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Dietary Habits and Body Composition of Turkish University Students

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Abstract: Nutritional status of university students is an indicator of health and well-being at both the individual and the population level. This study examines the diet and body constitution of university students in Turkey. 3 day diet recalls were collected, anthropometric and body composition measurements were made. The sample consisted of 57 male and 63 female students. Mean BMI was significantly lower in females than males ($p<0.01$). Significant differences between sexes were not found as regards total cholesterol and blood glucose. More than 50% of the respondents were meeting two thirds of the RDA for niacin, riboflavin, vitamin B6, vitamin C, phosphorus and zinc. The mean intakes of total energy, carbohydrate, protein, phosphorus, iron, magnesium, zinc, vitamin D, thiamine, riboflavin, vitamin B6 and folate were higher in males compared with female students. This research provides important information regarding anthropometric assessment, the micronutrient and macronutrient intake of university students in Turkey. The results show the need to consider the limitations of the reference data when carrying out nutritional assessments.

Key words: University students, dietary habits, body composition

Introduction

Epidemiologic studies show that lifestyle habits, one being food intake during young adulthood, may have long-term health implications and the food intake of young adults is not as nutritionally sound as desired (Keim *et al*., 1997). In university halls of residence, all meals are provided. But some students may have to provide their own food, if they live off campus. Students are usually poorly equipped to prepare their own food (Lang *et al.*, 1996); additionally students are undoubtedly short of money (Edwards and Meiselman, 2003). The eating behaviours and food choice of university students are determined by an interaction of various different factors (Jas, 1998). These are both biological such as changing energy demands and weight change and sociocultural factors like availability and price of food and culture. Also, there are psychological factors such as freedom from parental control and the need to come to terms with changing world in which they find themselves (Birch *et al*., 1996). If dietary changes are taking place at this time, there could be lack of nutrients and this might affect students' university performance or their general physical and mental well being (Edwards and Meiselman, 2003). It was presented that less than 2% of adolescents consumed an adequate amount of food groups and that almost 20% of females and 7% males did not recommended amounts of food groups. Generally males consumed larger quantities of foods than females and they were more likely to meet the RDA for both micro and macronutrients. Breakfast skipping is highly prevalent in the United States and Europe (10% to 30%) (Rampersaud *et al*., 2005). Females are more likely to skip breakfast that usually comprises total nutrient sufficiency (DiMeglio, 2000). Stockman *et al*. (2005) reported that dinner was the largest contributor of energy, macronutrients, cholesterol and dietary fibre, whereas both dinner and breakfast were the largest contributors of calcium and iron.

For population studies the Body Mass Index (BMI) can be used as a surrogate measure for body fatness (Deurenberg-Yap *et al*., 2000). An important aspect of health related to nutritional status is body composition (Gamez *et al*., 1998). Published anthropometric data on Turkish university students are scarce and restricted (Sanlier and Arli, 2000; Sanlier, 2001; Sanlier and Yabanci, 2001).

The objectives of the study were to generate baseline data and describe the nutritional and anthropometric profiles of a purposively selected group of university students.

Materials and Methods

Materials: The sample consisted of 57 male and 63 female students with the mean age 20.65±1.18. All of them were students in Department of Family Economics and Nutrition, at the Faculty of Vocational Education of Gazi University, Ankara, Turkey.

Anthropometry and body composition: All subjects were wearing light indoor clothes and no shoes. The total body weight was measured with firm digital portable scale with precision of 0.5 kg. Body height

was measured with the student standing upright without shoes. The measurements were taken for each subject in all 12 anthropometric variables. The anthropometric assessments were performed by the first author. Height, weight, triceps, biceps, subscapular, suprailiac, calf skinfold, mid-upper arm, waist, hip, calf, wrist circumferences were measured in that order (Gibson, 1990). Three complete sets of measurements were carried out and the mean of the three values were used. Weight was measured with bathroom scales graduated to nearest 0.1 kg. height was measured with the subject standing barefoot with heels together, arms at the side, legs straight, shoulders relaxed and head in the Frankfort horizontal plane, with heels, buttocks, scapulae and the lying against a vertical wall. From the anthropometric data, Body Mass Index (BMI) was calculated as weight (kg)/ (height m)^2 according to standards recommended by The World Health Organization (WHO, 1987).

Mid upper arm muscle area, upper arm fat area, mid upper arm muscle circumference, waist to hip ratio was calculated using the formula by Gibson (1990) and Lohman *et al*. (1988). Mid upper arm circumference was measured midway between the lateral projection of the acromion process of the scapula and the inferior margin of the olecranon process of the ulna. This middle score was marked with the elbow flexed at 90 degrees and the measurement was made with the arm hanging loosely at the side of the body. Calf circumference was registered at the middle of the fleshy and bulky part of the calf. The mid arm and calf circumferences were measured with flexible steel tape and recorded to the nearest 0.1cm. All measurements were performed by the first author.

