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Klinik Çalışma - Araştırma / *Original Article*

Evaluation of the Nutritional Status of Male Adolescents

Adolesan Erkeklerin Nutrisyonel Durumlarının Değerlendirilmesi

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Objectives: The aim of this study was to evaluate the nutritional status of adolescent male students in rural and urban areas of Edirne, Turkey.

Patients and Methods: In a sample of 1004 male adolescent boys (mean age 14.4±1.7 years; range 12 to 17 years), intake of macronutrients and micronutrients was assessed from three-day self-reported food records.

Results: It was observed that energy, calcium, magnesium, vitamin A, E, thiamine, folic acid and fiber intakes of the subjects were below the recommended levels, while protein, riboflavin, vitamin B6 and iron intakes exceeded the target levels. Distribution of macronutrients in daily energy consumption was in agreement with the recommended ratios. Nutritional status did not differ between rural and urban areas (p>0.05).

Conclusion: The dietary recommendations and menu samples based on these findings may help the male adolescents living in our region and our country have a more balanced nutritional status than before.

Key words: Male adolescents; macronutrients; micronutrients; RDA; rural; urban.

Amaç: Bu çalışmanın amacı Türkiye'nin Edirne ilinin kırsal ve kentsel alanında yaşayan adolesan erkek öğrencilerin nutrisyonel durumlarını değerlendirmektir.

Hastalar ve Yöntemler: Toplam 1004 erkek adolesanın (ort. yaş 14.4±1.7; dağılım 12-17) makronutrient ve mikronutrient alımları üç günlük diyet kayıtları ile değerlendirilmiştir.

Bulgular: Deneklerin enerji, kalsiyum, magnezyum, A, E, B1 (tiamin) vitaminleri, folik asit ve lif alımı önerilen günlük alımların altında saptanırken, protein, B2 (riboflavin), B6 vitaminleri ve demir alımları fazlaydı. Makronutrientlerin günlük enerji alımını oluşturan oranları önerildiği gibiydi. Kırsal ve kentsel alanda yaşayan adolesan erkeklerin nutrisyonel alımları farklılık göstermedi (p>0.05).

Sonuç: Bölgemizde yaşayan erkek adolesanların bu bulgulara göre oluşturulacak diyet alım önerileri ve diyet menü örnekleri, eskiye göre daha sağlıklı dengeli besinsel duruma ulaşmalarına yardımcı olabilir.

Anahtar sözcükler: Erkek adolesan; makronutrient; mikronutrient; RDA; kırsal; kentsel.

Adolescence is a time of rapid and often dramatic changes in physical, cognitive and emotional states of the human being. The relatively uniform growth of childhood is suddenly altered by an increase in the velocity of growth.[1] Half of the adult skeleton mass and the optimal body weight as well as 15 to 20% of the adult height are gained during the adolescence period. Due to these changes and developments in the body measurements, composition and functions, nutritional requirements make a peak during this stage.[1,2] However, adolescence is consid-

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ered a nutritionally vulnerable period of life for several reasons. Increasing nutrients as well as responsibilities and problems, changing of life style and food habits, doubt about body image, peer pressure, greater demand for independence and other behavioral changes affect eating patterns among adolescents.[1,3,4]

The adolescents lacking the nutrients necessary for growth and development fail to reach their optimum growth potentials, and face obesity, type 2 diabetes mellitus, cardiovascular disorders, anemia, goiter, tooth and gum disorders or osteoporosis in later stages of life.[5,6]

Comprehensive epidemiological studies in relation to the adolescent nutrition are very rare in Turkey. The former study which was conducted in Edirne under the heading "Dietary intakes among Turkish adolescent girls" has revealed that the adolescent population had an insufficient nutritional status.[7] The purpose of this study is to evaluate the nutritional intake of the male adolescents residing in this area and to provide guidelines in developing regional nutrition strategies.

PATIENTS AND METHODS

Data concerning the nutritional intake of male adolescents aged between 12 to 17 years have been collected. This cross-sectional study was carried out by Trakya University Faculty of Medicine, Pediatrics Department, between February and June 2004.

Male adolescents were selected with the cooperation of the Public Health Department of Trakya University. At the end of 2000, the entire population of Edirne was determined as 380,000 including 16547 male adolescents, aged between 12-17 years. The sample representing male adolescents aged between 12-17 years consisted of 1,670 subjects (10.1% of the target population), which is the same as in the former study made on adolescent girls. Subjects were selected from school lists by systematic random sampling with respect to age, urban-rural residency strata proportional to the corresponding distributions in Edirne population. Schools in the urban and rural areas of Edirne were randomly invited to take part in the study. The "rural area" represents the villages and the countryside, whereas the "urban area" represents the towns and the city center of Edirne.

