PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
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Pakistan Journal of Nutrition, 7 (2): 202-207, 2008
ISSN 1680-5194

The Relationship Between Caloric Beverage Consumption and Body Mass Index in Turkish University Students

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Abstract: The goal of this study was to correlate caloric beverage consumption (amount and type) and body mass index (BMI) in Turkish university students. Subjects (600 men and 593 women) were recruited from 3 public and 3 private universities in Ankara, Turkey. In each subject, socio demographic information was reviewed, a 3-day 24-hour dietary record was evaluated, body weight and height were measured, and BMI was calculated. Multi variate regression models were used to determine the independent relationship of caloric beverage consumption with BMI. The younger male subjects drank significantly more total caloric beverages than did the younger female subjects did. Caloric soft drinks were the beverage of choice among subjects, after which fluid milk, fruit drinks, and 100% fruit juices were preferred. No significant associations were noted between the BMI of the subjects and their intake of caloric beverages. Caloric beverage consumption accounted for 1% or less of the explained variance in BMI.

Key words: Obesity, beverage, soft drinks, young adults

Introduction

Obesity causes significant short-term and long-term health consequences in all age groups (Ogden *et al*., 2002). The World Health Organization is focusing international attention on overweight and obesity, both of which are indicated by a high body mass index (BMI) (World Health Organization, 2002). Obesity is influenced by many factors (genetic characteristics; age; sex; ethnicity; educational, economic, and marital status; parity; dietary habits; and level of physical activity) (Bouchard and Tremblay, 1997; Satman *et al*., 2000). Some studies have shown that changes in nutrition and the level of physical activity are occurring in many developing countries (Cavadini *et al*., 2000; Nielsen and Popkin, 2004). These changes are marked by increases in BMI in a variety of populations grouped by age, sex, or ethnicity (Guo *et al*., 2000).

The dietary causes of obesity are complex and poorly understood (Krauss *et al*., 2000). However, changes in beverage consumption patterns over the past several decades may be related to the high prevalence of obesity (Harnack *et al*., 1999; Cavadini *et al*., 2000; Ludwig *et al*., 2001; French *et al*., 2003; Forshee and Storey, 2003; Berkey *et al*., 2004; Forshee *et al*., 2004). In children aged 11 to 12 years, the consumption of sweetened beverages, such as non diet soda and fruit drinks that are not 100% fruit juice, was positively correlated with the incidence of obesity, but the consumption of diet soda was inversely related to obesity (Ludwig *et al*., 2001). However, 1 study showed no association between the consumption of added sugar and BMI (Storey *et al*., 2003). During adolescence, milk consumption decreases, and milk becomes the second most-consumed beverage (on a gram basis) after carbonated soft drinks (Forshee *et al*., 2004). Older teens tend to drink more carbonated beverages, fruit drinks, and citrus juices and less fluid milk and non citrus juices (Moore *et al*., 2006). Research has shown that the total amount of beverages consumed varies according to age and sex. Older individuals drink more than younger individuals, and boys drink more than girls (Guo *et al*., 2000; Forshee and Storey, 2003; Forshee *et al*,. 2004). This leads to an increase in the prevalence of overweight and obesity worldwide, (Cavadini *et al*., 2000; French *et al*., 2003; Nielsen and Popkin, 2004; Berkey *et al*, 2004) as well as in Turkey, which is a developing country with 7 geographic regions. Many studies from various regions of Turkey have evaluated the prevalence overweight and obesity and related factors (Ersoy *et al*., 2005; Sur *et al*., 2005). To our knowledge, no published studies have investigated the total caloric beverage consumption in Turkish university students or the beverage choices made by that population, and no published data have correlated total beverage consumption and beverage choices with the sex or BMI of the consumer. Therefore, our study had 2 goals: to examine caloric beverage consumption amount and choice in male and female university students in Turkey and to define the correlation of caloric beverage consumption with BMI.