The amount and distribution of body fat were assessed by measuring the thickness of subcutaneous adipose tissue with a large skinfold calliper. The skinfold thicknesses were measured on the left side of the body at four sites: biceps and triceps (limb), subscapula and supra-iliac (trunck). The sum of the four skinfold thickness measures was considered an indicator of total subcutaneous fat and the sum of trunck skinfold thickness as an index of central obesity WC and WHR were used to assess body fat distribution and specifically as indicators of intra abdominal or visceral fat deposition (Roche *et al*., 1998).

Dietary intake: The diet section of the study was based on the 3 day self-reported nutrient intake of the respondents. The 3 days included 1 weekend day and previous or next two days (Sunday, Monday, Tuesday or Thursday, Friday, Saturday). It was wanted to record everything they eat and drink. The respondents were asked to provide as much information as possible about serving size, method of cooking and all details of food consumption (ie fish with skin or without skin). The transformation of food into energy and nutrients has been carried out by a computer program that includes the Turkish Food Composition tables. Cut off points was calculated according to recommended daily intake (2/3 = 67%-70%)±33%). Students daily intake of energy and nutrients are classified as sufficient (67-133%), insufficient (<67%) and over sufficient (>133%). Nutrient intakes were evaluated using the Recommended Dietary Allowances (RDA) asset forth by the US National Academy of Sciences (NRC, 1989).

Physical activity data: Physical activity data were obtained from the reported physical activities at least 5 minutes intervals. Sleep, sitting, standing, walking, exercise hours were recorded during 3 days (1 weekend day and previous or next two days). RMR, energy expenditure for physical activities, total energy expenditure and PAR calculated according to the data (Bouchard *et al*., 1983; James and Schofield, 1990).

Laboratory tests: Volunteered students (n = 60, 30 males and 30 females) were asked not to eat within the previous 12 h for blood lipid/lipoprotein assessments and random blood glucose. Blood glucose and total lipoprotein tests were measured by using Roche test kits in Roche-Modular D+P auto analyzer (Roche Diagnostics, Indianapolis, USA). Hemoglobin and hematocrit were measured in Beckman Coulter Analyzer by using Electrical Impedance Technique. Digital sphygmomanometer was used to measure students' systolic and diastolic blood pressures and pulses.

Statistical analysis: The results obtained are expressed as mean and standard deviation. To find the influence of sex on anthropometric measurements, food intake, physical activity level and blood lipid levels, student's t-test was used. Association between variables was determined using Pearson correlation coefficient. Level of significance was set at 0.05. The Statistical Package for the Social Science (SPSS, version 12.0) was used in analyzing data.

Results

Table 1 shows the age, anthropometric characteristics, body composition and biochemical analyses of the studied population. Mean weight (kg) and height (cm) were significantly different by gender and mean BMI was significantly lower in females than males (22.6±2.6 vs 21.0±2.7 kg/m^2) ($p<0.01$). Despite the lack of statistical significance, the crude data in Table 1 suggest that the

