Eur J Nutr (2005) 44 : 174–182
DOI 10.1007/s00394-004-0509-8

ORIGINAL CONTRIBUTION

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Determination of dietary habits as a risk factor of cardiovascular heart disease in Turkish adolescents

Summary *Background* To investigate dietary habits and evaluate these with regard to cardiovascular risk status in Turkish adolescents aged 12–19 years. *Methods* A total of 300 adolescents, 135 males and 165 females aged between 12 and 19, were included in the study. Dietary intake was determined by using 3-day food records (including 1 weekend day). Adolescents' smoking habits and familial chronic diseases were recorded. The values obtained for energy and nutrient intakes were compared with RDA and DRI and recommendations given by AHA. *Results* The mean energy intakes of male and female subjects were 1964 ± 723 kcal and 1804 ± 486 kcal respectively. According to NHANES III, age-standardized (CDC: Centers for Disease Control and Prevention) prevalence of overweight indicated that 20.7 % among male and 17.5 % among female adolescents were at risk for becoming overweight. The prevalence of premature CHD family history was found to be 9.6 % for males and 11.5 % for females. The prevalence of current smoking was found to be 22.2 % for males and 18.2 % for females. In addition, 29.6 % of the males and 37.6 % of the females were physically inactive ($p < 0.05$); however, male adolescents (48.2 %) were significantly more likely than female adolescents (52.1 %) to report sufficient moderate physical activity ($p < 0.05$). The dietary fiber intake was slightly below the recommended intake of 10 g per 1000 kcal. Compared to the AHA averages, these adolescents had significantly higher intake of total fat, saturated fat, sodium and dietary cholesterol and lower intake of polyunsaturated fat, monounsaturated fat and dietary fiber. The Turkish adolescents also had higher amounts of energy from fat. The mean percentage of energy from fat was 34.2 ± 6 % TE for males and 35.2 ± 6.8 % TE for females; saturated fat was 11.8 ± 6.8 % TE for males and 12.1 ± 8.9 for females. The intake of fat and saturated fat was higher than the AHA recommendations. The polyunsaturated to saturated fat ratio was 0.4 ± 0.2 and reflected a high saturated fat (12.0 ± 7.7 % TE) and low polyunsaturated fat (5.5 ± 3.9 % TE) diet. In addition, the percentage of adolescents who did not meet 66 % of RDA for vitamin E, B6, and folates and the recommendation for RDA dietary fiber is presented. Approximately, 80 % of adolescents failed to meet the dietary recommendation of the AHA for polyunsaturated fatty acids, and about 26.7 % reported a cholesterol intake higher than 100 mg/1000 kcal. *Conclusion* It can be said that fiber, total fat, saturated fatty acid, cholesterol and sodium intake of Turkish adolescents are found to be high; however, their vitamin E, vitamin B6 and folate intake are found to be low compared to AHA recommendations. Turkish adolescents' fruit and vegetable intake are also found to be low.

Key words adolescents – cardiovascular disease – dietary intake – cholesterol – saturated fat – Turkey

Received: 20 October 2003
Accepted: 31 March 2004
Published online: 21 May 2004

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EJN 509

Introduction

Adolescence is a time marked by changes in lifestyle and the formation of new eating behaviors. The importance of developing healthy eating habits is obvious, as the high rates of physical growth in adolescence bring heightened nutritional needs. In addition, poor eating patterns formed early in life may lead to such health problems as cardiovascular disease, cancer, and osteoporosis in later years [1]. Prospective and retrospective studies have shown that the risk factor level found during childhood and adolescence correlated with those that were observed later. In addition, it has been demonstrated that the lifestyles and behaviors (such as diet, exercise, and smoking) that greatly determine the risk of cardiovascular disease are often learned and adopted early in life [2–5]. Dietary intake is one of the most important known environmental variables affecting serum lipids and lipoproteins. Unlike saturated fatty acid intake, mono- and polyunsaturated fatty acids are associated with a reduced risk of cardiovascular disease. Antioxidants, especially vitamin E are emerging as potentially useful protective factors, and there is an increasing evidence that hyper-homocysteinemia, which is an independent risk factor, may be modified by dietary changes. In addition many researchers have reported that a high-fiber diet has a hypocholesterolemic effect [6–10]. The American Heart Association's recently revised dietary guidelines advocate a population-wide limitation of saturated fat to < 10 % of energy and cholesterol < 300 mg/day to reduce the risk for coronary heart diseases. Most saturated fats increase serum total cholesterol and low density lipoprotein cholesterol; however, polyunsaturated fatty acids lower serum cholesterol concentrations, and monounsaturated fats either lower or have no influence on plasma triglyceride or low density lipoprotein cholesterol levels [11].