The body weight and height were measured, body mass index (BMI (kg/m^2)) was calculated and then classified as follows: >95th percentile as "obese", between 85th and 95th percentile as "overweight" and <5th percentile as "underweight".[8]

The diet section of this study was based on the three-day self reported nutrient intake of the recipients. The three days included one weekend day and the previous or next two days (Sunday, Monday, Tuesday or Thursday, Friday, Saturday). Prior to using the food records in the main study, a pilot study was carried out using a group of 30 male adolescents who completed the survey two times in a period of one month. The results obtained from both cases demonstrated that there was a statistically significant correlation between the energy intake ($r=0.64$, $p<0.05$), protein intake ($r=0.55$, $p<0.05$), carbohydrate intake ($r=0.49$, $p<0.05$) and fat intake ($r=0.65$, $p<0.05$).

After body weight and height were measured, the food record forms including the subject's name and date of birth were distributed by an experienced dietitian and pediatricians (trainers) who gave explanations to the subjects on how to fill in the forms. The trainers asked the subjects to record everything they eat and drink, including water, during this three-day period. The subjects were asked to provide as much information as possible about serving size (e.g. portion, cup, mug, tea glass, water glass, teaspoon, dessertspoon, soupspoon), method of cooking (e.g. boiled, grilled, fried), all the details of food consumption (e.g. chicken thigh, skin not eaten), and brand of the foods where possible, so that exact measurements could be estimated. If more than one item is consumed, the trainers asked the subjects to state the amount of each kind of food, separately. Subsequently, the trainers applied a method to increase the accuracy of the collected data. They asked the subjects to record whatever they ate

the night before, after 5:00 p.m. After the model data was collected and checked briefly, the subjects were informed about the errors made and supplied with further training to make correct recordings.

The subjects were also allowed to participate in the study by completing the food record forms at home and later on post them to the researchers where all the forms, envelope and postage fees (stamps) were financed by the researchers. Ethical permission for the present study was obtained from the local ethics committee of Trakya University. Informed consents were obtained from the principals of the schools and also from the subjects' parents.

All nutritional assessments and the nutrient calculations of dietary data were performed by the same trained dietitian. Quantitation was determined by a nutrient database program called BeBis (Beslenme Bilgi Sistemi), designed to calculate the nutritional values of Turkish foods and commercial foods.

Statistical analyses

All analyses were performed with the Minitab Release 13 (Ref. Number: WCP 1331.00197) statistical program. Descriptive statistics (means, standard deviation, ranges) of the data, obtained on 12- to 17-year-old male adolescents, were calculated for each age group. Since there was a large variation in the food intake of the male adolescents, a non-parametric Mann-Whitney U test was used in order to compare the rural and urban subjects, and to determine the difference between smoking and non-smoking subjects. Kruskal-Wallis test was used for the comparison of macro and micronutrient intakes among subjects with underweight, normal weight and overweight as well as those in the obesity group. When a statistical difference was detected in Kruskal-Wallis test, Mann-Whitney U test was also used for determining the group that deviate from the others. The recommended dietary allowance (RDA/DRI) method was used to assess the nutritional intakes of this population.[9-13] Two thirds or less of the RDA was used as the criterion for inadequate nutritional intake. $p<0.05$ was regarded as statistically significant.

RESULTS

The nutritional intakes of 12- to 17-year-old Turkish male adolescents of urban and rural areas of Edirne, Turkey, have been evaluated. Of the 1670 subjects selected from 79 schools (three private, 72 comprehensive, and four high schools for boys), 1038 agreed to participate in the dietary survey (completed and posted food records). Thirty-four record forms were eliminated (15 from rural Edirne (44.2%), 19 from urban Edirne (55.8%)) due to incorrect completion, in which it was evident that the boys did not comply with the requirements, making humorous remarks, and stating unrealistic replies such as extreme intakes and inappropriate serving sizes. Finally, the number of male adolescents taking part in the study was 1004 ((316 from rural Edirne (31.5%), 688 of which were from urban Edirne (68.5%)), representing 60% of the target population and 6.1% of the entire population.

The mean age of the sample was 14.4±1.7 years. Their mean weight was 52.9±13.4 kg (26-117), mean height was 163.2±13.5 cm (130-193), and mean BMI was 19.5±2.9 (13.4-40.5). Overall, 93 male adolescents were classified as being overweight or obese (9.2%), 854 as normal weight (85.3%) and 57 as underweight (5.5%).

