Preference of food intake among dental students in relation to exercise and body mass index: A cross-sectional study

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Abstract

The purpose of this study was to assess the preference of different food items among dental students of Riyadh Colleges of Dentistry and Pharmacy (RCsDP) in relation to exercise and body mass index (BMI). To do so, we conducted a cross-sectional population survey among dental students. Data were collected from Saudi and non-Saudi students of RCsDP, aged 17 – 24 years (n = 527). Food preferences were assessed by using a multiple-choice questionnaire. A scoring system was developed in which "continuous" and "often" were given a high score and "never" and "seldom" were given a low score. Food items were categorized into different food groups according to the food pyramid defined by the United States Department of Agriculture. The BMI for all of the students was calculated and students were categorized as underweight, normal weight, overweight, or obese. The normal weight students (2.19 ± 0.444) exhibited a greater preference for the grains group than the overweight students (2.035 ± 0.466). The obese students (1.438 ± 0.55) exhibited a greater preference for the oils group than the normal weight students (1.81 ± 0.609). Males had greater tendency than females to be obese (males, 21.7%, confidence interval (CI) (11.8% – 31.6%; females, 5.6%, CI 3.48% – 7.72%). A high prevalence of underweight (12.4%, CI 9.17% – 15.63%) and overweight (19.8%, CI 15.89% – 23.71%) in Saudi students was observed. We observed statistically significant associations (χ^2 = 10.7, P = 0.041) between living far from family and being underweight (14.3%, CI 9.07% – 19.53%) and overweight (25.6%, CI 19.08% – 32.12%). No statistically significant differences were observed for the performance of physical activity between the different BMI categories. The RCsDP dental students' food choices reflected proper weight maintaining strategies, accepted dietary knowledge, a reasonable adoption of healthy eating habits, and a moderate involvement in physical activities.

Introduction

Saudi Arabia is among the richest and highest per-capita income countries of the world (Al Assaf *et al.*, 2007). In such affluent societies, energy intake is no longer dependent on income, and food preferences are regarded as a valid indicator of eating habits. Food consumption was inferred from stated preference or "liking" of a specific food item, whereas an acceptable food was defined as one that was eaten and eaten with pleasure and satisfaction (Randall *et al.*, 1982).

The weight and height data for Saudi population groups, currently gathered by the Food Policy and Nutrition Division of Food and Agriculture Organization (FAO), follow the desirable growth pattern of the National Center for Health Statistics and the FAO/World Health Organization/United Nations standards. The body mass index (BMI) values for Saudi adult men and women were reported to be 22.4

and 22.1, respectively, and were comparable with the acceptable range of values of 20.1 – 25.0 for men and 18.7 – 23.8 for women (Hamill *et al.*, 1979). Interestingly a BMI of about 22.0 in men and 20.8 in women appears to be associated with the longest life expectancy in societies (Khan *et al.*, 1998).

In a Japanese study, almost half of the dental students missed one of the three main meals (Carter *et al.*, 2003). In another cross sectional survey in the United Arab Emirates, a large percentage of medical students were either underweight or obese and most believed their activity levels were insufficient, their stress levels were too high, and their diet was unhealthy (Motoko *et al.*, 2002; Carter *et al.*, 2003). Participation in health-enhancing physical activity is a key determinant of energy expenditure in youths and it leads to improved cardiovascular and metabolic fitness as well as bone health (Carter *et al.*, 2003). Persistent physical inactivity, on the other hand, is

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detrimental to health and well-being and is associated with a less healthy lifestyle (Janssen *et al.*, 2010).

Dietary surveys in Saudi Arabia are few. Most focused on the nutritional adequacy of types of food, rather than studying dietary-related habits. In view of the lack of studies on food consumption by the Saudi population (specifically, those involving young adults) this study was undertaken among a unicenter cohort of dental students. The purpose of the present study was to assess the preference of different food items among female and male dental students of the Riyadh Colleges of Dentistry and Pharmacy (RCsDP) in relation to exercise and BMI.

Materials and Methods

Study design

This was a cross-sectional descriptive study using data collected during a self-administered questionnaire adapted for 527 students. Importantly, some cases were omitted because of missing data for some items. Consequently, in some cases, the total number of participants was less than 527. The questionnaire was distributed to 321 preclinical-level and 206 clinical-level students (67 males and 452 females, total = 519). Four hundred were Saudis and 122 were non-Saudis (total = 522). The participants were dental students in RCsDP and their ages were 17 – 24 years. The study was accepted by the ethical committee of RCsDP.