This study was conducted to evaluate Turkish adolescents' dietary behavior as well as lifestyle factors as a cardiovascular risk factor.

Methods

The schools were chosen from a list of all public high schools in Ankara using a proportional-size probability formula. In each high school 33 students were selected randomly (approximately 5 students/grade). A total of 330 adolescents were invited to participate; 8 adolescents refused, leaving a total of 322 participants who agreed to participate. Of the 322 distributed surveys, 22 were not returned or had missing information; therefore, we used 300 surveys for the present analyses (response rate 90.9 %). Males and females constituted 45 % and 55 % of the total sample, respectively. Measurement and data collection were conducted during a 5 month period between February and June 2003.

Dietary intake and nutrient analysis

Five dietitians collected the dietary data using an open-ended, interviewer-administered dietary history. All participants completed detailed three-day food records. Participants were required to maintain the food records for 2 weekdays and 1 weekend day. Prior to completing the food records, all participants were required to attend a one-hour class of verbal instructions on maintaining the food records. The average energy, total fat, saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, vitamin E, vitamin B6, folates, fiber, sodium and cholesterol content for each individual's diet were analyzed using food composition tables [12]. Nutrient content of fast foods prepared in school cafeterias was determined from the list of ingredients of each preparation. The energy and nutrient intakes of these participants were compared to the Recommended Dietary Allowances (RDA) [13], Dietary Reference Intake (DRI) [14] and American Heart Association (AHA) recommendations [15]. The nutrient densities (units of nutrient/1000 kcal) of the diets of the students were calculated to assess the quality of their diets. The atherogenic indexes of polyunsaturated fatty acids-saturated fatty acids ratio (P/S) and cholesterol-saturated fat index (CSI) [16] were determined using the following formulas: P/S: (total polyunsaturated fatty acids)÷(total saturated fatty acids); CSI: (0.01 x g saturated fat) + (0.05 x mg cholesterol) [17]. To evaluate the atherogenic characteristics of Turkish adolescents' diet, a comparison was made with the AHA dietary guidelines [15].

Anthropometric measurements

Height was measured to the nearest 0.1 cm, and weight to nearest 0.5 kg in light clothing and without shoes. BMI was calculated as weight (kg)/height (m^2). All anthropometric measurements were taken by trained anthropometrists using standardized methods and apparatus of the same precision. Since reference data on BMI for the Turkish population are not available, the National Health and Nutrition Examination Survey (NHANES) reference data [18, 19] were used for estimating obesity in Turkish adolescents. The adolescents were grouped into four categories, underweight, normal-weight, at risk of overweight and overweight in accordance with the cut-off points of $< 5^{th}$, 5^{th} to $< 85^{th}$, 85^{th} to $< 95^{th}$ and $\geq 95^{th}$ percentiles of the NHANES III standard respectively [20].

Physical activity

Physical activity was surveyed through questions that included the time spent in daily activities, and timing and frequency of the physical exercise level. The different types of physical activities were grouped by intensity into three categories: inactive, moderately active and active. Inactivity was defined as performing no vigorous activity and performing no light to moderate activity (walking or bicycling for at least 30 minutes) during any of the 7 days preceding the survey. Moderately active defined as physical activity at least two times a week and minimum 20 minutes duration. Those adolescents who carried out a physical activity at least three times a week, for minimum of 30 minutes accumulated throughout the day were classified as physically active [21].

Smoking

The four categories of smoking used in the analysis are defined as follows:

Current smokers are those who reported to have smoked at least 100 cigarettes and were currently using tobacco at the time of interview. *Former smokers* are those who had ever smoked at least 100 cigarettes but were not currently using tobacco products at the time of interview. *Experimenters* are respondents who had tried smoking at some time but had not smoked 100 cigarettes in their life. *Nonsmokers* are those who never tried or used any tobacco products. *Age of smoking onset;* this variable is defined as the age when the respondent started smoking regularly. In the analyses age of smoking onset is divided into two groups: at age 13 or younger and at ages 14–16 [22].