Materials and Methods

Subjects: This study was conducted between March and May of 2004 in the central province of Ankara, which is in

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central Turkey. At the time of the study, Ankara had a population of about 136,245 university students (Higher Educational Council, 2004). We used multistage cluster sampling methods to select the subjects from 6 Turkish universities (70.71% from public universities and 29.29% from private universities). Three public and 3 private universities, 8 faculties or colleges from each university, and at least 3 departments from each faculty or college were randomly selected as sources of the study subjects. The subjects were selected in equal numbers from each class of every department. In total, 2205 subjects were recruited. Four hundred seventy-five (21.5%) female and 537 (24.4%) male subjects were excluded from the study because they did not complete a 3-day 24-hour dietary record. Therefore, 1193 subjects (600 men and 593 women; mean age, 21.4±1.80 years) participated in the study. The study protocol was approved by education department of each university. All subjects enrolled voluntarily after the study had been fully explained.

The questionnaire: A questionnaire about each subject's socioeconomic status, lifestyle, and dietary habits was completed during a face-to-face interview conducted in the cafeteria of each university. The questionnaire included questions about age, sex, marital status, and family history of obesity and other chronic diseases. Individual habits such as smoking or dietary habits (practice and frequency) were also recorded. Each interview required 20 to 25 minutes, and each interviewer questioned no more than 10 subjects on any given day to prevent interview fatigue.

Body mass index: Body weight was measured with a digital scale with an accuracy of ± 100 g. Each subject removed his or her shoes before standing height was measured to the nearest 0.5 cm with a commercial stadiometer. BMI was calculated as weight in kilograms divided by the square of height in meters. The following categories of BMI values were applied: lower than 18.5kg/m^2, underweight; 18.5 to 24.9 kg/m^2, healthful (normal) weight; 25 to 29.9 kg/m^2, overweight; and higher than 30 kg/m^2, obese (World Health Organization, 2002).

Beverage consumption assessment: Dietary data were recorded in a 3-day 24-hour dietary record by dietitians. The first day of the record consisted of a 24-hour recall completed by dietitians and participants about the detail needed during recording. Some subjects did not want to continue the study and withdrew after they had completed their 1 or 2 days of record keeping. Information on those individuals was omitted from this study. The average caloric beverage consumption per day was calculated by adding the milliliters of caloric beverages consumed during 3 days of dietary record keeping and dividing that total by 3. The nutritional interviews and analysis were conducted by dieticians. The following caloric beverage categories were included in this study: all fluid milk (whole, low-fat, skim, evaporated, fortified, lactose free), all carbonated soft drinks, all fruit drinks (not 100% fruit juice, including lemonade), and 100% fruit juices (fresh, frozen, canned, pulp-containing, and bottled citrus and non citrus juices), and energy drinks (including sport drinks, which were often confused with energy drinks). The caloric beverage category was subdivided into iced tea or coffee with sugar, traditional hot tea, Turkish coffee, and other types of coffees with sugar. These categories were also used to measure the total daily intake of sugar-sweetened beverages. Excluded from this study were liquids considered to be a meal, such as soups or meal replacements, and diet beverages (ie, those that contain fewer than 1 kcal/100 g).

Statistical analysis: The results were expressed as the mean ± SD, percentage, and range. The data were tested for normality by the one-sample Kolmogorov-Smirnov test and were log-transformed, if necessary, after which the Kruskal-Wallis H test was used for data that did not show normal distributions. An adjusted Bonferroni procedure was used for the Mann-Whitney *U* test pairwise comparisons of means. In cases of normality, comparisons between groups were performed with the independent t test. Multi variate regression models were estimated to determine the independent relationship of each variable with the outcome variable (BMI). All statistical analyses were performed separately for men and women. SPSS software (Statistical Package for the Social Sciences, version 11.5, SSPS Inc, Chicago, Ill, USA) was used for data management and statistical analysis. A 2-tailed *P* value of < 0.05 was considered significant.

Results

Characteristics of the subjects are shown in Table 1. The mean (± SD) values for height, weight, and BMI in the male subjects were significantly higher than those in the female subjects. Our study results showed that of the male subjects, 5.2% were underweight, 14.6% were overweight, and 2.0% were obese. Of the women subjects, 23.3% were underweight, 6.1% were overweight, and 0.3% were obese.