Table 1: Mean physical characteristics of the sample

	Male		Female		
Parameters	Mean	SD	Mean	SD	p value
Weight (kg)	69.7	9.9	56.3	9.0	0.00**
Height (cm)	175.7	5.9	163.5	6.6	0.00**
BMI (kg/m^2)	22.6	2.6	21.0	2.7	0.00**
Biceps skinfold (mm)	4.3	2.6	8.6	3.5	0.00**
Triceps skinfold (mm)	9.5	4.3	19.5	7.2	0.00**
Suprailiac skinfold (mm)	19.3	10.5	24.1	9.8	0.01**
Subscapular skinfold (mm)	13.9	6.4	17.2	7.4	0.01**
Sum 4 skinfolds (mm)	47.1	21.4	69.3	24.4	0.00**
Mid-upper-arm circumference (cm)	27.0	2.5	25.3	3.4	0.01**
Mid-upper-arm muscle circumference (cm)	24.0	2.0	19.1	3.1	0.00**
Mid-upper-arm muscle area (cm^2)	46.2	8.1	29.9	10.5	0.00**
Upper arm fat area (cm^2)	10.5	4.5	14.5	4.8	0.00**
Wrist circumference (cm)	19.3	18.8	15.1	0.9	0.08
Calf circumference (cm)	36.3	3.1	34.9	2.9	0.01**
Waist circumference (cm)	78.6	7.6	71.3	7.6	0.00**
Hip circumference (cm)	96.8	6.7	95.6	6.6	0.30
Waist/hip ratio	0.81	0.05	0.74	0.04	0.00**
Arm circumference (cm)	173.9	7.4	157.9	8.1	0.00**
Lean body mass (kg)	53.9	6.3	38.4	5.1	0.00**
Lean body mass (%)	77.7	5.4	68.7	4.6	0.00**
Body fat (kg)	15.8	5.6	17.9	4.8	0.03*
Body fat (%)	22.3	5.4	31.3	4.6	0.00**
Total cholesterol (mg/dL)	159.2	32.6	163.0	29.0	0.64
HDL-kolesterol (mg/dL)	48.8	9.5	63.2	12.0	0.00**
LDL-kolesterol (mg/dL)	88.6	26.1	84.0	25.7	0.49
VLDL-kolesterol (mg/dL)	21.8	11.0	15.8	6.0	0.01*
Blood glucose (mg/dL)	81.2	5.5	80.4	6.3	0.59
Blood pressure (mmHg) Systolic	120.7	14.2	107.6	13.1	0.00**
Diastolic	76.7	11.7	72.9	9.1	0.00**
Pulse	76.7	16.4	84.8	14.4	0.00**
Haemoglobin (mg/dL)	15.7	1.1	12.3	1.3	0.00**
Hematocrit (%)	44.4	2.8	36.5	3.4	0.00**

*p<0.05 **p<0.01

respondents have a higher body fat percentage at a lower BMI. Other than hip and wrist circumferences, there were significant differences between genders in other anthropometric measurements. Significant differences between sexes were not found as regards total cholesterol and blood glucose; however, hematocrit, haemoglobin, pulse and blood pressure levels differ between genders (p<0.01).

Mean intakes of nutrients varied between male and female respondents. A comparison of mean dietary intakes of respondents is shown in Table 2. The mean intakes of total energy, carbohydrate, protein, phosphorus, iron, magnesium, zinc, vitamin D, thiamine, riboflavin, vitamin B6 and folate were higher in males compared with female students who consume more vitamin A. The predominant types of fat for both female and male respondents were saturated and polyunsaturated fatty acids. Cholesterol intake ranged from 149.9 to 196.6 mg/day for female and male respondents.

The percentages of the respondents meeting two thirds of the RDA for nutrients are shown in Table 3. More than 50% of the respondents were meeting two thirds of the RDA for niacin (52.4%), riboflavin (62.5%), vitamin B6 (67.5%), vitamin C (57.5%), phosphorus (55.0%) and zinc (67.5%). Whereby a small percentages of the respondents met two thirds of the RDA for energy (32.5), vitamin A (45.0%), vitamin B1 (35.0%), calcium (27.5%), iron (45.0%) and magnesium (35.0%). None of the respondents were meeting two thirds of the RDA for folate.

Discussion

These data obtained from population of university students were aimed to provide a general picture of the typical aspects related to nutrition and body composition characterizing university students. Mean BMI ranged from 21.0 to 22.7 kg/m$^{2.}$ Using the classification of BMI ranges (15), the results reflect a high incidence of normal weight students among the respondents (64.2%). Indeed 10% of the subjects were overweight and 25.8% were underweight. Although obesity was common among males (14%), high prevalence of underweight was recorded among

Table 2: Macronutrient and micronutrient intake from 3 day recalls

	Male		Female		
Parameters	Mean	SD	Mean	SD	p value
Energy (kcal)	2261.3	961.3	1429.8	561.7	0.00**
Carbohydrate (g)	315.2	122.5	173.6	68.7	0.00**
Protein (g)	84.0	40.4	55.6	23.8	0.00**
Fat (g)	71.1	40.8	55.3	27.2	0.08
Dietary fibre (g)	28.9	11.8	21.6	22.8	0.12
Carbohydrate (%)	57.2	6.4	49.5	6.1	0.00**
Protein (%)	15.1	2.8	16.0	3.7	0.27
Fat (%)	27.6	6.6	34.4	6.2	0.00**
Polyunsaturated fat (g)	19.4	12.2	14.6	9.0	0.92
Monounsaturated fat (g)	23.3	12.2	17.6	8.5	0.04*
Saturated fat (g)	23.3	15.9	19.2	9.9	0.23
Cholesterol	196.6	169.0	149.9	95.2	0.19
Phosphorus (mg)	1244.0	545.8	841.4	349.0	0.00**
Calcium (mg)	605.2	293.9	544.5	314.6	0.44
Iron (mg)	13.7	6.2	10.0	7.4	0.04*
Magnesium (mg)	274.5	117.9	199.2	107.1	0.01**
Zinc (ìg)	11.6	6.5	7.7	3.1	0.00**
Vitamin A (ìgER)	876.0	489.1	1018.6	878.9	0.44
Vitamin D	1.9	2.9	1.3	1.4	0.00**
Thiamin (mg)	1.03	0.43	0.62	0.21	0.00**
Riboflavin (mg)	1.26	0.54	0.97	0.54	0.04*
Niacin (mgEN)	26.19	12.46	18.91	9.00	0.01**
Vitamin B_6 (mg)	1.44	0.56	1.04	0.43	0.00**
Vitamin C (mg)	97.8	50.8	80.2	41.3	0.14
Folate (ìg)	170.4	67.7	103.7	40.6	0.00**