Other assessments

Questionnaire interviews were conducted to gather information such as demographic information, history of premature CVD, hypertension and diabetes mellitus in family based on standard questionnaires.

Statistical analysis

Data's normality was checked by using One-Sample Kolmogorov-Smirnov Test. The differences between females and males mean values was determined by parametric (Independent Sample t-Test) and non-parametric (Mann-Whitney U Test) tests. The Chi-Squared Test (employing Fisher's exact test when indicated) was used to compare the percentage of the occupational level. All data analysis was performed by using SPSS statistical package (version 10.0) and the level of statistical significance for analysis was set at $p < 0.05$ unless otherwise stated.

Results

The study population consisted of 300 subjects, with 135 males and 165 females (Table 1). These subjects had a mean age of 14.72 ± 2.33 years, height of 159.51 ± 11.27 cm, weight of 51.91 ± 11.64 kg and BMI of 20.23 ± 3.04 kg/m^2. Age-standardized prevalence of overweight was 20.7 % among males and 17.5 % among females. The prevalence of premature CHD family history was found to be 9.6 % for males and 11.5 % for females. 22.2 % of males and 18.2 % of females was found to be current smokers. In addition 8 % of adolescents who reported current cigarette usage, smoked > 10 cigarettes per day on the day they smoked, and 29.3 % of adolescents had ever tried cigarette smoking (even one or two puffs) ($p < 0.05$). Overall, male adolescents (22.2 %) were significantly more active than female adolescents (10.3 %) ($p < 0.05$). Together with this, male adolescents (48.2 %) were significantly more likely than female adolescents (52.1 %) to report sufficient moderately activity ($p < 0.05$) and 29.6 % of males and 37.6 % of females had physical inactivity ($p < 0.05$).

Table 2 presents the 1000 kcal adjusted mean nutrient intake reported for Turkish adolescents. On average, participants consumed 1876.16 ± 608 calories per day. Total energy intake was higher in males than females ($p < 0.05$). The dietary fiber intake was slightly below the recommended intake of 10 g per 1000 kcal. Compared to the AHA averages these adolescents had significantly higher intakes of total fat, saturated fat, sodium and dietary cholesterol, and lower intakes of polyunsaturated fat, monounsaturated fat and dietary fiber. Compared to the recently released DRIs and 2000 RDA, the diets of adolescents did not meet the recommended intakes for vitamin E, vitamin B6 and folates.

Table 3 shows the daily energy from fat, carbohydrate, protein intake, and atherogenic indexes by gender. The Turkish adolescents had higher amounts of energy from fat. The mean percentage of energy from fat was 34.2 ± 6 % TE for males and 35.2 ± 6.8 % TE for females; saturated fat was 11.8 ± 5.9 % TE for males and 12.1 ± 8.9 for females. In addition, the mean percentage of energy from carbohydrate was 52.1 ± 5.9 % TE for males and 51.4 ± 7.6 % TE for females. The intake of fat and saturated fat was higher than the AHA recommendations. The polyunsaturated to saturated fat ratio, 0.4 ± 0.2, reflected a high saturated fat (12.0 ± 7.7 % TE) and low polyunsaturated fat (5.5 ± 3.9 % TE) diet. Likewise, the high cholesterol-saturated fat index (> 30) observed reflects elevated saturated fat intake. On the other hand, monounsaturated fat and polyunsaturated fat intakes of

Table 1 Subject characteristics and family history

Characteristics	Males (n = 135) n (%)	Females (n = 165) n (%)	Total (n = 300) n (%)	χ^2	p value
BMI					
Underweight (< 5th)	8 (5.9)	16 (9.6)	24 (8.0)		
Normal (5th – < 85th)	94 (69.6)	110 (66.6)	204 (68.0)	18.845	0.000*
Risk of overweight (85th – < 95th)	28 (20.7)	29 (17.5)	57 (19.0)		
Overweight (≥95th)	5 (3.8)	10 (6.3)	15 (5.0)		
Smoking status					
Nonsmoker	44 (32.6)	108 (65.5)	152 (50.7)		
Former	0 (0)	0 (0)	0 (0)	32.079	0.000*
Experimented	61 (45.2)	27 (16.4)	88 (29.3)		
Current smoker	30 (22.2)	30 (18.2)	60 (20.0)		
Early onset of regular smoking					
At age 13 or younger	14 (46.7)	9 (30.0)	23 (38.6)	2.538	0.281
14–16	16 (53.3)	21 (70.0)	37 (61.4)		
Physical activity					
Active	30 (22.2)	17 (10.3)	47 (15.6)		
Moderately active	65 (48.2)	86 (52.1)	151 (50.3)	8.345	0.015*
Inactive	40 (29.6)	62 (37.6)	102 (34.1)		
Family history of chronic diseases					
Coronary heart disease	13 (9.6)	19 (11.5)	32 (10.6)		
Hypertension	24 (17.8)	43 (26.1)	67 (22.3)	6.702	0.082
Diabetes mellitus	19 (14.1)	11 (6.7)	30 (10.0)		

