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Fluids Intake and Beverage Consumption Pattern among University Students

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ABSTRACT

Background: Insufficient and inappropriate daily fluid intake in a long period may have adverse effect on human's health. Therefore, the present study evaluated the amounts and sources of fluids consumed by university students to determine whether these amounts and sources of fluid were enough and appropriate.
Methods: In this descriptive study, 245 (142 females and 103 males) volunteer students of Tabriz University of Medical Sciences in 2009 were recruited. Food and fluid intake of subjects were assessed by 24-hour recall method of 3 days (two week days and one week- end included). Dietary intake of subjects was analyzed by Nutritionist III software program. The mean total fluid intake (drinking fluid values merged with data on the water content of foods) and the rate of metabolic water were figured out. Comparisons of the results with recommended dietary values were made using student's *t*-test.. Data of dietary intakes for two under-reporter female subjects were not included in the statistical analysis.
Results: Daily total mean of fluid intake for girls (1598±40ml) and boys (1861±59ml) reflect the sum of beverages (Girls, 818±29ml; boys, 1147±57ml) and food water (Girls, 780±47ml; boys, 714±86m). The most consumed beverage for girls and boys were water (40%) and tea (49%) respectively. Daily mean intake of milk for girls and boys were 106.31±10ml (13%) and 57.30±11ml (5%), respectively.
Conclusion: The mean daily fluid intake of subjects, specially water, and milk was lower than recommended values. Therefore, there is an urgent need for tailored nutrition intervention targeting the young adults to improve their beverage choices.
Keywords: Fluid Intake; Beverage Consumption Pattern; University; Student

Introduction

Water is the most essential nutrient for life, but its importance is overlooked and even in nutrition, it has not been taken into account. It is an essential nutrient required for all body tissues and it is the largest single component of the body. The volume, composition, and distribution of body fluids have profound effects on cell function [1].

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Fluids fill virtually every space in cells and between them [2]. As a solvent, it makes many solutes available for cell function and is the medium needed for all reactions. Water is also essential for the physiologic processes of digestion, absorption, and excretion [1, 3].

Whole- body thermoregulation is critically dependent on water [2, 3]. The body has no provision for water storage; therefore, the amount of water lost every 24 hours must be replaced to maintain health and body efficiency [2-4].

In addition, the type of fluid consumed by individuals should also have received attention (5-10). The required water of body could be supplied with various beverages including water, milk, tea, fruit juices, coffee, and soft drinks. However, regarding their nutritional value and their effect on health, it is necessary to have a healthy drinking pattern during life cycle. In fact, young adulthood is a unique period whereby youth obtain independence from their parents. People in this age group are vulnerable to develop unhealthy behaviors [11, 12], which will predispose them to chronic diseases later in life [13]. "A longitudinal study tracking soft drink intake from early adolescence to later adulthood demonstrated that soft drink consumption from young adulthood remained stable" [14). This data indicates beverage consumption habits formed during young adulthood may have a strong impact on beverage choices in later life.

The present study evaluated the amounts and sources of fluids consumed by university students to determine whether these amounts and sources of fluid are enough and appropriate. In addition, fluid intake was compared between male and female.

Materials and Methods

We asked 600 under graduate students (Faculty of Health and Nutrition) to participate in this study. Finally, 245 volunteer students participated in this study. In this descriptive study, 245 volunteer medical students of the Faculty of Health and Nutrition, Tabriz University of Medical Sciences including 142 female students and 103 male students were recruited in fall 2009. Height was measured using a mounted tape with the_subject's arm hanging freely at the side and was recorded to the nearest 0.5 cm. Body weight was measured barefoot and with light clothing to the nearest 0.1 kg with a Seca scale. The body mass index (BMI) was calculated as weight (kg) divided by height (m^2). General characteristic and drinking habits of subjects were obtained by completing a questionnaire. Food and fluid intake if subjects were assessed by 24-hour recall method of 3 days (two week days and one week- end included), In order to confirm the amount of fluid intake, the participants also were asked to report a 24-hour fluid intakes. Dietary intake of subjects was analyzed by Nutritionist III software program. Data of dietary intakes for 2 under-reporter female subjects were not included in the statistical analysis since their reported energy intakes were less than their estimated basal metabolic rate (BMR) multiplied by 1.1 (under-reporters). BMR was estimated using the Schofield equations [15]. This cut-off was used, as it is highly unlikely that habitual energy intake would be $< 1.1 \times$ BMR or $> 2.0 \times$ BMR [16]. The mean total fluid intake (drinking fluid values merged with data on the water content of foods) and the rate of metabolic water were figured out.