When nutritional status of adolescent male students was investigated in terms of vital macro and micro-nutrients, it was observed that energy, calcium, magnesium, vitamin A, E, thiamine, folic acid and fiber intakes were below the recommended level while protein, riboflavin, Vitamin B6 and iron intakes met or exceeded the recommended level of requirement. Percentage of our subjects meeting 2/3 RDA for selected nutrients are shown in Figure 1. Macro- and micronutrient intakes of male adolescents according to different age groups are summarized in Table 1.

Distribution of macro-nutrients in daily energy consumption was in agreement with the recommended percentages. The male adolescent groups living in both rural and urban site were found to meet 49% of the daily energy requirement from carbohydrates, 17% from proteins, and 34% from fats. As for the provision of

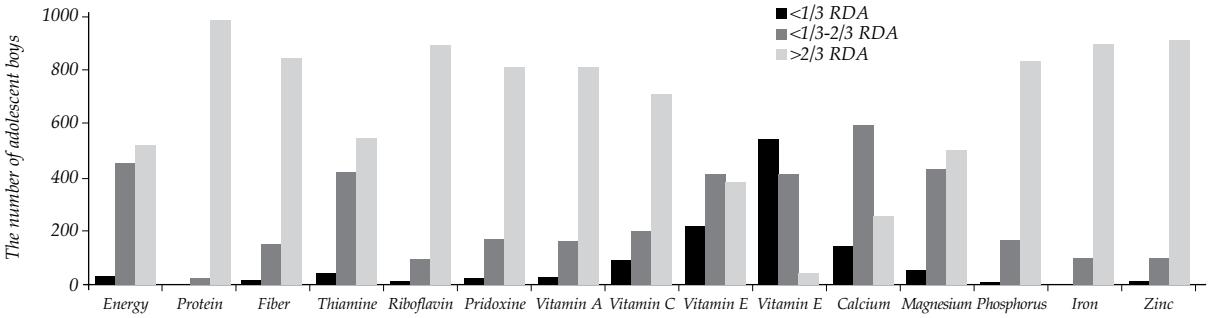

Fig. 1. *The RDA comparison of the macro and micronutrients of our subjects.*

energy from macronutrients, there was no statistically significant difference between the two groups (p>0.05). Mean intake of selected nutrients consumed by urban male adolescents was not different from those living in rural areas. Comparison between the mean dietary intakes of our subjects living in urban vs. rural area is shown in Table 2.

The macro- and micronutrient intakes of underweight, normal weight and overweight or obese male adolescents are shown in Table 3. The underweight students provided 48% of their energy from carbohydrates, 18% from proteins, and 34% from fats while the ones with normal weight, excess weight and the obese students provided 49% of their energy from carbohydrates, 17% from proteins, and 34% from fats. Among the macronutrients constituting the energy supply of the underweight, normal weight and overweight male adolescents, no statistically significant difference has been observed (p>0.05).

Table 1. Nutrient intake according to ages

Nutrients	12 years (n=188)	13 years (n=177)	14 years (n=163)	15 years (n=149)	16 years (n=155)	17 years (n=172)	Total (n=1004)
Energy, kcal	1908± 792	1985±982	1992±723	2098±796	2170± 1057	2101±722	2037±856
Protein, g/d	79.3±36.5	78.4±30.0	80.6±31.0	89.2±39.5	90.2±33.1	91.0±31.7	84.5±34.0
Carbohydrate, g/d	227±88	239±125	240±92	254±103	254±132	251±95	243±107
Fat, g/d	73.0±41.5	76.3±45.3	75.7±32.0	77.6±33.5	84.6±51.0	77.0±33.0	77.2±40.0
Cholesterol, mg/d	296±152	311±168	305±165	307±190	313±155	288±143	303±162
Fiber, g	19.6±9.3	18.8±8.0	19.0±9.0	20.7±8.4	21.0±8.1	19.7±7.8	19.8±8.5
Thiamine, mg/d	0.8±0.4	0.8±0.4	0.8±0.4	0.8±0.4	0.9±0.4	0.8±0.3	0.8±0.4
Riboflavin, mg/d	1.4±0.6	1.4±0.7	1.5±0.8	1.5±0.7	1.5±0.8	1.5±0.7	1.5±0.7
Niacin, mg/d1	1.2±0.5	1.2±0.6	1.2±0.5	1.3±0.5	1.2±0.5	1.2±0.4	1.2±0.5
Folic acid, μg/d	122±57	118±78	123±59	126±56	136±90	127±53	125±67
Vitamin A, μg/d	398±492	374±425	506±797	453±659	495±606	497±717	451±625
Carotene, mg/d	2.1±1.4	2.1±1.4	2.0±1.4	2.2±1.6	2.2±1.9	1.8±1.4	2.1±1.5
Vitamin C, mg/d	88.0±56.7	88.0±67.3	82.0±53.0	87.3±58.2	76.2±48.0	69.6±47.0	81.4±55.0
Vitamin E, mg/d	8.6±6.2	8.9±5.2	9.3±5.8	9.0±5.4	9.2±5.8	8.6±5.9	8.9±5.7
Calcium, mg/d	703±302	717±283	726±308	734±340	761±356	704±285	723±312
Magnesium, mg/d	251±178	247±103	245±103	262±108	268±135	247±96	253±125
Phosphorus, mg/d	1178±539	1167±443	1190±458	1261±517	1304±537	1262±434	1224±491
Iron, mg/d	11.2±5.8	11.2±4.4	11.2±4.5	12.2±5.0	12.4±5.2	12.0±4.5	11.7±5.0
Zinc, mg/d	10.6±5.0	10.6±3.9	11.0±4.3	12.0±5.0	12.8±5.2	12.8±5.0	11.6±4.9
Sodium, mg/d	3125±1393	3497±1344	3699±1546	4113±2151	4377±1814	4421±2020	4113±2151
Potassium, mg/d	2141±972	2160±856	2082±854	2240±921	2209±856	2048±730	2144±870

