

## Adherence to Recommended Dietary Guidelines and the Relationships with the Importance of Eating Healthy in Egyptian University Students

### Abstract

**Background:** Little is known on the food consumption habits and adherence to dietary guidelines among young adults. We examined students' adherence to recommended guidelines, and the associations between importance of eating healthy and guidelines adherence. **Methods:** A total of 3271 undergraduates at 11 faculties, Assiut University, Egypt (2009–2010), completed a questionnaire reporting their consumption of 12 food groups; number of servings of fruits/vegetables/day; and how important it is for them to eat healthy. We employed the WHO guidelines for the Eastern Mediterranean region (WHO 2012) to compute students' adherence to dietary guidelines for the different food groups. Chi-square tested the differences for adherence to guidelines by gender, and the associations between the importance of healthy eating and guidelines adherence for the whole sample and by gender. **Results:** Except for cereal products, no food group had an adherence level >45%. Gender differences were observed (men had better adherence for sweets, cake/cookies, snacks, and raw vegetables but not for fast food/canned food or cooked vegetables,  $P < 0.001$  for each). There was a significant positive trend between the increase of subjective importance of eating healthy and adherence to guidelines ( $P = 0.012 - < 0.001$ ). However, this association was only for some food groups and gender dependent. **Conclusions:** Across the majority of food groups we examined, this sample exhibited low adherence levels to International Nutrition Guidelines. Healthier eating educational/intervention efforts should target foods exhibiting low adherence (most food groups, particularly salad/raw vegetables, fresh fruits, dairy/dairy products, meat/sausage products); consider gender differences (females reported lower adherence across most food groups); and note the relation between adherence and subjective importance of eating healthy by food groups and gender.

**Keywords:** Adherence, eating healthy, feeding behavior, gender, Mediterranean region, students, vegetables and fruits

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### Introduction

Progress from high school to university has health implications, particularly for food choices and practices.<sup>[1,2]</sup> Students are receptive to consuming snacks and soft drinks that might lead to weight gain and undesirable health consequences; and their academic responsibilities may produce stress, leading to changes in diet.<sup>[3-7]</sup> Students select their food while being receptive to fashionable influences, for example, taking up distinct diets, skipping meals, or consuming new products.<sup>[4]</sup> Such lifestyle changes are important as they might lead to weight gain during the university years.<sup>[5]</sup> Furthermore, the food intake habits during university could persist into later life,<sup>[6]</sup> contributing to short- and long-term undesirable health and well-being consequences.<sup>[7]</sup>

Young adults' deleterious food consumption habits and low adherence to dietary guidelines,<sup>[3,8-14]</sup> sometimes differ by gender,<sup>[3,15,16]</sup> and students' nutritional knowledge seems not sufficient for guideline adherence.<sup>[12,17]</sup> In the USA, first year students who moved to campus decreased their fruits and vegetables intakes, whereas both campus and off-campus students decreased their consumption of dairy products, with only a few students meeting the dietary guidelines.<sup>[9]</sup> Students also make unhealthy dietary choices when purchasing food and beverages around campus;<sup>[10]</sup> and in Canada, the majority of female university students did not meet the minimum recommendations of the "Eating Well with Canada's Food Guide" for any food group.<sup>[12]</sup> Certainly, young adults display some of the poorest dietary habits of all age groups, and such habits include

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recurrent fast-food consumption,<sup>[13]</sup> and low adherence to National Dietary Guidelines.<sup>[14]</sup>

Few dietary guidelines adherence studies have been conducted in Eastern Mediterranean countries, for example, in Iran, Saudi Arabia, Kuwait, and Lebanon.<sup>[18-21]</sup> No studies of diet quality and/or dietary guidelines adherence seem to have been conducted in Egypt, and research that focuses on young adult university populations is sparse. We examined undergraduates' diet quality, guidelines adherence, and perceptions of the importance of eating healthy. This could be the first such study in Egypt.

## Methods

### Study design and participants

This cross-sectional study was a general student health and well-being survey similar to studies implemented in several countries.<sup>[22-24]</sup> Among other variables it included self-reported sociodemographic information, questions on the consumption of a range of food groups, and a question on the importance of eating healthy.