*p<0.05 **p<0.01

female students (33.3%). The BMI values of the respondents are in accordance with other study made in university students (Unusan, 2004a).

Sum of four skinfold thickness and body fat is influenced by genetic factors (Bar-Or *et al.*, 1998). Sum of four skinfolds and body fat of the female students was consistently higher than those of males (p<0.01). Visceral fat begins to accumulation early childhood. Sex and age differences have a significant effect on visceral fat (Goran and Gower, 1999). Excess body fat has been attributed as a risk factor for several non-communicable diseases such as diabetes, hypertension, hyperlipidemia and cardiovascular disease. Recent statistics in Turkey have indicated a high prevalence of these diseases in Turkey (TDHS, 1998). Therefore, it is important to establish an intervention programme to prevent and control non-communicable diseases. Standards for waist and hip circumferences are not yet available in Turkey but Larsson *et al.* (1984), in a 13 year follow up study have highlighted the significance of the distribution of abdominal adipose tissue as a predictor of cardiovascular problems. Anthropometric reference data for assessing the nutrition of university students in Turkey are limited. In summary, physical activity data do not affect BMI or body composition parameters of the university students studied here, whose energy intake meets the recommended level for their age and sex. Non-correlation found (p>0.05) between energy intake and BMI or body fat, indicates the need for a better choice of food to balance the diet, accompanied by an adequate physical activity (Gamez *et al.*, 1998).

Oner *et al.* (2005) showed that Turkish boys aged 12-17 consumed larger quantities of food than girls and they concluded that boys were more likely to meet RDA for nutrients. In this study females were more likely to meet the RDA for both micro and macro nutrients. This might be because unless training was given at home, male students were less likely to cook and feed themselves (Lang *et al*., 1996).

The energy requirements differ, but in general for ages 19-24, they need to be between 2200 and 2900 kcal/day (WHO, 1987). In this study 65% of university students consume insufficient energy daily. Energy should come from various foods. It is recommended that 55-60% of total calories should come from carbohydrates, 10-20% from protein and less than 30% from fat (DRI, 2002). When compared to females, male respondents have appropriate carbohydrate and fat intakes. Mean percent of total calories from fat for female group was 34.4%. This percentage is greater than the recommended 30% or less of kilocalories from fat (NRC, 1989) and was significantly different between the two groups. The National Cholesterol Education Program (1988) recommends that saturated fat percent be less than 10% of total calories. Females in this study consumed a mean of 12% of their calories from saturated fat. These

Table 3: The percentages of university students meeting RDA for nutrients

Parameters		Insufficient (%)	Sufficient (%)	Over sufficient (%)	
Energy	Male	78.9	21.1	-	Chi^2=3.45
	Female	52.4	42.9	4.8	p=0.18
	Total	65.0	32.5	2.5	
Vitamin A	Male	21.1	42.1	36.8	Chi^2=0.86
	Female	28.6	47.6	23.8	p=0.65
	Total	25.0	45.0	30.0	
Vitamin B_1	Male	68.4	26.3	5.3	Chi^2=1.21
	Female	52.4	42.9	4.8	p=0.55
	Total	60.0	35.0	5.0	
Niacin	Male	-	9.5	5.0	Chi^2=2.02
	Female	47.4	38.1	42.5	p=0.37
	Total	52.6	52.4	52.5	
Vitamin B_2	Male	21.1	73.7	5.3	Chi^2=2.08
	Female	33.3	52.4	14.3	p=0.35
	Total	27.5	62.5	10.0	
Vitamin B_6	Male	5.3	84.2	10.5	Chi^2=5.5
	Female	33.3	52.4	14.3	p=0.06
	Total	20.0	67.5	12.5	
Folate	Male	100.0	-	-	-
	Female	100.0	-	-	
	Total	100.0	-	-	
Vitamin C	Male	15.8	63.2	21.1	Chi^2=0.56
	Female	23.8	52.4	23.8	p=0.76
	Total	20.0	57.5	22.5	
Calcium	Male	73.7	26.3	-	Chi^2=099
	Female	66.7	28.6	4.8	p=0.61
	Total	70.0	27.5	2.5	
Phosphorus	Male	-	57.9	42.1	Chi^2=0.96
	Female	4.8	52.4	42.9	p=0.62
	Total	2.5	55.0	42.5	
Iron	Male	-	52.6	47.4	Chi^2=22.2
	Female	61.9	38.1	-	p=0.00
	Total	32.5	45.0	22.5	
Zinc	Male	21.1	73.7	5.3	Chi^2=2.75
	Female	14.3	61.9	23.8	p=0.25
	Total	17.5	67.5	15.0	
Magnesium	Male	84.2	15.8	-	Chi^2=7.45
	Female	42.9	52.4	4.8	p=0.02
	Total	62.5	35.0	2.5	