Data were shown as mean±SD.

Table 2. Comparison mean dietary intakes by Turkish adolescent boys living in urban vs. rural area

Nutrients	Rural area (n=316)	Urban area (n=688)	p^*
Energy (kcal)	2040.2±987.6	2035.1±789.2	NS
Protein (g)	84.9±40.7	84.3±30.6	NS
Carbohydrate (g)	240.2±116.1	244.9±102.4	NS
Fat (g)	79.1±49.6	76.3±34.8	NS
Cholesterol (mg)	320.0±188.7	295.6±148.0	NS
Fiber (g)	19.7±9.4	19.8±8.1	NS
Thiamine (mg)	0.8±0.4	0.8±0.3	NS
Riboflavin (mg)	1.5±0.8	1.4±0.7	NS
Pyridoxine (mg)	1.2±0.6	1.2±0.5	NS
Folic acid (μg)	127.6±74.5	124.4±62.8	NS
Vitamin A (IU)	1583.7±2169.0	1470.8±2044.4	NS
Carotene (μg)	2.0±1.3	21.1±1.6	NS
Vitamin C (mg)	77.7±49.7	83.2±57.6	NS
Vitamin E (mg)	8.6±6.2	9.0±5.5	NS
Calcium (mg)	732.7±335.8	718.5±300.2	NS
Magnesium (mg)	257.7±158.4	250.6±106.9	NS
Phosphorus (mg)	1249.8±580.6	1212.5±443.8	NS
Iron (mg)	11.8±5.8	11.7±4.5	NS
Zinc (mg)	11.6±5.5	11.7±4.5	NS
Sodium (mg)	4026.2±2164.4	3787.7± 1539.1	NS
Potassium (mg)	2157.7±950.2	2138.7±830.5	NS

*Mann-Whitney U test was used to compare these variables. NS: Non-significant.

Forty-eight (4.8%) of the adolescent male students forming our working environment in Edirne were smokers, while 906 (90.2%) have never smoked. Fifty students (5%) gave contradicting answers or no answer at all when asked about smoking. The number of smoking students in the urban site was 46 (6.7%) while in the rural site, only two students (0.6%) smoked. The percentage of smokers among the adolescent students living in the city was significantly higher than their contemporaries living in the rural areas ($p<0.01$). As a result of the examination made on the nutrient intakes of the smoking and nonsmoking students, it was observed that the smoking adolescent male students take significantly lower vitamin C and carotene, in comparison to their nonsmoking contemporaries ($p>0.05$).

DISCUSSION

The most important finding of this study is that the male adolescents living in the rural and urban sites of Edirne province fail to take sufficient macro- and micronutrients that are vital for human body, such as calcium, magnesium, vitamin E, thiamin or folic acid.