* Significantly different ($p < 0.05$) between males and females; *BMI* body mass index

Table 2 Mean daily intake/1000 kcal of nutrients associated with cardiovascular disease

Nutrients	Males (n = 135)	Females (n = 165)	Total (n = 300)	p value
Energy intake, kcal/d	1964±723	1804±486	1876±608	0.023*
Fiber, g/d	7.7±3.1	8.2±5.2	8.0±4.4	0.675
Total fat, g/d	38.0±6.7	39.1±7.5	38.6±7.2	0.194
SFA, g/d	10.9±6.4	11.1±9.6	11.0±8.3	0.449
MUFA, g/d	12.7±6.5	13.0±9.8	12.9±8.4	0.345
PUFA, g/d	5.9±3.1	6.4±5.2	6.1±4.4	0.882
Cholesterol, mg/d	116.6±114.7	114.7±94.2	115.6±103.8	0.643
Sodium, mg/d	4723.1±1591.3	3049.4±914.2	3161±951.3	0.858
Vitamin E, mg α-TE/d	4.1±1.6	4.3±2.5	4.2±2.1	0.260
Vitamin B6, mg/d	0.6±0.8	0.8±1.6	0.7±1.3	0.632
Folat, µg/d	49.1±27.4	50.4±34.7	49.8±31.6	0.971

* Significantly different ($p < 0.05$) between males and females
Values are means ± SD
SFA saturated fatty acid; MUFA monounsaturated fatty acid; *PUFA* polyunsaturated fatty acid

males and females were lower than AHA recommendations.

The percentage of Turkish adolescents exceeding the dietary recommendations of the AHA for total fat, fatty acids, and dietary cholesterol is presented in Table 4. In addition, the percentage of adolescents who did not meet 66 % of RDA for vitamin E, B6, and folates and the recommendation for dietary fiber is presented. Around 76.3 % of males and 80.6 % of females reported dietary fat intake > 30 % of total energy; in addition, 38.5 % of males and 35.2 % of females reported a saturated fat intake > 10 % of total energy. There were no significant differences in the proportion of males and females who failed to meet these recommendations, except for folate, vitamin B6, vitamin E, and fiber. Approximately 80 % of adolescents failed to meet the dietary recommendation of the AHA for polyunsaturated fatty acids, and about 26.7 % reported a cholesterol intake higher than 100 mg/1000 kcal. Around 94.3 % of adolescents reported diets with a polyunsaturated to saturated fat ra-

Table 3 Energy from fat, protein, carbohydrate and atherogenic indexes of Turkish adolescents diet

	Males (n = 135)	Females (n = 165)	Total (n = 300)	p value
Total fat, % kcal	34.2±6.0	35.2±6.8	34.8±6.4	0.194
Carbohydrate, % kcal	52.1±5.9	51.4±7.6	51.7±6.9	0.362
Protein, % kcal	13.5±2.3	13.3±3.0	13.4±2.7	0.446
SFA, % kcal	11.8±5.9	12.1±8.9	12.0±7.7	0.449
MUFA, % kcal	11.5±5.9	11.7±8.8	11.6±7.6	0.345
PUFA, % kcal	5.3±2.7	5.7±4.7	5.5±3.9	0.882
P/S ratio	0.4±0.1	0.4±0.2	0.4±0.2	0.613
C-SFA index	32.2±20.6	28.9±16.6	30.1±18.3	0.303

* Significantly different ($p < 0.05$) between males and females
Values are means ± SD
SFA saturated fatty acid; *MUFA* monounsaturated fatty acid; *PUFA* polyunsaturated fatty acid; *P/S* ratio polyunsaturated/saturated ratio; *C-SFA* index cholesterol-saturated fatty acid ratio

tio < 1. Likewise 90.7 % of adolescents did not meet the total dietary fiber recommendation of 10 g/1000 kcal.

