continuous studying of adolescent daily diet should be continued in order to improve the nutritional habits of adolescents.

*Key words:* nutrition, nutrition habits, nutritional status, adolescent

### Introduction

The quality of nutritive intake influences the growth and development of the organism, as well as the nutritive and health status. Therefore, it is important that nutrition is adequately adjusted to the needs of the organism. Children and adolescent populations are very sen-

sitive to inadequate nutrition (1). Teenagers make many more choices for themselves than they did as children. At the same time, social pressure thrusts choice at them (2). The consequences of these choices will influence their nutritional health both today and throughout life (3).

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The aim of this study was to establish the nutrient intake and food habits of adolescents (15–17 years) for both sexes.

## Methods

The studied subject was a group of 233 high school adolescents (34 % males, 64 % females) between 15 and 17 years of age. The principals of the high schools approved the study protocol.

### Dietetic study

The monitoring of food consumed was performed using specially designed semiquantitative Food Frequency Questionnaire (FFQ) to assess usual intake over the previous year, but not less than once a month. The portion sizes used in the FFQ were based on typical or natural portion consumed (*e.g.* slice, piece, cup, *etc.*). When a typical or natural portion size was uncertain, portion size was declared as small, medium or large with help of qualified personnel demonstrating typical dishes (plates, cups, glasses) and food models in natural size.

The survey is performed in the form of personal interviews.

To determine the weight of consumed food predefined measures for all foods were provided. The nutritive and energy values of each food eaten were calculated using the composition tables of raw and cooked food (4,5). The table containing chemical contents of typical local dishes, as well as their energetic and nutritional values, was also used to make as precise determination of consumed food quality as possible (6). Observed intakes were compared to recommended daily allowance (RDA) according to age and sex (7, 8).

### Anthropometric study

Weight and height were taken following the standards of the World Health Organisation (WHO) (9). Measurements were made in the morning with subjects wearing only underwear and without shoes. Weight was determined using a weighing scale (range: 5–150 kg). Height was measured using a manual stadiometer (range: 60–200 cm). Body mass index (BMI) as a standard was calculated from height and weight (1). Calibrated calliper is used to measure skin fold thickness on the back of the arm (over the triceps muscle) and below the shoulder blade (subscapular).

### The statistical analysis

Where the results were distributed homogeneously, differences between means were established using the F-test (10,11). Linear correlation coefficients were calculated for different dietetic data (12). The influence of sex was also taken into account.

## Results and Discussion

The obtained data were qualitatively evaluated for energy, proteins, total fats, saturated, monounsaturated and polyunsaturated fatty acids, cholesterol, total carbo-

hydrates and alcohol content (Table 1). Energy and nutrient needs are greater during adulthood than at any other time of life, except during pregnancy and lactation. The energy need of adolescents varies greatly, depending on the current rate of growth, body size and physical activity.

According to the semiquantitative food frequency method, the male and female adolescents take more energy than they need with respect to age and sex (Tables 1 and 2; Fig. 1). Significantly lower ( $p < 0.01$ ) intakes of energy were observed in females than males (Table 1). Adolescent females generally take less energy than males (13), which was confirmed by this study (Table 1). Daily energy intake of less than 9.20 MJ was observed in 76 % of girls (Table 2). Low energy intake among the girls is common and is connected to the extreme ideas of slimness (14,15). The weight-for-height ratio is in 37 % of girls at lower centiles than the 50th (Table 8).

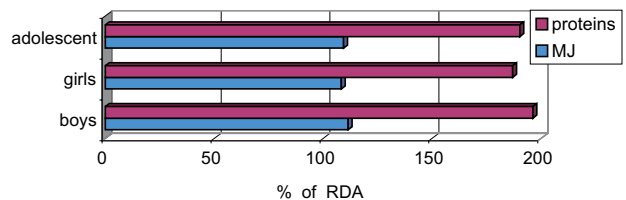


Fig. 1. Mean energy and protein values of adolescent daily meal according to sex

Energy intake per kilogram of body weight was also statistically different with respect to sex. Average energy intake for the boys according to body weight was not in accordance with recommendation (188 kJ/kg), while the girls complied with this recommendation (167 kJ/kg) (Table 1) (1,7).