In general, the average daily requirement for energy during the adolescence stage varies between 2200-3150 calories in respect of age and sex,[13] while increase in physical activity results in higher energy requirement.[3] The daily energy intake of adolescent males were reported as 2894±1242 kcal by Zive et al.,[14] 2342±751kcal by Monge-Rojas,[15] and 2764±836 kcal by Hassapidou and Fotiadou's.[16] In our study, it has been determined that our subjects fail to meet their energy requirements for a physically active life (2036.7±856 kcal). Likewise, in the study of Öner et al.,[7] it has been observed that the female adolescents are also provided with insufficient energy. When we evaluated for percentage energy distribution derived from macronutrients we observed that carbohydrate, protein and fat intakes of our adolescents were similar to the values reported by Stang et al.,[17] and Martinchik et al.[18] and Baş et al.'s.[19] All these values approximate to the recommendations stating that 45 to 65% of the energy is to be provided by carbohydrates, 10 to 20% from proteins and 20 to 35% from fats.[13]

According to the nutrient intake studies, insufficient daily energy intake is in parallel with the inadequate intake of most of the nutrients in general.[15,17,18,20] One of the vital micronutrients to be taken sufficiently in the adolescent period is calcium. As per the results of our study, the daily amount of calcium consumed by adolescent males appears to be low. According to DRI, the average daily calcium intake in adolescents should be 1200 to 1300 mg/dl.[9] However, in the studies[14,20-25] carried out on adolescents including ours, none of the subjects was observed to consume calcium at this level. The researches[18,24,26-28] revealed that most of the young people at this stage consume insufficient milk and dairy products due to weight anxiety

Table 3. Comparison of the nutritional intakes of adolescent boys who had under-, normal- and overweight

Nutrients	Underweight (n=57)	Normal weight (n=854)	Overweight or obese (n=93)	Statistical difference between groups and p values
Energy (kcal)	1664.5±511.9	2022.5±731.0	2394.3±1630.5	1-2 ve 1-3 (<0.001) 2-3 (<0.05)
Protein (g)	70.6±21.2	84.1±33.0	96.2±44.8	1-3 (<0.001) 1-2 ve 2-3 (<0.05)
Carbohydrate (g)	195.1±64.3	241.9±91.2	286.8±203.8	1-2 ve 1-3 (<0.001) 2-3 (NS)
Fat (g)	64.1±23.2	76.4±34.4	92.0±76.4	1-3 (<0.001) 1-2 ve 2-3 (<0.05)
Fiber (g)	16.8±6.5	19.7±8.7	22.2±11.0	1-2 ve 1-3 (<0.001) 2-3 (NS)
Sodium (mg)	3193.1±1005.1	3911.7±1711.8	4452.4±2320.5	1-2 ve 1-3 (<0.001) 2-3 (<0.05)
Thiamine (mg)	0.7±0.2	0.8±0.3	0.9±0.5	1-2. 1-3. 2-3 (<0.05)
Riboflavin (mg)	1.3±0.5	1.4±0.6	1.7±1.1	1-2 (NS) 1-3 ve 2-3 (<0.05)
Pyridoxine (mg)	1.0±0.3	1.1±0.4	1.4±0.8	1-2 (NS) 1-3 ve 2-3 (<0.05)
Folic acid (μg)	112.4±43.5	122.3±52.2	160.8±143.4	1-2 (NS) 1-3 ve 2-3 (<0.05)
Magnesium (mg)	222.0±95.1	251.4±125.5	284.8±134.7	1-3 (<0.001) 1-2 ve 2-3 (<0.05)
Phosphorus (mg)	1074.6±342.2	1213.8±466.7	1416.7±696.1	1-3 (<0.001) 1-2 ve 2-3 (<0.05)
Iron (mg)	9.9±3.8	11.6±4.8	13.2±6.5	1-2 (<0.05). 2-3 (NS) 1-3 (<0.001)
Zinc (mg)	9.6±2.9	11.5±4.7	13.2±6.0	1-2 ve 1-3 (<0.001) 2-3 (<0.05)

*Kruskal-Wallis and Mann-Whitney U tests were used to compare these variables. Other macro- and micronutrient intakes were not different between groups. NS: Non-significant.

and accordingly, the adolescents' calcium intake is lower than the required level. Our adolescents also fail to consume milk and dairy products. The reason behind the low milk and dairy product consumption among our subjects is related to an increase in soft drink consumption.

The daily thiamine consumption of our subjects was below the recommended value, whereas Zive et al.,[14] Lambert et al.,[29] and Decarli et al.[30] reported that the daily thiamine intake was adequate in adolescent males. Nicklas et al.[31] have also observed that thiamine intake was adequate in the adolescent group consuming high fiber. Thiamine is high in vegetable seeds, and especially in the outer parts of the seeds and embryos. Therefore it is easily damaged while processing grains. Nuts and legumes are also rich in thiamine. Thiamine deficiency in our working group proved that the adolescent males in this region do not prefer whole wheat/meal flour and bread, pasta and especially bulgar (boiled and pounded) wheat which are preferred in other regions of Turkey.