Daily fluid requirements of subjects were estimated by reasonable allowance based on recommended caloric intake (1ml/kcal) and body weight (35 ml/kg of usual body weight in adults [1]. It has been reported that, the oxidation of foods in the body produces metabolic water as an end product. The oxidation of 100gr fat, carbohydrate, and protein yields 107, 55, and 41gr of water respectively for a total of approximately 200-300ml/day [1]. Therefore, the rate of metabolic water in students was also figured out.

Statistical analysis

The normality of data distribution was assessed by Kolmogorov Smirnov test. Means ±SD or SEM for continuous variables was calculated for each variable by study groups. A

student's *t*-test for independent samples was used to look for the differences between groups.

Results

Characteristics of participants

General characteristics of participants are shown in Table 1. In both genders, the mean of BMI was in normal range. Of 140 female students, 8 % (11 subjects) were overweight and 12 % (17 subjects) were underweight. Whilst from the 103 male students, 14 % (15 subjects) were overweight and 5% (5 subjects) were underweight. However, about 80% of participants in both gender had normal BMI.

Daily Intake of Energy and macronutrients

Table 2 shows the mean daily intake of energy and macronutrients of females and males. The mean daily energy intake was 2125±49 kcal in females and 2453±64 kcal in males. Energy expenditure was calculated based on height, weight, and sex, age, and physical activity levels of subjects (1919±27 kcal in females, 2542±21 kcal in males). The mean energy intakes in both genders showed no significant difference. However, difference between the mean daily intake of energy in males and females was strongly significant. The percent of energy from carbohydrate, lipid, and protein were 50%, 37%, and 13% respectively in female students. As the percents above indicate, lipid intake in female students was higher than the recommend range. In male subjects, the percent of energy from carbohydrate, lipid, and protein were 58%, 29%, and 13% respectively, which were in normal ranges.

Daily Intake of Fluids

As considered in Table 3, the total mean of fluid intake (1598±40 ml) in females reflects the sum of drinking fluid (818±29 ml, 51%) and the water content of foods (780±47ml, 49%). The rate of metabolic water was 260±6ml. In male subjects the total mean of fluid intake (1861±59ml) reflects the sum of drinking fluid (1147±57 ml, 62%) and the water content of foods (714±86ml, 38%). The rate of metabolic water was 302±8ml in male students.

In females the total mean of fluid intake, which was 1598±40 ml, was significantly ($P<0.05$) lower than both reasonable allowance based on recommended caloric intake (1919±27ml) and body weight (1856±39ml). In male subjects also the total mean of fluids intake, which was 1861±59 ml, was significantly ($P<0.05$) lower than both reasonable allowance based on recommended caloric intake (2542±21 ml) and body weight (2432±37ml). The difference in fluids intake between females and males was strongly significant ($P<0.05$).

Mean daily intake of various beverages are shown in Table 4. As considered, the most consumed beverage in females was water (40%), whilst, tea was the most consumed beverage, accounted for (49%) of total daily beverage intake of males.

Comparison of mean daily intake of various beverages between males and females indicated that the mean daily intake of tea, fruit juices and yoghurt drinking was significantly higher in male students, where as the mean daily intake of milk was higher in female students ($P<0.05$).