The proteins are the major nutrient needed for healthy growth and development of adolescents. Boys need 0.30 g/cm and girls 0.28 g/cm of proteins, or about 15 % of total food energy (13). Statistically significant difference ( $p < 0.01$ ) according to mean protein intake was observed with respect to sex, although in both groups intake was almost twice as much as RDA (Tables 1 and 2; Fig.1). The Diet and Health Report advice people to maintain moderate protein intakes which are between the values of RDA and its doubled values (1). High protein intake is not correlated to sex. The obtained ratio between animal and vegetable proteins was in accordance to the health advice, but at the same time fish was very poorly represented and red meat was too high in adolescent daily diet, which is contrary to recommendation of health authorities (Tables 4 and 5) who recommend that more fish should be consumed because of omega-3-fatty acids presence (16). Judging the protein intake, as percentage of energy, without a specific number of grams is always risky. It is useful only if the energy intake is within reasonable limits. The adolescent daily diets maintained 14.2 % of daily energy from proteins (Table 1). Statistical significance of the difference in the protein intakes as percentage of energy between sexes was observed (Table 1).

Table 1. Energy and nutritional values of adolescents daily diet (mean  $\pm$ SD)

Parameters	Boys	Girls	Adolescents
Daily consumed energy value/MJ day <sup>-1</sup> *	13.8 $\pm$ 5.2	9.8 $\pm$ 3.5	11.4 $\pm$ 4.7
Daily consumed energy per body weight/kJ kg <sup>-1</sup> day <sup>-1</sup>	201.2 $\pm$ 82.8	169.7 $\pm$ 69.8	182.34 $\pm$ 76.6
Daily consumed proteins/g day <sup>-1</sup> **	113.6 $\pm$ 43.6	81.70 $\pm$ 35.2	94.5 $\pm$ 41.7
Energy fraction of proteins in daily diet/%*	14.4 $\pm$ 2.6	14.04 $\pm$ 2.6	14.2 $\pm$ 2.6
Consumed proteins in daily diet/g (4.18 MJ) <sup>-1</sup>	35.1 $\pm$ 7.2	34.4 $\pm$ 6.7	34.7 $\pm$ 6.8
Consumed proteins per body height/g cm <sup>-1</sup>	0.6 $\pm$ 0.2	0.5 $\pm$ 0.2	0.6 $\pm$ 0.2
Daily consumed fats/g day <sup>-1</sup> *	120.4 $\pm$ 52.3	83.7 $\pm$ 34.2	98.4 $\pm$ 45.9
Energy fraction of fats in daily diet/%	33.5 $\pm$ 5.5	32.9 $\pm$ 5.6	33.1 $\pm$ 5.6
Consumed fats in daily diet/g (4.18 MJ) <sup>-1</sup>	36.4 $\pm$ 6.5	35.5 $\pm$ 6.6	35.58 $\pm$ 6.6
Consumed fats per body weight/g kg <sup>-1</sup>	1.8 $\pm$ 0.80	1.5 $\pm$ 6.60	1.6 $\pm$ 0.7
Daily consumed saturated fatty acids/g day <sup>-1</sup> *	53.8 $\pm$ 12.5	37.2 $\pm$ 9.8	45.9 $\pm$ 10.9
Energy fraction of saturated fatty acids/%**	16.5 $\pm$ 1.9	14.3 $\pm$ 1.5	14.6 $\pm$ 1.6
Daily consumed monosaturated fatty acids/g day <sup>-1</sup> *	47.2 $\pm$ 9.9	31.5 $\pm$ 7.2	39.4 $\pm$ 8.0
Energy fraction of monosaturated fatty acids/%**	14.5 $\pm$ 1.7	12.1 $\pm$ 2.0	12.5 $\pm$ 2.3
Daily consumed polyunsaturated fatty acids/g day <sup>-1</sup> *	18.3 $\pm$ 3.3	14.8 $\pm$ 2.4	16.5 $\pm$ 2.6
Energy fraction of polyunsaturated fatty acids/%	5.6 $\pm$ 1.3	5.7 $\pm$ 1.4	11.8 $\pm$ 1.9
Daily consumed cholesterol/mg day <sup>-1</sup> *	2000.0 $\pm$ 128.4	1079.0 $\pm$ 89.3	1539.0 $\pm$ 107.9
Daily consumed carbohydrates/g day <sup>-1</sup> *	401.7 $\pm$ 145.8	313.2 $\pm$ 112.9	348.7 $\pm$ 133.9
Energy fraction of carbohydrates/%	51.2 $\pm$ 6.7	52.9 $\pm$ 6.8	52.3 $\pm$ 6.8
Consumed carbohydrates in daily diet/g (4.18 MJ) <sup>-1</sup>	123.7 $\pm$ 19.6	133.9 $\pm$ 17.3	129.9 $\pm$ 18.9
Consumed carbohydrates per body weight/g kg <sup>-1</sup>	5.9 $\pm$ 2.5	5.4 $\pm$ 2.2	5.6 $\pm$ 2.4
Energy fraction of alcohol in daily diet/%*	3.1 $\pm$ 4.6	0.8 $\pm$ 1.7	1.9 $\pm$ 3.2