We examined the choices and the mean (± SD) amount of caloric beverage consumption among the subjects according to sex and category of BMI (Table 2). In young men and women of all BMI categories, carbonated soft drinks were the beverage of choice, after which fluid milk, fruit drinks, and 100% fruit juice were preferred in that order. The male subjects in all BMI categories consumed significantly more total caloric beverages (except from fluid milk) than did the females subjects

Table 1: Characteristics of the study subjects

Variables	Male Subjects (n = 600)	Female Subjects (n = 593)	P Value
	Mean±SD		
Age (y)	21.7±1.79	21.2±1.78	0.000*
Height (cm)	177.4±0.07	165.4±0.06	0.000*
Weight (kg)	72.2±10.15	56.7±7.39	0.000*
Body mass index (kg/m^2)	22.9±2.80	20.7±2.41	0.000*
Underweight (≤ 18.5 kg/m^2)	18.3±1.33 (5.2%)	18.2±1.09 (23.3%)	0.815
Normal weight (18.5-24.9 kg/m^2)	22.4±1.50 (78.2%)	21.0±1.32 (70.3%)	0.000*
Overweight (25-29.9 kg/m^2)	26.9±1.41 (14.6%)	26.2±0.76 (6.1%)	0.003*
Obese (≥ 30 kg/m^2)	32.2±2.55 (2.0%)	31.6±0.55 (0.3%)	0.763

*P<0.05 indicates a significant difference between male and female subjects (independent t test).

Table 2: Beverage choices of the study subjects according to sex and body mass index

BMI (kg/m^2)	Fluid milk (g/d)	Carbonated soft drinks (g/d)	Fruit drinks (g/d)	100% Fruit juices (g/d)	Iced tea or coffee (g/d)	Sugar-sweetened hot beverages (g/d)	Energy/ Sport drinks (g/d)
	Mean±SD						
Male Subjects (n = 600)							
Underweight	196.9±172.92^a	268.3±250.92^e	115.3±152.29	36.9±55.45^l	53.8±74.86	16.5±15.3	7.8±17.93
Normal weight	192.9±195.63^b	207.9±207.39^e	94.3±98.65	67.3±96.57^l	39.7±72.71	15.7±17.02	14.8±42.49
Overweight	225.9±221.68^c	236.7±236.46	81.3±81.55	53.2±69.44	46.0±69.61	19.1±25.38	13.3±40.01
Obese	80.1±76.16^{a,b,c}	206.4±190.34	125.1±200.61	23.3±26.96	21.5±43.01	22.9±28.40	2.1±6.61
Total	196.0±196.68^d	218.3±216.65^j	95.1±105.82^k	61.2±89.23	41.7±72.05	16.5±18.64^o	13.6±39.93^r
Female Subjects (n = 593)							
Underweight	138.7±119.96	165.9±187.45^{f,g}	85.4±122.15	55.1±71.55	46.9±79.84^m	13.2±22.40	9.5±46.40^p
Normal weight	153.9±144.94	154.5±193.69^h	91.9±128.99	50.1±74.96	29.2±56.94^{m,n}	12.3±13.41	6.7±26.76^p
Overweight	153.6±126.26	106.1±125.19^{f,i}	75.2±92.00	55.5±73.51	20.3±34.62	13.9±14.06	8.8±20.81
Obese	41.8±18.74	343.5±19.09^{a,h,i}	70.5±99.70	25.2±5.37	113.6±142.27^n	16.0±5.66	0.0±0.00
Total	147.1±133.75^d	156.9±187.85^j	88.1±123.93^k	52.5±73.12	36.4±67.45	12.8±17.75^o	7.9±36.08^{p,s,t}

Means in a column with different superscripts are significantly different (P < 0.05).

(535 g/d and 395 g/d, respectively). The young male subjects drank an average of 218 g (7.7 oz) of carbonated soft drinks per day, and the young female subjects drank an average of 157g (5.5 oz) of carbonated soft drinks per day. The male subjects consumed a significantly higher amount of fluid milk, fruit drinks, sugar-sweetened beverages, and energy drinks than did the young female subjects (Table 2).