In our study, the daily average folic acid intake was found to be very low. Likewise, in many studies[14,16,17,19,25,30] folic acid intake of adolescents was also found low. Folic acid intake is important for adolescent girls, particularly for the ones at the age of birth giving. Öner et al.[32] found that the girls in the region took folic acid lower than required which showed a positive correlation with the serum folic acid values. The adolescents at this age should consume foods rich in folic acids and the diets of the adolescent girls at the age of birth giving should be reinforced with this nutrient.[33]

As a result of many studies including ours,[14,16,17,20,23,25,30] it has been reported that vitamin A intake of adolescents is usually below the recommended level. People get pro-vitamin A from green and yellow vegetables and fruits and vitamin A from fish oil and animal products. According to the results we obtained, we conclude that our subject male adolescents consume insufficient vegetable and fruits which are major sources of fiber and sufficient animal products which are major sources of protein.

The adolescents in our study consume vitamin E insufficiently in their daily diets. Likewise, in the studies made on adolescents,[14,17,23,25,30] the

daily vitamin E intake is observed to be inadequate. The reason for the inadequate vitamin E intake revealed in our study can be associated with adolescents' insufficient consumption of important vitamin E resources, i.e. walnuts, chestnuts, green leafy vegetables, oily seeds, and whole grains.

In several studies[19,22,34-37] it has been reported that adolescents consume inadequate amounts of vegetables, fruits, legumes, grains and therefore their fiber intake is low. Nicklas et al.[31] have observed that only 26 out of 319 students at the age of 15 take sufficient amount of fiber. The daily fiber intakes of the adolescents in our working group was also found to be insufficient and in the former study[7] carried out in the region, the daily fiber intake of the adolescent girls was found to be considerably low. Risks of various intestinal disorders, obesity, cardiac disorders or colorectal carcinoma formation decrease considerably while diabetes is taken under control through consumption of high-fiber foods.[32,38]

Although some nutrients are consumed lower than required levels by our subject adolescents, we have concluded that some macro- and micronutrients are consumed at or above the adequate level. In our study, we have observed that the average protein intake of all age groups is 85 g/day which is a value higher than the daily requirement. That is, adolescents' protein intake is usually higher than the required level. Lambert et al.[29] also reported that protein intake of male adolescents in Europe was higher (71-127 g/day) than the requirement.

The other micronutrients consumed by male adolescents who either meet or slightly exceed the daily requirement are vitamin C, B6, riboflavin, iron and zinc. In general recommended amount of vitamin C is easily consumed through a normal diet in our country. Hence in the studies made on adolescents[14,16,18,22,25,29,30] including ours, it has been observed that vitamin C consumption remains at a sufficient level.

It was shown that the male adolescents usually take adequate or excess amount of iron.[14,34,39-43] We have also observed that the iron intake is sufficient in all age groups. The adolescent males in our study had a sufficient daily iron and protein intake, which proves that red meat has an important place in their diet contrary to the adolescent females. As was the case in our study, Thane et al.[40] also found out that the average zinc intake of the male adolescents is adequate. Whereas in the study carried out by Öner et al.[7] in this region on female adolescents, the average zinc intake is found to be significantly lower than that in our subjects. Zinc deficiency results in retarded growth, compressed immunity and failure of the cell in performing its metabolic functions.

In our study we have also examined the effects of rural and urban sites on the nutrition of the male adolescents; however no material difference has been detected between the 316 subjects living in rural site and the 688 subjects living in the urban site. On the other hand, in the former study carried out in 2001 on female adolescents, it was observed that the nutrients consumed in the rural site are less than those consumed in the urban site.[7] Monge-Rojas[15] in his study found out that the energy, fat and sodium intakes of male adolescents was higher in the urban sites while the fiber and folic acid intakes was higher in the rural regions. Such a difference may be attributed to the socioeconomic levels of the rural and urban regions of Costa Rica. Also in the studies performed by Shahabuddin et al.[41] and Shi et al.,[42] it was demonstrated that the impact of the socioeconomic and cultural level difference on the nutrition quality, that the adolescent nutrition in the rural region was considerably insufficient.