Significance assessed with F-test: \*  $p < 0.01$  \*\*  $p < 0.05$

Adolescent daily diet was also reach in fat but poor in carbohydrates. There were differences between sexes in the amount of fats and carbohydrates intake in daily diet. Both sexes consume more fat and less carbohydrates than it is recommended by the Committee on the Diet and Health (Tables 1 and 2) (1). Differences in daily consumption of fat and carbohydrates, as percentage of energy, have not been assessed between sexes (Table 1).

Major sources of carbohydrates in adolescent diets are bread, cereal, rice and pasta followed by sweets, which was not expected according to food frequency list (Table 4). Contribution of complex carbohydrates was two to three times higher than simple carbohydrates (Table 5). Still, sweets as rich source of simple carbohydrates and energy were the greatest source of energy (24 % kJ) in daily diet (Tables 3 and 4; Fig. 2). With regard to ener-

Table 2. Contribution of energy and macronutrients in daily diet according to recommended dietary allowances (RDA) and dietary standars (% participants)

	Boys/%	Girls/%	Adolescents/%
Daily consumed energy/MJ day <sup>-1</sup>			
Less than RDA	38.5	76.7	63.5
According to RDA	6.4	2.9	4.3
More than RDA	55.1	20.4	32.2
Consumed proteins as fraction of RDA/% of RDA			
Less than RDA	6.4	11.6	9.9
According to RDA	0	3.2	2.2
More than RDA	93.6	85.2	87.9
Energy fraction of proteins in daily diet/% of RDA			
<14.5	51.7	63.2	59.7
15.0 $\pm$ 0.5	14.2	11.7	12.4
> 15.5	34.1	25.1	27.9
Energy fraction of fats in daily diet/% of RDA			
< 29.5	20.1	25.8	23.6
30.0 $\pm$ 0.5	1.6	6.5	4.7
> 30.5	78.3	25.1	71.7
Energy fraction of carbohydrates in daily diet/% of RDA			
< 54.5	70.3	57.6	61.9
55.0 $\pm$ 0.5	7.3	6.3	6.8
> 55.5	22.4	36.1	31.3

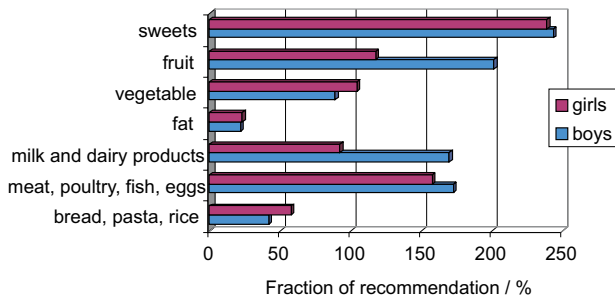


Fig. 2. Contribution of different food groups in adolescent daily diet

getic shares of sweets in the diets statistically significant differences were not observed between boys and girls (Table 3).

Saturated (SFA) and monounsaturated (MUFA) fatty acids in adolescent daily diet were present in more and polyunsaturated fatty acids (PUFA) in less than 10 % of daily energy (Table 1). Boys had statistically significant higher SFA and MUFA and lower PUFA content expressed as percentage of energy intake in daily diet than girls (Tables 1). As it was expected, the fatty acids ratio (1:0.9:0.4) in adolescent diet was not satisfying because of animal fats intake was higher than proposed (Tables 4 and 5). The ratio of fatty acids should be 1:1:1 (1).