The results of our study showed that there was no significant difference in the consumption of fruit drinks, 100% fruit juices, sugar-sweetened hot drinks or energy drinks, according to BMI category in both sexes. Carbonated soft drink consumption of the male subjects was not dependent on a high BMI. The consumption of carbonated soft drinks deferred significantly between underweight and normal weight male subjects. Underweight male subjects, who consumed about 268 g (9.5 oz) per day of carbonated soft drinks, were the greatest consumers of that type of beverage. The male subjects in the 90th percentile of consumption drank 500 g (about 1.5 × 12 oz per day). Obese female subjects drank significantly more carbonated soft drinks than did the other subjects. However, there were some significant differences in amount of milk consumption across BMI categories in the male subjects. Only obese males consumed significantly less milk than did the other male subjects (Table 2).

In the regression analysis, we examined the relative importance of caloric beverage consumption to the BMI of young adults (Table 3). The multiple regression model did not show a significant relationship between carbonated soft drink consumption and BMI. R^2 statistics for the models ranged from 0.015 to 0.018. Sugar-sweetened hot drinks and fluid milk consumption had a positive and significant association with BMI for both sexes. Each additional gram of sugar added to a beverage increased the consumer's predicted BMI by 0.0103 kg/m^2 (P < 0.005), and each additional gram of fluid milk consumption increased the consumer's predicted BMI by 0.015 kg/m^2 (P < 0.005). Other caloric beverage consumption was not statistically significant in the model (Table 3).

Discussion

We investigated beverage consumption and choices among Turkish university students as well as the contribution of total caloric beverage consumption to the consumer's BMI. According to a report from the World Health Organization, in Turkey the mean BMI in people aged 15 to 29 years was 21.9 kg/m^2 in men and 24.0 kg/m^2 in women (World Health Organization, 2002). Most studies have shown that women have a higher BMI than do men (World Health Organization, 2002; Nielsen and Popkin, 2004), perhaps because in women, body weight gain most often consists of fat rather than metabolized active lean tissue (World Health Organization, 2002).

Table 3: Multiple regression results between beverage choices and body mass index for subjects

Beverage Consumption (g/d)	Male Subjects (n = 600)			Female Subjects (n = 593)			Total (n = 1193)		
	Coeff.	95% CI	P Value	Coeff.	95% CI	P Value	Coeff.	95% CI	P Value
Fluid milk	0.0005	-0.001-0.002	0.343	0.001	-0.001-0.002	0.293	0.0015	0.001-0.002	0.002
Carbonated soft drinks	-0.0006	-0.002-0.000	0.259	-0.001	-0.002-0.000	0.239	0.0001	-0.001-0.001	0.725
Fruit drinks	-0.0009	-0.003-0.001	0.403	0.000	-0.002-0.002	0.923	-0.0004	-0.002-0.001	0.565
100% Fruit juices	0.0001	-0.002-0.003	0.885	0.000	-0.003-0.002	0.850	0.0004	-0.002-0.002	0.672
Iced tea and coffee	-0.0004	-0.004-0.003	0.802	-0.003	-0.006-0.001	0.070	-0.0016	-0.004-0.001	0.164
Sugar-sweetened hot drinks	0.0074	-0.005-0.020	0.226	0.001	-0.010-0.012	0.814	0.0103	0.001-0.019	0.022
Energy drinks	-0.0017	-0.008-0.004	0.552	0.002	-0.004-0.007	0.490	0.0021	-0.002-0.006	0.323
Constant	23.037	22.535-23.541	0.000	20.851	20.454-21.248	0.000	21.502	21.171-21.834	0.000
R^2	0.015			0.018			0.017		

However, in our study, women (0.3%) had less risk of obesity than did men (2.0%), perhaps because in the age group studied, women are more concerned about their body image and weight than are men (Barr and Broughton, 2000). In addition, level of education is inversely correlated with overweight and obesity (Paeratakul *et al.*, 2002). Several studies have also found that the prevalence of obesity increases with age (Onat *et al.*, 1996; Satman *et al.*, 2002).