The questionnaire contained sociodemographic questions including gender, age, address, e-mail address, mobile number, marital status, nationality, level of education, and living style in Riyadh city (i.e., living with family or living in the students' dormitories). The questionnaire also asked whether the student thought he/she was eating a balanced diet and was involved in physical activity. Anthropological data including subjects' height and weight were determined and the mean BMI in kg/m^2 was calculated.

A consent form was attached to each questionnaire. If the student agreed to participate in the study, he/she signed the consent form. Students who were allergic to any food item mentioned in the food preference list were excluded from the study. A food preference checklist with 40 food items commonly eaten in Saudi Arabia were classified into groups based on the food pyramid of the United States Department of Agriculture (Food and Agricultural Organization, 1992; United States Department of Agriculture, 2010).

These were as follows: (1) The grains group (macaroni, whole wheat bread, white rice, and brown rice); (2) The vegetables group (broccoli, spinach, green leafy vegetables, okra, squash, and tomatoes); (3) The fruits group (dates, raisins, figs, guava, grapefruit, kiwi, watermelon, oranges, and blueberries); (4) The milk group (milk, yogurt, ice cream, and cheddar cheese); (5) The protein group (eggs, tuna, beef meat, chicken, walnut, liver, mushrooms, beans, lentils, peanuts, fish, and shrimp); and (6) The oil group (olives, sunflower seeds).

Students were asked to indicate how much they liked to eat or did not like to eat each food item by using a 5-point Likert scale: 0 = never, 1 = seldom, 2 = sometimes, 3 = often, and 4 = continuous. "Sometimes" was considered the neutral point, "continuous" and "often" were given a high score, while "never" and "seldom" were given a low score. A scoring system was developed.

Food groups

The United States Department of Agriculture Food Pyramid, used as a guideline for the grouping of food items, was then correlated to the cut-off points proposed by a World Health Organization expert committee for the classification of overweight. These figures apply to both men and women and to all adult age groups (see Seidell *et al.*, 1997) and are as follows:

<18.5 kg/m^2 Underweight, thin
18.5 – 24.9 kg/m^2 "Healthy," "normal," or "acceptable" weight
25.0 – 29.9 kg/m^2 Grade 1 overweight, overweight
30.0 – 39.9 kg/m^2 Grade 2 overweight, obesity

In addition, the food groups were correlated to different demographic data and whether the students lived with their families or in the dormitories/ hostels.

Statistical analysis

The data were analyzed statistically using SPSS version 19.0 statistical software. The data were analyzed by one-way analysis of variance (ANOVA), Tukey's honestly significant difference (HSD) multiple comparison test, Kruskal-Wallis test, and t-tests. In all analyses, the level of significance was set at 0.05. The results were reported as percentages, means ± standard deviation (SD), or percentiles.

Results

The subjects' demographics are summarized in Table 1. Students preferred only 18 items from the 40 items listed (45% of the items), based on the nutritional pyramid. The items included grains (macaroni, whole wheat bread, and white long

Table 1. The demographic characteristics of the students

Demographic characteristics		Number (n)	Percentage (%)	Total
Gender	Male	67	12.8	519*
	Female	452	87.2	
Level of education	Preclinical	321	60.9	527
	Clinical	206	39.1	
Marital status	Not married	432	83.4	518*
	Married	86	16.6	
Nationality	Saudi	400	76.6	522*
	Non-Saudi	122	23.4	
Living in Riyadh	Yes	345	66.7	517*
With family	No	172	33.3	

*A decreased number of subjects due to missing data for some of the items.