Health authorities recommend limiting cholesterol to less than 300 mg/day. FDA has authorised two health claims concerning dietary saturated fat and cholesterol

Table 3. Contribution of different food groups in adolescent daily diet as daily energy fraction (%) (mean  $\pm$ SD)

Food groups	Boys	Girls	Adolescents
Bread, cereal, rice, pasta**	16.7 $\pm$ 6.9	17.3 $\pm$ 8.6	17.1 $\pm$ 8.0
Meat, poultry, fish, eggs*	17.2 $\pm$ 5.1	15.8 $\pm$ 6.9	16.3 $\pm$ 6.3
Dairy products	16.9 $\pm$ 7.8	18.5 $\pm$ 8.0	17.9 $\pm$ 7.9
Vegetable	8.90 $\pm$ 4.3	10.4 $\pm$ 4.8	9.9 $\pm$ 4.7
Fruit **	10.1 $\pm$ 6.2	11.8 $\pm$ 7.7	11.2 $\pm$ 7.3
Fats **	3.3 $\pm$ 2.7	2.3 $\pm$ 2.2	2.3 $\pm$ 2.5
Sweets	24.3 $\pm$ 9.9	23.9 $\pm$ 10.8	24.0 $\pm$ 10.5

Significance assessed with F-test: \* $p < 0.01$  \*\* $p < 0.05$

(i) risk of coronary heart disease and (ii) dietary fat and cancer development (17). Among the adolescents' studied intake of cholesterol it was found out that cholesterol was three to five times higher than recommended, mostly because of very high intake of the food of animal origin (Tables 1, 4 and 5). Food frequency lists showed that red meat and poultry were mostly consumed 3–6 times/week, eggs 1–2 times/week and milk once a day. Significant differences between sexes existed in cholesterol intake (Table 1).

According to FFQ adolescents consumed more often fruits and fruit juice than vegetable. Still, the portion of fruits and vegetables consumed is not satisfactory in adolescent daily diet. In terms of energy, fruits and vegetables were well present, although it would be interesting to assess their contribution in the terms of micro-

Table 4. Sources of macronutrients in adolescent daily diet (%) (mean  $\pm$ SD)

Food	Boys	Girls	Adolescents
<b>Protein sources</b>			
Red meat	20.3 $\pm$ 9.6	15.3 $\pm$ 10.1	17.0 $\pm$ 10.2
Poultry	6.5 $\pm$ 5.5	6.9 $\pm$ 5.7	6.7 $\pm$ 5.6
Fish	2.8 $\pm$ 3.4	2.6 $\pm$ 2.9	2.7 $\pm$ 3.1
Eggs	4.1 $\pm$ 3.9	2.9 $\pm$ 2.9	3.3 $\pm$ 3.3
Milk	29.6 $\pm$ 12.9	32.6 $\pm$ 12.8	31.6 $\pm$ 12.9
Others	36.8 $\pm$ 10.2	39.8 $\pm$ 11.9	38.8 $\pm$ 11.4
<b>Fat sources</b>			
Meat, poultry, fish, eggs	34.9 $\pm$ 11.3	27.4 $\pm$ 11.4	29.9 $\pm$ 11.8
Dairy products	19.4 $\pm$ 10.5	21.6 $\pm$ 10.9	20.8 $\pm$ 10.9
Food high on fat	12.1 $\pm$ 8.9	17.8 $\pm$ 10.3	15.9 $\pm$ 10.2
Others	33.6 $\pm$ 12.1	33.3 $\pm$ 13.9	33.4 $\pm$ 13.4
<b>Carbohydrate sources</b>			
Bread, cereal, rice, pasta	34.2 $\pm$ 17.7	36.2 $\pm$ 17.4	35.2 $\pm$ 17.5
Sweets	25.6 $\pm$ 11.9	26.9 $\pm$ 11.4	26.3 $\pm$ 11.7
Vegetable and fruit	21.6 $\pm$ 9.6	24.1 $\pm$ 10.9	22.9 $\pm$ 10.3
Others	18.7 $\pm$ 9.4	14.4 $\pm$ 7.9	16.6 $\pm$ 8.7

Table 5. Ratios of macronutrients and fatty acids with regard to sources and saturation, respectively, in adolescent daily diet