Although the cause of the obesity is probably multifactorial, some studies suggest that caloric beverage consumption could be an important contributory factor (Ludwig *et al.*, 2001; Storey *et al.*, 2003). Soft drinks, which are usually high in "empty" calories, contribute the most calories to the daily diet (Bowman, 2002). Some studies have shown that between 12% and 16% of the daily caloric intake for children and adolescent comes from soft drinks alone (Subar *et al.*, 1998; Forshee *et al.*, 2004). Troiano *et al.* (2000) found that soft drinks contributed a significantly higher proportion of daily energy intake in overweight adolescents than in adolescents who were not overweight. According to Harnack *et al.* (1999), the consumption of one 12-ounce serving of soft drinks represented about a 60% increase in the risk of obesity; consuming two 12-ounce servings of soft drinks tripled the risk of obesity, and people who drank 3 or more servings of soft drinks had a 5-fold increase in the risk of becoming obese. In our study, overweight or obese men and women drank the equivalent of about 2.5 x 200 g and 1.6 x 200 g of caloric beverages per day, respectively, compared with about 2.5 x 200 g and 2.0 x 200 g, respectively, for men and women of normal weight. The most recent Continuing Survey of Food Intake by Individuals (CSFII89) data also showed that at the age of 13, when girls are at the threshold of adolescence, they seem to drink less milk and fewer fruit drinks, both of which are often perceived as children's beverages. In people aged approximately 15 to 18 years, an increase in diet carbonated soft drink consumption could be related to an increased awareness of body weight and body image. Some studies have shown that major changes in beverage consumption patterns occur in people who are 19 years of age (Bowman, 2002; Nielsen and Popkin, 2004). We found that obese and overweight students consumed 13 g (0.5 oz) more fluid milk and 4 g more sugar-sweetened hot drinks than did students whose weight was within normal limits. However, the mean intake of whole fluid milk of all types was less than 1 cup/d in university students.

To our knowledge, this is the first correlation of BMI with caloric beverage consumption in Turkish university students. We did not find a significant association between the intake of carbonated soft drinks, fruit drinks, 100% fruit juices, sugar-sweetened iced tea or coffee or energy drinks and BMI in the subjects. According to the regression model, caloric beverage consumption accounted for 1% or less of the explained variance in BMI. Recent studies have been widely cited as having proven the link between sugar-sweetened beverage consumption and adolescent overweight (Ludwig *et al.*, 2001; Berkey *et al.*, 2004; Forshee *et al.*, 2004), but the magnitude of the relationship between sugar-sweetened beverage consumption and BMI reported in those studies was remarkably similar to that in our findings. Caloric beverage consumption was not significant in our model, but the coefficient estimate showed that changing the caloric beverage consumption by 1 serving (7 oz or 200 g) changed the consumer's predicted BMI by 0.40 kg/m^2. One serving of sugar-sweetened beverage contains approximately 100 kcal and 20 g to 30 g of sugar. If these calories are added to a typical Turkish diet with no offsetting reduction in other caloric sources, one serving of sugar sweetened beverage per day could lead to a 11.6 lb (5.21 kg) weight gain in one year. A longitudinal study by Ludwig (Ludwig *et al.*, 2001) reported that as the number of servings of soft drinks increased, so did the risk of obesity. The increase of a once-daily serving of a sugar-sweetened drink was associated with a 95% confidence interval of 0.10 to 0.39 (P 0.03). If the subjects eliminated all sugar-sweetened drinks, the model predicted a decrease in BMI of 0.32 kg/m^2 (Ludwig *et al.*, 2001). Berkey *et al.* (2004) reported that "consumption of [a] sugar-added beverage may contribute to weight gain among adolescents, probably due to their contribution to total energy intake," but the magnitude of the relationship that

those authors reported was even smaller than that in the study by Ludwig and colleagues (Ludwig *et al*., 2001). Results from our study showed that refined sugar added a significant amount of beverage per day and may likely to contribute to a higher BMI. In other words, the average consumption of refined sugar added the traditional tea and/or coffee (14.7 g/d) in subjects were an increase in BMI of 0.13 kg/m^2. Studies based on cross-sectional data may be biased because many overweight or obese persons will switch to drinking diet beverage as a way of combating their increasing weight. Thus, cross-sectional studies may underestimate the link between sugar-sweetened beverages and overweight. Longitudinal data allow researchers to follow up with participants and account for any switch to diet drinks (Bawa, 2005).