Table 2. Sorting the data into three groups

Group	Lower bound	Upper bound
Low	1.00	1.67
Sometimes	1.68	2.35
High	2.36	3.00

Table 3. The use of one-way ANOVA to compare food pyramid categories and BMI

Food items	BMI categories	Number (n)	Mean (SD)	p-value
Grains	Underweight	45	2.1 (0.5)	**0.04***
	Normal weight	263	2.2 (0.4)	
	Overweight	79	2.0 (0.5)	
	Obese	33	2.1 (0.5)	
Vegetables	Underweight	45	1.8 (0.5)	0.09
	Normal weight	261	1.9 (0.5)	
	Overweight	79	1.8 (0.4)	
	Obese	33	1.6 (0.5)	
Fruits	Underweight	44	1.6 (0.4)	0.15
	Normal weight	263	1.7 (0.4)	
	Overweight	79	1.7 (0.4)	
	Obese	33	1.5 (0.4)	
Proteins	Underweight	45	1.8 (0.4)	0.78
	Normal weight	264	1.8 (0.4)	
	Overweight	80	1.8 (0.3)	
	Obese	33	1.7 (0.4)	
Milk	Underweight	45	1.9 (0.5)	0.05
	Normal weight	263	2.1 (0.5)	
	Overweight	79	2.0 (0.5)	
	Obese	33	1.8 (0.5)	
Oil	Underweight	43	1.7 (0.6)	0.01*
	Normal weight	261	1.8 (0.6)	
	Overweight	78	1.7 (0.6)	
	Obese	32	1.4 (0.5)	

*Statistically significant at P < 0.05

Table 4. Multiple comparisons test (Tukey's HSD) to analyze the differences between food pyramid items and BMI categories

	weight	P-value for the multiple comparison tests			
		Under weight	Normal weight	Over weight	Obesity
Grains items	Under weight	1.000	0.480	0.934	0.999
	Normal weight		1.000	0.04*	0.657
	Over weight			1.000	0.927
	Obesity				1.000
Oil	Under weight	1.000	0.860	0.998	0.152
	Normal weight		1	0.577	0.005*
	Over weight			1.000	0.131
	Obesity				1.000

*Statistically significant at P < 0.05

Table 5. Correlating subject characteristics and BMI

		Underweight% (n)	Normal% (n)	Overweight% (n)	Obese% (n)	χ^2	P-value
Gender	Male	6.7% (4)	43.3% (26)	28.3% (17)	21.7% (13)	27.7	0.01*
	Female	11.1% (40)	66.1% (238)	17.2% (62)	5.6% (20)		
Nationality	Saudi	12.4% (40)	60.7% (196)	19.8% (64)	7.1% (23)	8.3	0.041*
	Non-Saudi	4.1% (4)	71.1% (69)	14.4% (14)	10.3% (10)		
Educational study level	Preclinical	10.5% (27)	64.6% (166)	16.7% (43)	8.2% (21)	1.67	0.64
	Clinical	11.8% (15)	62.2% (79)	20.5% (26)	5.5% (7)		
Marital status	Single	10.6% (37)	62.6% (218)	19% (66)	7.8% (27)	6.42	0.69
	Married	5.9% (7)	64.9% (46)	37% (13)	14% (5)		
Living with family in Riyadh	Yes	9.1% (26)	67.6% (194)	15.7% (45)	7.7% (22)	10.7	0.041
	No	14.3% (19)	51.9% (69)	25.6% (34)	8.3% (11)		
Physical activity	Yes	7.8% (16)	65.5% (135)	18.9% (39)	7.8% (16)	3.3	0.36
	No	13.1% (28)	60.7% (130)	18.2% (39)	7.9% (33)		

grain rice), vegetables (green leafy vegetables and tomatoes), fruits (oranges and watermelon), proteins (eggs, beef meat, chicken, oatmeal, cheddar cheese, liver, and fish), milk (milk and ice cream), and oils (olives and sunflower seeds).

Dietary habits, food pyramid, and BMI

Forty-three percent of the students reported having a balanced diet. With the ANOVA analysis, according to the scoring system (Table 2), all types of measurements were averages. The sample showed a significantly high consumption of grains (P = 0.04), a moderate consumption of vegetables, fruits, milk, and proteins, and a significantly low consumption of oils (P = 0.01). For all food items, the mean, SD, and p-value are shown in (Table 3).

Tukey's HSD and multiple comparison tests demonstrated that for grains, the normal weight mean was (2.19, SD = 0.44), which was significantly higher than the mean of overweight (2.04, SD = 0.47) (P = 0.04). For the oils group, the mean of the obese students was (1.44, SD = 0.6) which was significantly lower than the mean of those with a normal weight which was (1.80, SD = 0.61) (P = 0.005) (Table 4).