Sex	Ratios								
	Proteins		Fats		Carbohydrates		Fatty acids		
	Animal	Vegetable	Animal	Vegetable	Simple	Complex	SFA	MUFA	PUFA
Boys	1	0.6 $\pm$ 0.7	1	0.1 $\pm$ 0.5	1	2.7 $\pm$ 1.6	1	0.9 $\pm$ 0.7	0.4 $\pm$ 0.6
Girls	1	0.7 $\pm$ 0.4	1	0.2 $\pm$ 0.3	1	3.0 $\pm$ 1.9	1	0.9 $\pm$ 0.9	0.4 $\pm$ 0.219

Table 6. Energy distribution through the adolescent daily meals (mean  $\pm$ SD)

Daily meals	Boys	Girls	Adolescents
<b>Breakfast</b>			
Consumed energy/MJ	3.1 $\pm$ 1.6	2.5 $\pm$ 1.2	2.8 $\pm$ 1.4
Energy fraction in daily diet/%	25.4 $\pm$ 10.5	26.4 $\pm$ 11.1	25.9 $\pm$ 10.8
Consumed energy as fraction of recommended dietary allowances/% of RDA	24.3 $\pm$ 5.2	27.2 $\pm$ 6.4	26.3 $\pm$ 5.7
<b>Lunch</b>			
Consumed energy/MJ	3.8 $\pm$ 1.8	2.8 $\pm$ 1.3	3.3 $\pm$ 1.7
Energy fraction in daily diet/%	31.4 $\pm$ 8.8	28.6 $\pm$ 9.2	30.1 $\pm$ 9.1
Consumed energy as fraction of recommended dietary allowances/% of RDA	29.9 $\pm$ 10.3	31.1 $\pm$ 11.2	30.9 $\pm$ 12.0
<b>Supper</b>			
Consumed energy/MJ	2.5 $\pm$ 1.7	1.4 $\pm$ 1.1	1.9 $\pm$ 1.5
Energy fraction in daily diet/%	19.2 $\pm$ 8.7	13.8 $\pm$ 8.1	16.7 $\pm$ 8.9
Consumed energy as fraction of recommended dietary allowances/% of RDA	19.7 $\pm$ 8.9	15.5 $\pm$ 6.6	18.6 $\pm$ 7.9
<b>Snacks</b>			
Consumed energy/MJ	2.9 $\pm$ 1.9	3.2 $\pm$ 1.9	3.1 $\pm$ 1.9
Energy fraction in daily diet/% **	23.9 $\pm$ 10.5	31.0 $\pm$ 12.6	27.3 $\pm$ 12.1
Consumed energy as fraction of recommended dietary allowances/% of RDA	23.8 $\pm$ 5.8	34.2 $\pm$ 6.9	28.8 $\pm$ 6.3

Significance assessed with F-test: \*\* $p < 0.05$

nutrient presence (Table 3). Fruit consumption was different between males and females (Table 3). Girls consumed more fruit and vegetable (Table 3; Fig. 2).

Arrangement of daily energy intake through the meals is well balanced for breakfast and lunch, while supper is poorly balanced with snacks dominating (Table 6). Snacks are rich in energy and are common intake for adolescents regardless of sex and living area (18). Significant difference, in relation to quantity of energy intake through snacks, was established between sexes (Table 6).

Fast food and soft drinks are widespread between adolescents (19,20). This study showed that the adolescents consume fast food less than once a week and soft drinks more than once a day.

With physical maturity and growing independence adolescents are faced with new choices to make, thus some teenagers begin to use alcohol and tobacco (21). Alcohol alters nutrient absorption and metabolism, so imbalance develops and cigarettes influence hunger, body weight and nutrient status. This study also showed that adolescents use alcohol approximately once a week, which makes 1.97 % of daily energy intake (Table 1). As it was expected the boys consume more alcohol than girls (Table 1).

The studied subjects, 80 boys and 153 girls, showed significant differences ( $p < 0.01$ ) with respect to sex and weight, height, body fat and body mass index (BMI) (Table 7). Among young and prepubescent children those parameters are usually not significantly different with regard to sex, due to slight difference in body composition, while during the adolescent spurt, differences between sexes become apparent.