Table 1: General Characteristics of Participants (mean±SD)

	Females (n=140)	Males (n=103)	Total (n=243)
Age (y)	20±2.51	21.4±2	21±2.42
Weight (kg)	55±7	69.5±11	61.5±11
Height (cm)	162±5	176±7	168±9
BMI(kg/m^2)	21±4.30	22.30±5.41	21.65±4.42

Table 2: The daily mean intake of energy and macronutrients in students (mean±S.E.M)
* Students *t*-test

	Female (n=140)	Male (n=103)	*P**	Total (n=243)
Total energy(kcal)	2125±49	2453±64	0.03	2265±40
carbohydrate(kcal)	1062.50±17	1423±19.61	0.001	1223±13
%energy	50±0.81	58±0.94	0.04	54±0.61
Lipid (kcal)	786.24±17	711±17	0.03	747±13
%energy	37±0.82	29±0.71	0.01	33±0.60
Protein(kcal)	276.20±4.21	319±5	0.00 2	295±2.3
% energy	13±0.20	13±0.20	0.3	13±0.1

Table 3: The daily mean of total fluids intake and metabolic water of foods in students

	Female (n=140)	Male (n=103)	*P**	Total (n=243)
Total fluids intake(ml)	1598±40	1861±59	0.001	1702±35
Beverages (ml)	818±29	1147±57	0.02	940±31
Food water (ml)	780±47	714±86	0.06	762±46
Metabolic water(ml)	260±6	302±8	0.01	287±5

* students *t*-test

Table 4: Daily mean intake of total various beverages

	Female (n=140)	Male (n=103)	*P**	Total (n=243)
Total beverage(ml)	818±29 (100%)	1147±57 (100%)	0.001	940±3(100%)
Water	327.20±26 (40%)	355.51±31(31%)	0.07	338±20(36%)
Tea	294.52±18 (36%)	562±49 (49%)	0.001	404±25(43%)
Milk	106.31±10(13%)	57.30±11(5%)	0.007	85±8(9%)
Soft drinks	49±8.64(6%)	69±11(6%)	0.09	56±7(6%)
Fruit juices	16.42±4 (2%)	45.91±10(4%)	0.001	28±5(3%)
Yoghurt drinking	16.40±5 (2%)	34.40±8(3%)	0.03	19±5(2%)
Other drinking**	8.2±2.43 (1%)	22.92±7(2%)	0.07	10±3.50(1%)

* Students t-test,
**other drinking is include coffee, syrups and herbal drinking's

Discussion

In this study, a sample of the university students was studied in order to evaluate their daily fluid and energy intake.The BMI data showed that the most students were in normal range of BMI.

Energy and Fat intake

As comparison with other studies, the mean energy intake in female students was higher than the mean energy intake reported for females of Kuwait [17], California and New York [18], America [19] and Greek [20]. In contrast, the mean energy intake in males of this study was slightly lower than mean energy intake reported for Greek [20] and American [19) males. Our values were similar to the mean energy intake of Spanish males [21]. However, the mean energy intake of both genders was close to nutritional recommended values. The results of the present study showed the percentage of energy from fat in females (37%) was higher than the value in females of Kuwait (33%) and America (25%) [19].The percent of energy from fat, in females of current study, was exactly similar to that of Spanish [16] females (37%) and it was very close to the mean reported percentage (36±7%) in the 1987-1988 Nationwide Food Consumption Survey [22]. Surprisingly, the percentage of energy from fat source in males was 29%, which was lower than the reported percentage for males of Spain (33%) and Greek (40%) [20].

Fluid intake

Daily fluid intake in the US population aged 20 years or more in 1977 – 1978. Nationwide Food Consumption Survey was 2083ml in males and 1966ml in females [23] and total mean per capita drinking fluid intake based on USDA, CSFII data from 1989 – 1991 was 1247ml in males and 1074 ml in females [24]. The results of both surveys were higher than the total mean of beverage consumption in current study (1147±57ml for males and 818±29ml for females). Although the report of USDA excluded milk and soft drinks, the beverage consumption rate of USDA report was higher than that of our study, which included milk and soft drinks. The mean daily intake of non-alcoholic beverages from the 1995 National Nutrition Survey in Australia [25] was in males and females, 2052 ml and 1917ml respectively. These values were greater than our reported values. In addition, the mean beverage consumption, according to results of : a study conducted in Britain [26] (1589±20.3 ml/day), the report of ICRP [27] in 1981 (1000- 2400 ml/day), the report of US.EPA [28] in 1984 (1484±45.9 ml/day), NHANES Data in 1988 – 1994 (3908±65 ml for males and 2838±41ml for female [29], CSFII [30] in 1994 – 1996 and 1998 (3361ml for males and 2367ml for females) and Canadian dietary intake data in 1990 – 1997 (3039±79ml in males and 2455±130ml in females) was considerably greater than the mean consumption of beverages in both genders of current study.