Table 5 reports the mean number of servings along with the recommended number of servings, for each food group in the Food Pyramid. The mean number of daily servings of vegetables was 1.4 ± 1.1, which is below the recommended number of servings. Mean daily servings for sweets was 5.9 ± 5.4; for fats, it was 6.1 ± 3.8, both well above the recommended "minimal servings" per day. There were significant differences in amount of breads/cereals, fruits and meats servings by gender ($p < 0.05$).

Discussion

Overweight is a major problem in many developed countries and is an important risk factor for many diseases including diabetes and cardiovascular diseases

Table 4 Percentage of Turkish adolescents not meeting American Heart Association recommendations for cardiovascular disease prevention

Dietary Risk Factors	Males (n = 135) n (%)	Females (n = 165) n (%)	Total (n = 300) n (%)	p value
Fiber < 10 g/1000 kcal	122 (90.4)	150 (90.9)	272 (90.7)	0.977
Total fat > 30 % TE	103 (76.3)	133 (80.6)	236 (78.7)	0.365
SFA > 10 % TE	52 (38.5)	58 (35.2)	110 (36.7)	0.547
MUFA < 10 % TE	55 (40.7)	73 (44.2)	128 (42.7)	0.542
PUFA < 7 % TE	110 (81.5)	130 (78.8)	240 (80.0)	0.562
P/S ratio < 1	130 (96.3)	153 (92.7)	283 (94.3)	0.183
Cholesterol > 100 mg/1000 kcal	30 (22.2)	50 (30.3)	80 (26.7)	0.115
C-SFA index > 25	83 (61.5)	99 (60.0)	182 (60.7)	0.988
Sodium > 3000 mg/day	78 (57.8)	62 (37.6)	140 (46.6)	0.000*
Vitamin E < 2/3 RDA	104 (77.0)	136 (82.4)	240 (80.0)	0.246
Vitamin B6 < 2/3 DRI	86 (63.7)	100 (60.6)	186 (62.0)	0.232
Folates < 2/3 DRI	132 (97.8)	161 (97.6)	293 (97.7)	0.705

* Significantly different ($p < 0.05$) between males and females
TE total energy; *RDA* Recommended Dietary Allowances; *DRI* dietary reference intakes; *SFA* saturated fatty acid; *MUFA* monounsaturated fatty acid; *PUFA* polyunsaturated fatty acid; *P/S* ratio polyunsaturated/saturated ratio; *C-SFA* index cholesterol-saturated fatty acid ratio

Table 5 Mean number of servings per day by food guide pyramid categories

Pyramid Food Group	Recommended (servings/day)	Males (n = 135)	Females (n = 165)	Total (n = 300)	p value
Breads/cereals	6–11	4.3±2.0	3.8±1.5	4.1±1.8	0.027*
Vegetables	3–5	1.4±1.1	1.4±1.1	1.4±1.1	0.416
Fruits	2–4	0.5±0.7	0.8±0.8	0.7±0.8	0.001*
Meats	2–3	1.7±0.9	1.4±0.8	1.5±0.9	0.002*
Dairy	2–3	1.2±0.7	1.2±0.6	1.2±0.7	0.956
Sweets	minimal	5.8±5.3	6.0±5.4	5.9±5.4	0.756
Fat	minimal	6.5±4.1	5.8±3.5	6.1±3.8	0.073

* Significantly different ($p < 0.05$) between males and females
Values are means ± SD servings/day

[23–25]. A consistent positive correlation between childhood obesity with adult obesity has been reported [26]. The proportion of children and adolescents who are overweight has risen dramatically in the past several decades. NHANES II data from 1976–1980 show that about 5% of youth were classified as overweight (based on body mass index in the 95th percentile) and 15% of youth were classified as at risk for overweight (based on the 85th percentile of BMI). By the NHANES III survey from 1988–1994, 11% of youth were overweight and 22% were at risk for overweight by the same BMI standards [27–29]. The present study showed that the prevalence of overweight (based on the ≥95th percentile of BMI) was found to be 3.8% for males and 6.3% for females. Longitudinal tracking studies showed that adolescent weight-related risk carries on into adult cardiovascular disease risk. Data from Bogalusa showed that adolescents with a BMI greater than the 75th percentile were more than 8 times more likely to have hypertension as adults as compared with leaner adolescents [30].