For adolescents the obesity is defined when BMI is  $\geq 25.8$  for boys and  $\geq 24.9$  for girls (22). Mean BMI for boys and girls is between 21 and 22 (Table 8). Majority of studied boys and girls had appropriate weight (Table

Table 7. Personal and anthropometric data (mean  $\pm$ SD) (n=233)

Parameters	Boys	Girls
Number	80	153
Age/years	15.9 $\pm$ 0.7	15.8 $\pm$ 0.6
Weight/kg *	69.9 $\pm$ 11.1	58.5 $\pm$ 6.2
Height/cm *	177.4 $\pm$ 4.9	165.6 $\pm$ 6.2
Body mass indeks/kg m <sup>-2</sup> *	21.8 $\pm$ 3.0	21.3 $\pm$ 1.71
Body fat/% *	14.5 $\pm$ 5.9	27.6 $\pm$ 4.5

Significance assessed with F-test: \* $p < 0.01$

7). Difference between sexes existed in the number of under- and overweight participants (Table 8).

To observe nourishment only on the bases of BMI is not valid enough as it does not reflect body composition. In this study the fat fold measures were made to estimate total body fat and a fair assessment of the fat location. About half of the fat in the body lies directly beneath the skin, so the thickness of this subcutaneous fat reflects total body fat (23). The ideal amount of body fat is 12–20 % for men and 20–30 % for women (24). For adequate validation of the body fat, except the sex, the age of subjects was also very important, as body composition varies during life circle. Because of that, the referent amount of body fat for boys aged 15 is 13 % and for girls of the same age 26 % (13). Mean body fat for boys and girls was not inside the ideal amount (Table 7). Both groups had slightly higher body fat composition (47.7 % for boys and 50.0 % for girls) (Table 8). This study confirmed that the percentage of the body fat also depends on the sex (Table 7).

Correlation of established dietetic and anthropometric data were also observed (Table 9). Among the adolescents studied, the BMI was in correlation to weight, body fat and carbohydrates intake (mostly bread, rice, pasta and sweets) (Table 9).

Table 8. Weight-for-height; BMI and body fat for adolescents (fraction of participants/%)

Sex	Weight for height/centile			BMI/kg m <sup>-2</sup>				Body fat/%		
	<50th	=50th	>50th	I*	II*	III*	IV*	I**	II**	III**
Boys	24.6	56.9	18.5	9.2	78.5	6.2	6.2	32.3	20.0	47.7
Girls	37.1	51.5	11.3	8.3	83.5	7.2	1.0	39.0	11.0	49.9
Adolescent				8.6	81.5	6.8	3.1			

\* I &lt;18.5; II 18.5–24.0; III 25.0–26.9; IV &gt;27.0

\*\* boys: I &lt;12.5; II 13.0 ± 0.5; III &gt;13.5

\*\* girls: I &lt;25.5; II = 26.0 ± 0.5; III = &gt;26.5

Table 9. Some correlations of dietetic and anthropometric data

Correlation coefficient (r)	Boys	Girls	Adolescents
Body mass index/kg m <sup>-2</sup>			
Weight/kg	0.836*	0.302*	0.801*
High/cm	0.135	-0.215	0.088
Body fat/%	0.474*	0.734*	0.455*
Daily consumed energy/MJ day <sup>-1</sup>	-0.097	-0.247**	-0.198**
Daily consumed proteins/g day <sup>-1</sup>	-0.072	-0.183	-0.159
Daily consumed fats/g day <sup>-1</sup>	-0.038	0.069	-0.125
Daily consumed carbohydrates/g day <sup>-1</sup>	-0.201	-0.299*	-0.236*
Weight/kg			
High/cm	0.630*	-0.939*	0.652*
Body fat/%	0.032	0.478*	-0.060
Daily consumed energy/MJ day <sup>-1</sup>	0.132	-0.181	0.110
Daily consumed proteins/g day <sup>-1</sup>	0.889*	0.230**	0.068
Daily consumed fats/g day <sup>-1</sup>	0.943*	0.749*	0.123**
Daily consumed carbohydrates / g day <sup>-1</sup>	0.861*	-0.804*	0.001
Body fat/%			
Daily consumed energy/MJ day <sup>-1</sup>	-0.467*	-0.224**	-0.460*
Daily consumed proteins/g day <sup>-1</sup>	-0.386*	-0.221**	-0.421*
Daily consumed fats/g day <sup>-1</sup>	-0.418*	0.288*	-0.414*
Daily consumed carbohydrates/g day <sup>-1</sup>	-0.480*	-0.478*	-0.438*
Daily consumed energy/MJ day <sup>-1</sup>			
Daily consumed proteins/g day <sup>-1</sup>	0.888*	0.874*	0.895*
Daily consumed fats/g day <sup>-1</sup>	0.943*	0.350*	0.924*
Daily consumed carbohydrates/g day <sup>-1</sup>	0.861*	0.599*	0.896*
Daily consumed alcohol/g day <sup>-1</sup>	-0.091	0.043	0.077