The mean consumption of water in males and females were respectively 355.5±31ml (31%) and 327±26ml (40%) which were just higher than that of Great Britain [25], 6.48% (103±5ml). In comparison with other countries, the mean water consumption by male and females of our study was considerably lowered [23-25, 28-30]. In report of ICRP in 1981, the mean water consumption by adults (45-730ml), on average (387.5 ml) was nearly similar to the reported values of current study (338±20 ml).

In males and females, the mean consumption of tea was 49% (562±49 ml) and 36% (294.5±18ml) of total beverage intake respectively which were higher than the mean consumption of tea in Nationwide Food Consumption Survey [23] (males: 1.15%, 24±120ml, and females : 1.22%, 24±96ml and the report of USDA [24]

(males: 10.91%, 136ml, females : 11.2%, 120ml).

In a study conducted in Great Britain [26] the mean consumption of tea was 584±12ml which was higher than that of current study (average of total participants: 404±25ml). Mean daily intake of tea from the 1995 National Nutrition Survey [25] in Australia was in males 16.83% (345ml) which was lower than the mean consumption of tea in our study (49%, 562±49ml). In Australian females, the mean consumption of tea 23.64% (453ml), was higher than that of our study in females (36%, 294.5±18ml).

In current study, the mean intake of milk was 5% (57.3±11ml) of total beverage intake for males and 13% (106.3±10 ml) for females. These values were lower than reported values by Nationwide Food consumption survey [23] (males: 19.59%, 408±312 ml, females: 20.75%, 408±312 ml). ICRP reported that the mean intake of milk in adults was in range of 120 – 450ml, on average 285ml, which was greater than the reported value in current study.

The mean consumption of soft drinks in National Survey in Australia were 11.51% (236ml) in males and 6.58% (126ml) in females [21].The findings of other study indicated that almost all of the participants reported that drinking 2 glasses of soda or more per day [31].These values were higher than the reported values in this study, (6%,49±8.6ml for female, 6%,69±11ml for male).

The mean intakes of fruit juices in Nationwide Food Consumption survey [23] (males: 8.06%, 168ml, females: 8.2%,161ml), National Nutrition Survey [25] in Australia (6.78%, 139ml for males and 5.69%, 109ml for females), the report of USDA [24] (males: 8.1%, 101ml and females: 5.7%, 61ml), and in a studies conducted in Great Britain [26] (3.6%, 57±2ml) and Canada [32] (28%,201 ml)were considerably higher than the mean intake of fruit juices in the present study (males: 4%, 45.9±10ml and females: 2%, 16.4±4ml).

In this study, the most consumed beverages in males were tea 49%, water 31%, soft drinks 6% and in females were water 40%, tea 36%, milk 13%. However, in National Nutrition Survey in Australia 1995, the most intake beverages in males were water 41.71%, coffee 23.17%, and tea 16.83%, and in female subjects were water 44.31%, tea 23.64%, and coffee 19.78%. Both our study and the study conducted in Great Britain found the most consumed beverage in total participants to be tea. There were remarkable contrasts between the mean intake of water, tea, milk, fruit juices, soft drinks, and coffee in this study and other studies.

The cause of less fluid consumption in the current study might be concerned with the season. Since current study was conducted in fall, it could be assumed that the low climatic temperature of this season contributed to low consumption of fluids. Thus, subsequent studies are necessary to determine the mean per capita total fluid intake rate.

Conclusion

The average daily intake of fluids in both genders was lower than the recommended values and pattern of fluids consumed was inappropriate. Therefore, there is an urgent need for tailored nutrition intervention targeting the young adults to improve their beverage choices.

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