Forshee *et al.* (2004) reported that data from the NHANES III Multi variate regression models of BMI for adolescent men and women aged 12 to 16 years were used to examine the importance of demographic factors, beverage consumption, physical activity, and level of sedentary behavior in maintaining a healthful body weight. Those authors reported that demographic variables accounted for a large portion of the explained variances in BMI. Roughly 20% of the explained variance in BMI was accounted for by participation in teams sports or exercise programs. The consumption of sweetened carbonated soft drinks accounted for 1% of the explained variance in BMI in both men and women (Forshee *et al*., 2004). That result was similar to our findings. We did not include other variables such as physical activity or personal income in regression model. For university students, the prevention of obesity is critical, and weight loss should be achieved by eating a nutritionally balanced, low-calorie diet and exercising regularly to increase energy expenditure. In addition, the consumption of milk should be encouraged, particularly if increased soft drink consumption begins to replace milk consumption.

Limitations of the study: A number of limitations in our study should be considered. We studied only university students, and we evaluated the relationship between BMI and caloric beverage consumption at one point in time (during spring). Further studies involving variables (study duration, different education level, seasonal changes, training and geographic region etc.) different from those in our research and longitudinal studies are needed to evaluate more accurately the association between caloric beverage consumption and BMI in adolescents and young adults in Turkey.

Conclusion: We found that caloric beverage consumption accounted for 1% or less of the explained variance in BMI in Turkish university students. A variety of research designs in this study showed that the relationship between caloric beverage consumption and BMI was either weak or nonsignificant in that population.

References

Barr, S.I. and T.M. Broughton, 2000. Relative weight, weight loss efforts and nutrient intakes among health-conscious vegetarian, past vegetarian and nonvegetarian women ages 18 to 50. J. Am. Coll. Nutr., 19: 781-788.

Bawa, S., 2005.The role of the consumption of beverages in the obesity epidemic. J. Royal Society for the Promotion of Health., 125: 124-128.

Berkey, C.S., H.R. Rockett A.E. Field, M.W. Gillman and G.A. Colditz, 2004. Sugar-added beverages and adolescent weight change. Obes. Res., 12: 778-788.

Bouchard, C. and A. Tremblay, 1997. Genetic influences on the response of body fat and fat distribution to positive and negative energy balances in human identical twins. J. Nutr., 127: 943S-947S.

Bowman, S.A., 2002. Beverage choices of young females: changes and impact on nutrient intakes. J. Am. Diet. Assoc., 102: 1234-1239.

Cavadini, C., A.M. Siega-Riz and B.M. Popkin, 2000. US adolescent food intake trends from 1965 to 1996. Arch. Dis. Child., 83: 18-24.

Ersoy, C., S. Imamoglu, E. Tuncel, E. Erturk and I. Ercan, 2005. Comparison of the factors that influence obesity prevalence in three district municipalities of the same city with different socioeconomical status: a survey analysis in an urban Turkish population. Prev. Med., 40: 181-188.

Forshee, R.A. and M.L. Storey, 2003.Total beverage consumption and beverage choices among children and adolescents. Int. J. Food. Sci. Nutr., 54: 297-307.

Forshee, R.A., P.A. Anderson and M.L. Storey, 2004. The role of beverage consumption, physical activity, sedentary behavior, and demographics on body mass index of adolescents. Int. J. Food Sci. Nutr., 55 :463-478.

French, S.A., B.H. Lin and J.F. Guthrie, 2003. National trends in soft drink consumption among children and adolescents age 6 to 17 years: prevalence, amounts, and sources, 1977/1978 to 1994/1998. J. Am. Diet. Assoc., 103: 1326-1331.