\*p &lt; 0.01 ; \*\*p &lt; 0.05

The correlation between body fat and BMI is not obligate as BMI is usually correlated with lean body mass (25). The girls' BMI was in correlation with energy intake as well. Adolescents' weight is only correlated with height and fat intake, and for the girls it is also correlated with body fat and macronutrients intake. In the case of boys the weight is not correlated with body fat. Body fat is correlated with energy and macronutrients intake, while energy intake, as it was expected, was in correlation only with macronutrients but not with alcohol.

Some studies showed that mostly women have better nourishment than men do, but among the adolescents that conclusion could not be made (26,27). In this study it is established that more girls (37 %) are smokers than boys (13 %), what is opposite to the similar reports (28,29).

## Conclusions

Adolescents daily diet is mostly inadequate in terms of energy, fat, cholesterol and carbohydrates intake as well as with regard to the low energy food rich on micronutrients and dietary fiber (vegetable, fruit, bread, cereals, rice and pasta). Fast food contribution in daily diet is not of great concern but soft drinks are. Average BMI is appropriate for the adolescents while body fat compositions were higher than referent values.

Some differences between the sexes and the nutritive habits have been established. The lunch and supper for boys are rich in energy while girls get most of the energy through snacks during the day. Boys intake more red meat, eggs, milk and dairy products and added fats than girls. Girls consume more, but not enough, grain products (bread, pasta and rice) as well as fruit and veg-

etable, white dairy products are not present as recommended. Alcohol consumption is more present among boys and smoking is more spread among girls.

In terms of anthropometric data, both over- and underappropriate BMI appeared to be greater among boys than girls. Girls are characterised with more body fat than boys.

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## Prehrambene navike i prehrambeni status adolescenata

### Sažetak

Različiti su razlozi zbog kojih pojedinac odabire način prehrane. Neovisno o razlozima, odabir hrane utječe na ljudsko zdravlje. Najosjetljivija su skupina adolescenti koji uglavnom sami odabiru svoju vrstu hrane.

Svrha je ovoga rada bila procijeniti kakvoću dnevne prehrane i prehrambene navike adolescenata (broj različitih vrsta hrane i učestalost njihove potrošnje) koristeći posebno sastavljen upitnik o učestalosti potrošnje hrane i pića (Food Frequency Questionnaire) te dodatna pitanja o njihovim navikama (pušenje i potrošnja alkohola). Istraživanje je obuhvatilo 233 ispitanika u dobi od 15 do 17 godina. Nekoliko različitih tablica, kao i jedna koja sadržava kemijski sastav tipičnih jela s našega područja, korištene su za određivanje udjela energije, proteina, ukupnih masti, ugljikohidrata, masnih kiselina, kolesterola i konzumiranog alkohola u dnevnom obroku adolescenata. U obzir su uzeti indeks mase tijela (BMI), omjer tjelesne mase i visine (izražen u centilima), te udjel masnog tkiva. Razlike među spolovima utvrđene su F-testom, a izračunata je i korelacija između antropometrijskih i djetetičkih parametara (korelacijski koeficijenti). Uzimajući u obzir prosječnu dnevnu prehranu, rezultati pokazuju da adolescenti unose više ukupnih i zasićenih masti te kolesterola, a manje ugljikohidrata. Nedovoljno troše povrće i voće, a prekomjerno unose slatkiše i gazirane napitke. Prosječni indeks mase tijela bio je u skladu s preporukama za adolescente, dok je udjel masnog tkiva bio veći od referentnih vrijednosti za dob i spol. Uočene su statistički značajne razlike ( $p < 0,01$ ) između spolova s obzirom na prosječni unos hrane

(mesa i mesnih proizvoda, mlijeka i mliječnih proizvoda, povrća i voća), raspodjelu energije, konzumirani alkohol, naviku pušenja i udjel masnog tkiva. Utvrđena je i statistički značajna razlika među spolovima s obzirom na broj ispitanika koji ne pripadaju pravilno uhranjenj skupini. Stoga je prijeko potrebno educirati adolescente o pravilnoj prehrani i redovito pratiti kakvoću njihovih obroka.