Physical inactivity, considered a major target in preventative medicine in the US, is evidently difficult to evaluate accurately. Self-reported physical inactivity was reported to be 18–34% in Northern Irish adolescents [31]. Uçar et al. [32] from Turkey reported that 20.7% of the girls and 14.5% of the boys in 7–18 year-old schoolchildren were physically inactive. In the present population, the frequency of physical inactivity was higher than that found in another study (29.6% of males and 37.6% of females). An important part of assessing a child's or adolescent's risk of CVD later in life is evaluation of the occurrence of CVD due to atherosclerosis in the child's immediate and extended family. If a positive family history is identified, information about CVD risk and about strategies to reduce risk should be introduced. Parents with significant CVD risk factors need to be referred for evaluation if this has not been done previously. Since the health status of family members is still evolving in young families, family history must be updated annually [33]. In our study about 10.6% of the adolescents reported having a family history of CVD. Turkey, which is a developing country, has a high cardiovascular morbidity and mortality, despite relatively low general levels of plasma cholesterol. In spite of the fact that Turkish adults consist mostly of young people, the age bracket 45–74 years, deaths considered to be due to coronary heart diseases during 10 years of follow-up reflected an annual coronary heart disease mortality of 800 men and 470 women per 100,000 people [34].

The present study showed that the prevalence of current smoking was 22.2% for males and 18.2% for females. Male adolescents (45.2%) were significantly more likely than female adolescents (16.4%) to have ever tried cigarette smoking. Smoking cigarettes is the most widespread risk factor in Turkey [34]. According to 1986 surveys among students, smoking prevalence among 10–14 year olds was 7% for boys and 2% for girls. Among 15–19 year old students, 31% of males and 5% of females smoked. A 1991 survey among university students aged 20–24 years found that 47% of females and 31% of males in that group smoked [35].

Saturated fatty acids are a major dietary determinant of LDL cholesterol level. Several meta-analyses and reviews have been carried out to estimate the impact of saturated fatty acids on cholesterol levels. These analyses indicate that for every 1 percent of total energy, the serum LDL cholesterol rises about 2 percent [36]. According to the AHA a diet that provides < 10% of calories from saturated fatty acids, up to 10% from polyunsaturated fatty acids, and as much as 15% from monounsaturated fatty acids is recommended [37]. With regard to this recommendation, more than 80% of adolescents show low intake of polyunsaturated fatty acids (5.5 ± 3.9% total energy), which, together with a high intake of saturated fatty acids (12.0 ± 7.7% total energy), indicates the diet of Turkish adolescents is potentially atherogenic. This characteristic is clearly demonstrated by the P/S ratio, which is < 1.

Together with the imbalance of fatty acids, the diet of more than 26.7% of youth is high in cholesterol (> 100 mg/1000 kcal) and mean cholesterol intake was about 115.6 ± 103.8/1000 kcal. Therefore, the high cholesterol-saturated fat index (> 30) observed reflects elevated saturated fat index. It is known that reducing cholesterol intakes decreases serum LDL cholesterol in most persons [36]. Current dietary guidance in general recommends a diet that contains ≤30% of energy as fat, ≤10% of energy as saturated fatty acids, up to 10% of energy as PUFAs, and < 300 mg of cholesterol per day. These recommendations are coupled with guidance on physical activity and weight maintenance and are distinct from those for individuals with specific metabolic profiles that might necessitate more restrictive or targeted regimens. In the current revisions of the recommendations, increased recognition is placed on the diet as a whole and away from segmented guidance on individual dietary components. In effect, this shifts the emphasis from the question of what not to consume to what to consume. A more comprehensive approach to dietary guidance will likely reduce the risk of overemphasis on one component of the guidelines over another, allow for a stronger message regarding other aspects of lifestyle (e.g., body weight maintenance and regular exercise), and support the necessity of the dietary guidelines/lifestyle approach to disease risk reduction as a lifelong endeavor [38]. With regard to this recommendation, more than 78.7% of Turkish adolescents show high intake of total fat (34.2 ± 6% of total energy for males and 35.2 ± 6.8% of total energy for females). Among the fatty acids that make up the total fat in the diet, only saturated fatty acids and trans fatty acids raise

LDL cholesterol levels. Similarly, the results from NHANES III indicate that children and adolescents average 33–35 % of their calories from fat [39].