findings are in accordance with other studies (Hendricks and Herbold, 1998; Lewis *et al*., 1999). This result is lower than studies conducted in Spain (Cruz, 2000) and higher than Pacific Island females (Pobocik *et al*., 2000). The females' mean monounsaturated fat intake (11%) and polyunsaturated fat intake (9%) were within the recommendations (10-15% and <10% of kcal respectively). Mean dietary fibre intakes of respondents were within the current recommendation level (20 to 30 g/day) (NRC, 1989). Mean dietary cholesterol was within the recommendations of less than 300 mg/day (NCEP, 1988).

When the mean intake of vitamins of respondents was compared with RDA, our respondents consumed inadequate thiamine, riboflavin and niacin that are essential for carbohydrate use. Folic acid intake of females at childbearing age is of special interest because it can prevent birth defects known as Neural Tube Defects (NTD) and other malformations. Turkey has a very high prevalence rate of NTDs when compared with the EUROCAT registries. Prevalence rate of NTDs is 30,1 per 10,000 births in Turkey (Tunçbilek *et al*., 1999). It was shown that Only 22% of the subjects had heard or read about folic acid (Unusan, 2004b). For that reason all females should consume 0.4 mg from supplements, fortified food and food rich in folic acid. Unfortunately the respondents in this study do not consume adequate folic acid.

Vitamins A and C are sufficiently consumed by the respondents. Both of them are vital for healthy immune systems and act as an antioxidant that participates in oxidation-reduction reactions (Shapiro and Saliou, 2001). Vitamin A and C intakes were found to be lower than Turkish adolescent girls living in Marmara region in Turkey (Oner *et al*., 2005).

The threat of osteoporosis in later life means that the bone mass women achieve during their youth is

important. An intake of more than two portions of milk per day is optimum for achieving bone mineral density (Basabe *et al*., 2004). According to RDA, 1200 mgs of calcium and phosphorus for 19-24 year old adolescents provide adequate levels. Only male respondents consume enough phosphorus. The reason for low intake may due to inadequate consumption of milk and milk products by the respondents.

Estimated prevalence of iron deficiency anaemia age 15-49 is 33% in Turkey. 32.5% of the respondents have inadequate iron intake. Iron intake of female students was lower than that of males. NHANES III data show that the mean iron intake of adolescent girls is less than 12 mg (Alajma *et al*., 1994). In our study although males consume adequate amounts of iron (10 mg RDA), females do not (15 mg RDA). Although 40% of American girls meet two thirds of the RDA for intake of iron, on average 45% of our respondents meet this level (52.6% and 38.1% for males and females respectively).

Conclusion: These data obtained provided a general picture of the typical aspects related to nutrition and body composition characterising university students. The study has several limitations. Existing reference data for anthropometric nutritional assessment of university students in Turkey are not representative of all populations. The discrepancy may due to geographical differences. Urgent steps must be taken to establish the reason for the differences and to obtain reference data for the whole of Turkey. Therefore students with malnutrition are identified and enable early and appropriate intervention for the time being. The 3 day food records may not reflect a year. On the other hand food records are regarded as reproducible and provide a useful scale for categorizing individuals according to their intake of energy and nutrients (Friis *et al*., 2001; Schroder *et al*., 2001; Kelemen *et al*., 2003).

Despite limitations, the results of this study raise several issues deserving further exploration. This research provides important information regarding anthropometric assessment, the micronutrient and macronutrient intake of university students in Turkey. The results show the need to consider the limitations of the reference data when carrying out nutritional assessments. Further research is needed of the apparent low dietary intake of energy, vitamin B1, niacin, folate, calcium and magnesium in university students with exploration of potential effects on health and academic performance.

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