Smoking is a dangerous habit, which may affect the nutritional status, generally reducing the appetite.[43] The results of our study on the nutrient intakes of the smoking and nonsmoking adolescents have revealed the fact that the smokers' vitamin C and carotene intake is significantly lower than that of their nonsmoking contemporaries. As reported by Muñoz et al.[36] and Neumark-Sztainer et al.,[37] the adolescents do not consume sufficient amount of fruits in their daily diets. Furthermore, there is reason to believe that low concentration of vitamin C

in blood due to insufficient intake of vitamin C (vitamin C deficiency) will increase the smokers' risks for various types of cancer and cardiovascular diseases.[43,44]

As a result, the adolescent group should be supported with a sufficient and balanced diet as is true for all other age groups. The dietary recommendations and menu samples that will be prepared as per our study results may help the male adolescents living in the region and throughout the country to have an optimal nutritional status and enjoy a healthy life.

REFERENCES

1. Spear BA. Adolescent growth and development. J Am Diet Assoc 2002;102(3 Suppl):S23-9.
2. Herbold NH, Frates SE. Update of nutrition guidelines for the teen: trends and concerns. Curr Opin Pediatr 2000;12:303-9.
3. Rome ES, Vazquez IM, Blazer NE. Adolescence: healthy and disordered eating. In: Walker WA, Duggan C, Watkins JB, editors. Nutrition in pediatrics: basic science and clinical applications. 3rd ed. Hamilton Ontario: BC Decker; 2003. p. 861-77.
4. Story M, Neumark-Sztainer D, French S. Individual and environmental influences on adolescent eating behaviors. J Am Diet Assoc 2002;102(3 Suppl):S40-51.
5. Fitzgibbon ML, Stolley M. Promoting health in an unhealthful environment: lifestyle challenges for children and adolescents. J Am Diet Assoc 2006;106:518-22.
6. Lytle LA. Nutritional issues for adolescents. J Am Diet Assoc 2002;102(3 Suppl):S8-12.
7. Öner N, Vatansever U, Garipağaoğlu M, Karasalihoğlu S. Dietary intakes among Turkish adolescent girls. Nutr Res 2005;25:377-86.
8. Bundak R, Furman A, Gunoz H, Darendeliler F, Bas F, Neyzi O. Body mass index references for Turkish children. Acta Paediatr 2006;95:194-8.
9. Institute of Medicine. Dietary reference intakes: for calcium, phosphorus, magnesium, vitamin D, and fluoride. 1st ed. Washington DC: National Academy Press; 1997.
10. Institute of Medicine. Dietary reference intakes for thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, pantothenic acid, biotin, and choline. 1st ed. Washington DC: National Academy Press; 2000.
11. Institute of Medicine. Dietary reference intakes for vitamin C, vitamin E, selenium, and carotenoids. 1st ed. Washington DC: National Academy Press; 2000.
12. Institute of Medicine. Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. 1st ed. Washington DC: National Academy Press; 2001.
13. Institute of Medicine. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids. 1st ed. Washington DC: National Academies Press; 2005.
14. Zive MM, Nicklas TA, Busch EC, Myers L, Berenson GS. Marginal vitamin and mineral intakes of young adults: the Bogalusa Heart Study. J Adolesc Health 1996;19:39-47.
15. Monge-Rojas R. Dietary intake as a cardiovascular risk factor in Costa Rican adolescents. J Adolesc Health 2001;28:328-37.
16. Hassapidou MN, Fotiadou E. Dietary intakes and food habits of adolescents in northern Greece. Int J Food Sci Nutr 2001;52:109-16.
17. Stang J, Story MT, Harnack L, Neumark-Sztainer D. Relationships between vitamin and mineral supplement use, dietary intake, and dietary adequacy among adolescents. J Am Diet Assoc 2000;100:905-10.
18. Martinchik AN, Baturin AK, Helsing E. Nutrition monitoring of Russian schoolchildren in a period of economic change: a World Health Organization multicenter survey, 1992-1995. Am J Clin Nutr 1997;65(4 Suppl):S1215-S9.
19. Baş M, Altan T, Dinçer D, Aran E, Kaya HG, Yüksek O. Determination of dietary habits as a risk factor of cardiovascular heart disease in Turkish adolescents. Eur J Nutr 2005;44:174-82.
20. Khan MR, Ahmed F. Physical status, nutrient intake and dietary pattern of adolescent female factory workers in urban Bangladesh. Asia Pac J Clin Nutr 2005;14:19-26.
21. Rozen GS, Rennert G, Rennert HS, Diab G, Daud D, Ish-Shalom S. Calcium intake and bone mass development among Israeli adolescent girls. J Am Coll Nutr 2001;20:219-24.
22. Leclercq C, Piccinelli R, Arcella D, Le Donne C. Food consumption and nutrient intake in a sample of Italian secondary school students: results from the INRAN-RM-2001 food survey. Int J Food Sci Nutr 2004;55:265-77.
23. Johnson RK, Johnson DG, Wang MQ, Smiciklas-Wright H, Guthrie HA. Characterizing nutrient intakes of adolescents by sociodemographic factors. J Adolesc Health 1994;15:149-54.
24. Harel Z, Riggs S, Vaz R, White L, Menzies G. Adolescents and calcium: what they do and do not know and how much they consume. J Adolesc Health 1998;22:225-8.
25. Monge-Rojas R. Marginal vitamin and mineral intake of Costa Rican adolescents. Arch Med Res 2001;32:70-8.
26. Cavadini C, Siega-Riz AM, Popkin BM. US adolescent food intake trends from 1965 to 1996. Arch Dis Child 2000;83:18-24.
27. Forshee RA, Anderson PA, Storey ML. Changes in calcium intake and association with beverage consumption and demographics: comparing data from CSFII 1994-1996, 1998 and NHANES 1999-2002. J Am Coll Nutr 2006;25:108-16.
28. Neumark-Sztainer D, Story M, Dixon LB, Resnick MD, Blum RW. Correlates of inadequate consumption of dairy products among adolescents. J Nutr Educ Behav 1997;29:12-20.
29. Lambert J, Agostoni C, Elmadfa I, Hulshof K, Krause