Guo, S.S., C. Huang, L.M. Maynard, E. Demerath, B. Towne and W.C. Chumlea. 2000. Body mass index during childhood, adolescence and young adulthood in relation to adult overweight and adiposity: the Fels Longitudinal Study. Int. J. Obes. Relat. Metab. Disord., 24: 1628-1635.

Harnack, L., J. Stang and M. Story, 1999. Soft drink consumption among US children and adolescents: nutritional consequences. J. Am. Diet. Assoc., 99: 436-441.

Krauss, R.M., R.E. Eckel and B. Howard, 2000. AHA Dietary Guidelines: Revision 2000: A statement for health care professionals from the Nutrition Committee of the American Hearth Association. Circulation, 102: 2284-2299.

Ludwig, D.S., K.E. Peterson and S.L. Gortmaker, 2001. Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. Lancet, 357: 505-508.

Moore, R.H., D. Thompson, S.G. Affenito, D.L. Franko, E. Obarzanek and B.A. Barton, 2006. Correlations of beverages intake in adolescent girls: The national heart, lung, and blood institute and health study. J. Pediatrics, 148: 183-7.

Nielsen, S.J and B.M. Popkin, 2004.Changes in beverage intake between 1977 and 2001. Am. J. Prev. Med., 27: 205-210.

Ogden, C.L., K.M. Flegal, M.D. Carroll and C.L. Johnson, 2002. Prevalence and trends in overweight among US children and adolescents, 1999-2000. J. Am. Medic. Assoc., 288: 1728-1732.

Onat, A., V. Sansoy and B. Ökçün, 1996.Türk Eriskinlerde Glikoz Intoleransi ve Diyabet. Türk Eriskinlerde Kalp sagliginin dünü ve bugünü (TEKHARF Çalismasi). Istanbul: Karakter Color Basimevi; p: 103-111.

Paeratakul, S., J.C. Lovejoy, D.H. Ryan and G.A. Bray, 2002. The relationship of gender, race and socioeconomic status to obesity co-morbidities in a sample of US adults. Int. J. Obes., 26: 1205-10.

Satman, I., N. Dinccag and K. Karsidag, 2000. Epidemiology of diabetes and obesity in Turkey. Diabetes Res. Clin. Pract., 50: S142.

Satman, I., T. Yilmaz, A. Sengul, S. Salman, F. Salman and S. Uygur, 2002. Population-based study of diabetes and risk characteristics in Turkey: results of the Turkish Diabetes Epidemiology Study (TURDEP). Diabetes Care, 25: 1551-1556.

Storey, M.L., R.A. Forshee, A.R. Weaver and W.R. Sansalone, 2003. Demographic and lifestyle factors associated with body mass index among children and adolescents. Int. J. Food Sci. Nutr., 54: 491-503.

Subar, A.F., S.M. Krebs-Smith, A. Cook and L.L. Kahle 1998. Dietary sources of nutrients among US children, 1989-1991. Pediatrics, 102: 913-923.

Sur, H., M. Kolotourou, M. Dimitriou, B. Kocaoglu, Y. Keskin, O. Hayran and Y. Manios, 2005. Biochemical and behavioral indices related to BMI in schoolchildren in urban Turkey. Prev. Med., 41: 614-621.

Troiano, R.P., R.R. Briefel, M.D. Carroll and K. Bialostosky, 2000. Energy and fat intakes of children and adolescents in the Uunited sStates: data from the national health and nutrition examination surveys. Am. J. Clin. Nutr., 72: 1343S-1353S.

Turkish Government, Higher Educational Council, 2004. Student Selection and Placement Center (ÖSYM), Ankara, Turkey. [cited 2007 Feb 10]; Available from: http://http://www.osym. gov.tr/dosyagoster.aspx? DIL =1&BELGEANAH=6308&DOSYAISIM=3_Egitim.pdf.

World Health Organization, 2002. [Internet]. Joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Disease. Geneva, Switzerland: World Health Organization. WHO Technical Report Series 916. [cited 2006 Dec 12]. Available from: http://whqlibdoc.who.int/trs/ WHO_TRS_916.pdf.