Characteristics of the sample and BMI

Of the 519 dental student participants, 452 (87.2% of the participants) were females and 67 (12.8% of the participants) were males. The results of the BMI analysis showed that 63% of the participants were of normal weight, 18.6% were overweight, and 7.8% were obese. The mean BMI was within the healthful range ($18.5 - 24.9 \text{ kg/m}^2$) and was $24.8 \pm 1.23 \text{ kg/m}^2$.

Males exhibited a higher tendency to be obese (21.70% of the males, confidence interval (CI) 11.80% – 31.60%) than females (5.60% of the females, CI 3.48% – 7.72%) (P = 0.01). There was a statistically significant association between the nationality of the dental students and their BMI. Specifically, a high prevalence of underweight (12.4%, CI 9.17% – 15.63%) and overweight (19.8%, CI 15.89% – 23.71%) Saudi students was observed (P = 0.041).

A statistically significant association ($\chi^2 = 10.7$, P = 0.041) between living far from family and being underweight (14.3%, CI 9.07% – 19.53%) or overweight (25.6%, CI 19.08% – 32.12%) was observed. In the evaluation of BMI, no statistically significant difference was detected between preclinical and clinical levels (P < 0.05). In the evaluation of BMI, no statistically significant differences were detected between marital status (P < 0.05) or the number of family members (P < 0.05).

When different categories of the BMI were correlated with the performance of physical activity, there was no significant difference between the students who performed physical activity (65.5% of these individuals had a normal weight, 7.8% were underweight, 7.8% were obese, and 18.9% were overweight) and those who did not perform physical activity (60.7% of these individuals had a normal

weight, 13.1% were underweight, 18.2% were overweight, and 7.9% were obese) (Table 5).

Discussion

This cross sectional study determined food preference in relation to different food groups, and correlated data to different BMI categories and the performance of physical activity. Regarding food preference, the students preferred only 18 items from the 40 listed items (45% of the items) based on the nutritional pyramid of United States Department of Agriculture categorization as mentioned in the Results section.

The students' selections reflected a tendency towards a healthy and balanced diet. In fact, their selections constituted the 6 main nutritional groups. This finding was in contrast with the findings of a comparable study conducted in Pakistan (Sajwani et al., 2009), which revealed that despite the fact that the students were studying basic health sciences, no significant difference was found between medical and non-medical students when asked if they made an effort to eat healthy foods. In another study conducted in England (Pollard et al., 1998), university students who stated that health was important to them confirmed their choice of healthier foods. In the present study, although 43% stated they were eating a balanced diet, normal weight, underweight, and overweight students moderately ate food items within the vegetables, fruits, milk, and protein groups. There was a significant increased utilization ($p < 0.05$) of grains and oils in the normal weight group compared to the overweight and obese groups. On the other hand, obese students showed low consumption of vegetables, fruits, and oils.

Interestingly, body weight was inversely associated with whole-grain intake but positively associated with refined-grain intake (Liu et al., 2003). In addition, a high amount of olive oil consumption was not associated with a greater amount of weight gain or a significantly higher risk of becoming overweight or obese (Bes-Rastrollo et al., 2006). An individual's culture has a significant influence on what he or she considers an "ideal" physical body stature. The cultural determinants are complex societal issues that involve attitudes, beliefs, aesthetics, knowledge, economic, and political considerations (Sedrani, 1986).

This study examined the correlations between BMI and demographic data and BMI and physical activity. We observed a tendency towards obesity in 21.7% of the males and 5.6% of the females. These findings are in agreement with those of Al-Rethaiaa et al. (2010) who studied obesity among college males. It was found that 21.8% of the sample was overweight and 15.7% was obese (Al-Rethaiaa et al., 2010). Higher rates of obesity in males than females have been reported by others (Abdel-Mageid et al., 2001; Hughes et al., 2006; Yahia et al., 2008).

Preclinical and clinical-levels of study were not significant correlated with normal weight. However, there was a tendency for the students in the clinical-levels but not the preclinical levels to be underweight or overweight. This trend may be due to the increased stress encountered during the clinical years. Some studies (Macht et al., 2005; Serlachius et al., 2007; Ferrara, 2009) reported increased stress association with academics or life issues that may also contribute to the risk of weight gain in college students. (Koek et al., 2011) found that Dental Environment Stress (DES) was significantly higher between clinical levels than preclinical levels.