E, Livingstone B, et al. Dietary intake and nutritional status of children and adolescents in Europe. Br J Nutr 2004;92 Suppl 2:S147-211.
30. Decarli B, Cavadini C, Grin J, Blondel-Lubrano A, Narring F, Michaud PA. Food and nutrient intakes in a group of 11 to 16 year old Swiss teenagers. Int J Vitam Nutr Res 2000;70:139-47.
31. Nicklas TA, Myers L, O'Neil C, Gustafson N. Impact of dietary fat and fiber intake on nutrient intake of adolescents. Pediatrics 2000;105:E21.
32. Oner N, Vatansever U, Karasalihoğlu S, Ekuklu G, Celtik C, Biner B. The prevalence of folic acid deficiency among adolescent girls living in Edirne, Turkey. J Adolesc Health 2006;38:599-606.
33. Eskes TK. From anemia to spina bifida - the story of folic acid. A tribute to Professor Richard Smithells. Eur J Obstet Gynecol Reprod Biol 2000;90:119-23.
34. Alaimo K, McDowell MA, Briefel RR, Bischof AM, Caughman CR, Loria CM, et al. Dietary intake of vitamins, minerals, and fiber of persons ages 2 months and over in the United States: Third National Health and Nutrition Examination Survey, Phase 1, 1988-91. Adv Data 1994;258:1-28.
35. Greene-Finestone LS, Campbell MK, Evers SE, Gutmanis IA. Adolescents' low-carbohydrate-density diets are related to poorer dietary intakes. J Am Diet Assoc 2005;105:1783-8.
36. Muñoz KA, Krebs-Smith SM, Ballard-Barbash R, Cleveland LE. Food intakes of US children and adolescents compared with recommendations. Pediatrics 1997;100:323-9.
37. Neumark-Sztainer D, Story M, Resnick MD, Blum RW. Correlates of inadequate fruit and vegetable consumption among adolescents. Prev Med 1996;25:497-505.
38. American Institute for cancer research, World cancer research fund. Food, nutrition and the prevention of cancer: A global perspective. 1st ed. Washington: American Institute for cancer research. 1997. p. 24-5.
39. Thane CW, Bates CJ, Prentice A. Risk factors for low iron intake and poor iron status in a national sample of British young people aged 4-18 years. Public Health Nutr 2003;6:485-96.
40. Thane CW, Bates CJ, Prentice A. Zinc and vitamin A intake and status in a national sample of British young people aged 4-18 y. Eur J Clin Nutr 2004;58:363-75.
41. Shahabuddin AK, Talukder K, Talukder MK, Hassan M, Seal A, Rahman Q, et al. Adolescent nutrition in a rural community in Bangladesh. Indian J Pediatr 2000;67:93-8.
42. Shi Z, Lien N, Kumar BN, Holmboe-Ottesen G. Socio-demographic differences in food habits and preferences of school adolescents in Jiangsu Province, China. Eur J Clin Nutr 2005;59:1439-48.
43. Alberg A. The influence of cigarette smoking on circulating concentrations of antioxidant micronutrients. Toxicology 2002;180:121-37.
44. Dowdell EB, Santucci ME. Health risk behavior assessment: nutrition, weight, and tobacco use in one urban seventh-grade class. Public Health Nurs 2004;21:128-36.