In the study by Munoz et al. [40], the mean daily servings of bread was 5.5 for overall and 7.3 for males aged 12–19 years and 5.1 for females aged 12–19 years. In the current study, the daily bread/cereal servings (4.1 ± 1.8 servings/day) was just under the recommended 6 to 11 serving per day, also lower than the number of servings reported by the Munoz study [40]. The same study reported fat and sugar intake in kilocalories and indicated that fat and sugars were extremely high, providing around 40 % of the daily calories across all groups (age, gender, and poverty status). In our study, the combined sweets and fats category (tip of the Pyramid) was very high at 12.1 ± 7.4 servings per day.

Dietary fiber has previously been shown to be inversely associated with the risk of coronary disease in many observational studies [41–43]. The mean levels of fiber intake for both males (7.7 ± 3.1 g/1000 kcal) and females (8.2 ± 5.2 g/1000 kcal) were lower than recommended daily intake of RDA and AHA. In the Health Professionals Follow-up Study [44] fiber from grain, vegetable and fruit sources contributed to the lower risk of CHD, suggesting fiber per se may be beneficial, although fiber from cereal presented a stronger inverse association. Moreover, there is a substantial epidemiologic evidence that whole grains are associated with decreased risk of coronary artery disease [45], but the main source of cereals in our population was white bread, rice, pasta and almost no consumption of whole-grain bread was observed among the adolescents in our study. Interestingly, the mean of fruit consumption of our study was lower than recommended fruit consumption of AHA, US Department of Agriculture and Health and Human Service, and US Department of Agriculture [36, 46]. In our study, the mean number of servings/day of fruit among adolescents was 0.7 ± 0.8. Similarly, the mean of vegetables consumption of our study was found to be 1.4 ± 1.1 servings/day (132.0 ± 87.7 g/day, no data). The US Dietary Guidelines and the Food Guide Pyramide both recommended eating five or more servings of fruit and vegetables per day [46].

Folic acid and vitamin B6 and B12 play a role in the metabolism of homocysteine, and levels of these vitamins correlate inversely with homocysteine levels. Data from the Framingham Heart Study suggest that the mandated fortification of cereal grains with folic acid has lowered population mean homocysteine levels as well as the prevalence of hyperhomocysteinemia [47]. Lower folate concentrations have been associated with increased coronary disease risk, and a significant association between lower folate levels and fatal coronary artery disease has also been reported. Lower levels of vitamin B6 also confer an increased risk of atherosclerotic vascular disease in case-control and prospective studies. The risk of atherosclerosis associated with lower levels of vitamin B6 is independent of high homocysteine concentrations [48]. The RDA for folate is 400 μg and vitamin B6 is 1.3 mg for males and 1.2 mg for females per day [49]; however, the large proportion of adolescents who do not satisfy even two-thirds of the RDA for these vitamins is worrisome. The mean level of vitamin B6 (0.6 ± 0.8 mg for males and 0.8 ± 1.6 mg for females) and folates (49.1 ± 27.4 μg for males and 50.4 ± 34.7 μg for females) were lower than the recommended daily intake of RDA.

Adolescent diets also exceed the recommended level of 2400 mg sodium or less daily [50]. Data from the NHANES III showed the range of sodium intake of youth aged 12 to 19 years was approximately 4000 to 5000 mg/day for boys and 3000 mg/day for girls [51]. Similarly, sodium intake of Turkish adolescents was found to be 4723.1 ± 1591.3 mg/day for males and 3049.4 ± 914.2 mg/d for females. In addition, our study has determined 57.8 % of females and 37.6 % of males have higher sodium intake than the recommended levels and the reason may be fast foods intake which occupy an important part in daily nutritional habits of Turkish adolescents during recent years. Evidence suggests that even those with normal blood pressure levels can reduce their chances of developing high blood pressure by consuming less salt. The current AHA guideline limits salt intake to 6 g per day [15, 52].

Conclusion

It can be said that fiber, total fat, saturated fatty acid, cholesterol and sodium intake of Turkish adolescents are found to be high; however, their vitamin E, vitamin B6 and folate intake are found to be low compared to AHA recommendations. Turkish adolescents' fruit and vegetable intake are also found to be low. The need to develop primary prevention programs about sufficient and balanced diets at schools for Turkish adolescents to avoid further increases of cardiovascular disease mortality and morbidity rate in Turkey is very clear.

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