Ethical approval was provided by Assiut University Ethics Committee, Egypt. Data were collected simultaneously from all participating faculties (2009–2010). Self-administered questionnaires were distributed to students attending lectures of randomly selected courses at Assiut University in Assiut city. Student participation was voluntary and anonymous. The sample included 3271 students (mean age 18.9 years, standard deviation 1.42). We excluded participants with missing data on dietary items and on the question of importance of eating healthy, reducing the number to 2502 students; and also excluded those with missing data for gender, leaving 2422 participants (1119 males, 1303 females) in the dataset. Participating students were enrolled at 11 faculties of Assiut University (Business, Engineering, Education, Arts, Social Work, Sciences, Physical Education, Computers and Information, Veterinary Medicine, Specific Education, and Agriculture). Data were confidential and protected at all stages. As this is an exploratory study, no formal sample size calculation was undertaken, and a convenient sample of students was sought at all participating faculties ( $\approx 10\%$  of students at each Faculty). Based on the number of returned questionnaires, the response rates were about 90%, probably due to the general culture of university students in Egypt; the fact that the survey was administered usually in the last 10 min of lectures that students attended, thus facilitating students' participation; and that it was a paper and pencil questionnaire (i.e., not an online survey which could yield lower response rates).

### Study instruments and variables assessment

#### *Assessment of food consumption habits (12 items)*

Students self-reported their nutritional habits in a food frequency questionnaire comprising 12 indicator

variables that measured their consumption of sweets, cakes/cookies, snacks and fast/canned food, fresh fruits, raw and cooked vegetables and salads, meat and fish, milk products, and cereals. The instrument incorporated food groups that are important for dietary habits research, and the face and content validity of the tool were established by grounding the questionnaire on wide literature review. The introductory question, "How often do you eat the following foods?" queried students about the frequency of their usual consumption of each food group individually (5-point scale: "several times a day," "daily," "several times a week," "1–4 times a month," "never"). The instrument was based on pre-existing food frequency questionnaires and adapted for the current study, and its psychometric features have been published elsewhere.<sup>[22-25]</sup>

#### *Number of servings of fruits/vegetables consumed per day*

"How many servings of fruits and vegetables do you usually have per day (1 serving = 1 medium piece of fruit, 1/2 cup chopped, cooked, or canned fruits/vegetables, 3/4 cup fruit/vegetable juice, small bowl of salad greens, or 1/2 cup dried fruit)?" The response scales were: "I don't eat fruits and vegetables," "1–2 times," "3–4 times," or "5 or more times."

#### *Importance of eating healthy*

"How important is it for you to eat healthy?" (5-point scale, 1 = "Not at all important," 5 = "very important").<sup>[22]</sup>

In terms of dietary guidelines, for sweets, cake/cookies, snacks, fast food/canned food, and lemonade/soft drinks, there are no specific guidelines; therefore, we considered the "1–4 times a month" and "never" as recommended. For all the remaining food groups, we employed the WHO dietary guidelines recommendations for Eastern Mediterranean region.<sup>[26]</sup> Hence, for the number of daily fruit/vegetables servings, "3–4 times" and " $\geq 5$  times" were considered as recommended because the international guidelines suggest 5 servings of vegetables/day and 4 servings of fruit/day.<sup>[26]</sup> In terms of fresh fruit, salad/raw vegetables, cooked vegetables, dairy/dairy products, and cereal/cereal products, we considered the "several times a day" and "daily" categories as recommended.<sup>[26]</sup> For meat/sausage products, the recommendations are 1–2 servings/week;<sup>[26]</sup> therefore, we considered as recommended, people who consumed these items "1–4 times a month" and "never." Finally, as regards to eating fish/seafood, the guidelines are  $\geq 2$  servings/week,<sup>[26]</sup> so we considered as recommended, people who consumed these items "several times a day," "daily," or "several times a week."<sup>[26]</sup>

### Statistical analysis

SAS software package version 9.3 (Statistical Analysis System, SAS Institute, Cary, North Carolina, USA) was

used for statistical analyses (significance set at  $P \leq 0.05$ ). Descriptive statistics (frequencies) described students' food consumption habits, as well as the percentages of students who adhered to dietary guidelines (for the whole sample and separately for men and women).