Relating nationality to BMI, majority of students were within the normal weight but with significant tendency towards being more underweight and overweight in Saudi students compared to non Saudi students. According to Madani et al. in 2000, obesity was becoming one of the most important public health problems in Saudi Arabia (Madani et al., 2000; Madani, 2000).

When correlating the marital status with the BMI, no significant differences were found between single and married individuals and for most of them, their weights were within the normal weight range with tendency towards being overweight in single individuals, whereas there was equal tendency towards underweight and overweight observed in married individuals. Some existing data suggested that generally married men and women were more likely to be overweight and obese than unmarried individuals (Lipowicz et al., 2002).

Living in Riyadh with family or living in dormitories, had significant correlation with the BMI. Of those living in dormitories, 25.6% were overweight, while, 14.3% were underweight. On the other hand, only 15.7% of those living with their families were overweight, and 9.1% were underweight p = 0.041. Our finding differ from a study of Turkish girls living in the dormitories where the BMI of 11.6% of the students indicated underweight, 80.8% normal, and 7.6%; with no obese student. (Papadaki et al., 2007) Also inverse correlations were detected between both BMI, and the frequency of eating with families (Al-Rethaiaa et al., 2010).

This could be due to the fact that students, eating away from home, depended mainly on fast food which is high in calories and fats and low in

vegetables and fruits. This is in agreement with the results of earlier studies which reported that diets of the university students living away from the family were characterized by a number of undesirable practices affecting their healthy lifestyles. Significant decrease in the consumption of fruits, fresh and cooked vegetables, seafood and pulses together with increased intake of sugar and fast foods were the major dietary changes reported for university students living away from the family home (Papadaki *et al.*, 2007; Kremmyda *et al.*, 2008).

When the different BMI categories were correlated to the performance of physical activity, 49% mentioned they performed physical activity, while 51% mentioned they did not perform any physical activity. In comparing our results with the findings of some of the American colleges, it was found that only 40% were participating in some kind of regular physical activity; 30% or more of the students were not participating in any exercise at all on a weekly basis (Huang *et al.*, 2003; Keating *et al.*, 2005; Racette *et al.*, 2005). This suggests that more than half of college students do not meet the minimum goal of 150 minutes of moderate physical activity each week or approximately 30 minutes of exercise at least five days per week, as proposed by the Centers for Disease Control and the American College of Sports Medicine (Suminski *et al.*, 2002).

Colleges and universities are potentially important settings for the promotion of regular exercise and weight maintenance strategies by creating an environment that encourages physical activity and a healthy lifestyle. Possible weight maintenance strategies include increasing accessibility to safe walking and enhancing stairwells in buildings around campus with new paint, carpeting, artwork, or music which may encourage individuals to use the stairs (Boutelle *et al.*, 2004; Tsatsoulis *et al.*, 2006).

Requiring students to take a course in nutrition and physical activity, increasing the accessibility of recreational facilities (Boutelle *et al.*, 2001), and increasing the opportunities for physical activity on campus are important for the promotion of physical activity in the campus community. These changes may result in increased physical activity by students during the college years and after graduation. In addition, offering health and wellness services, such as health and fitness appraisal, nutrition counseling, an individualized exercise prescription, and electronic newsletters, may also be important for health promotion on campus. Such programs, although potentially increasing costs for colleges and universities, will help to promote physical activity and healthy eating, which may help students deal more

effectively with daily stressors (Raeed *et al.*, 2005). These changes will reduce the risk of obesity-related disorders and improve the health of the entire college and university community. Exercise physiologists, nutritionists, and other health professionals should play an important role in the development of these new policies and programs (Leslie *et al.*, 2001; Raeed *et al.*, 2005).

Conclusions

According to the results of the present study, 18 food items were preferred out of 40 food items. The normal weight students exhibited a significantly high consumption of grains and oils, a moderate consumption of vegetables, a low consumption of fruits, a moderate consumption of milk, and a moderate consumption of proteins. All of these reflected the students' balanced diet. The BMI was calculated and related to the food pyramid. Normal weight was the predominant finding among dental students in the RCsDP. When BMI was related to the demographic data, there was tendency for males but not females to be overweight and obese. Those students who lived away from their families showed a tendency to be either underweight or overweight. No significant relationship was found between performing physical activity and being underweight or overweight.

Acknowledgments

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