Chi-square statistic tested the overall differences for adherence to dietary guidelines between men and women, and also the associations between the gradients of importance of healthy eating and the actual self-reported food consumption habits for all food items, for the whole sample and for men and women. If expected cell counts were  $<5$ , then Fisher's exact test was used.

## Results

Table 1 presents the consumption habits/patterns (frequencies) of the 12 food items for the whole sample ( $N = 2502$ ). Sweets and cake/cookies had very similar distributions, whereas snacks, fast food/canned food, and lemonade/soft drinks showed more distinct distributions. For all these categories, there were high percentages of "several times a week" consumption, whereas fast food had the highest levels of never being consumed compared to all the other abovementioned food items (16.4%). Fresh fruit and raw vegetables had also similar distributions, which was not the case for cooked vegetables, which were more often consumed on a daily basis (32.8%).

In addition, consumption of fresh fruit and raw vegetables was low for the "several times a day" (6.4% and 4.4%, respectively) and "daily" (14.4% and 18%, respectively) categories. Meat and fish consumption differed in their distribution, with meat being consumed almost daily (13.0% vs. 1.8%) or several times a week (67.5% vs. 29.3%), whereas fish being mostly consumed 1–4 times a month (14.6% vs. 51.1%) or never (1.9 vs. 16.8%). Dairy products had the highest levels of "never" consumption (29.0%), whereas cereal/cereal products had a very high consumption for the "several

times a day" (25.3%) and "daily" (46.6%) categories.

Table 2 shows the frequencies of adherence to the International Dietary Guidelines, for the 12 food items and the question on the number of daily servings of fruit/vegetables, for the whole sample ( $N = 2502$ ), as well as for 1119 males and 1303 females ( $N = 2422$ , due to missing data for gender). For the whole sample, cereal/cereal products achieved the highest percentages for compliance to guidelines (71.8%). Sweets, cake/cookies, snacks, fast food/canned food, and lemonade/soft drinks but not snacks (33.0%) had relatively satisfactory percentages of adherence to the recommendations. Among fruits and vegetables, cooked vegetables had the highest adherence to guidelines (37.3%). Meat/sausage products, fish/seafood, and dairy/dairy products had low levels of compliance to the recommendations (16.5%, 32.1%, and 19.1%, respectively).

When men and women were analyzed separately, there were differences in the adherence to guidelines for many food items. Compared to women, men had higher levels of adherence for sweets, cake/cookies, and snacks but not fast food/canned food ( $P < 0.001$  in all cases). There were no gender differences for lemonade/soft drinks. For fruit and vegetables, men had higher compliance for the number of daily servings of fruit and vegetables ( $P = 0.003$ ) and for raw vegetables ( $P < 0.001$ ), whereas women had higher adherence for cooked vegetables ( $P < 0.001$ ). There were no gender adherence differences for fresh fruit. In addition, higher percentages of men met the guidelines for dairy/dairy products and meat/sausage products compared to women ( $P = 0.002$  and  $P < 0.001$ , respectively). There were no gender differences for the guidelines adherence for cereal/cereal products or fish/seafood.

Table 3 presents the associations between eating habits and the importance of eating healthy for the whole sample. Results were significant for the number of daily fruit and vegetable servings ( $P = 0.008$ ), salad/raw vegetables ( $P = 0.003$ ), cooked vegetables ( $P < 0.001$ ),

**Table 1: Consumption habits/patterns of 12 food items among university students at Assiut University, Egypt**

Food item/group	Several times/day, n (%)	Daily, n (%)	Several times/week, n (%)	1-4 times/month, n (%)	Never, n (%)
Sweets <sup>a</sup>	147 (5.9)	291 (11.6)	977 (39.1)	869 (34.7)	218 (8.7)
Cake/cookies	111 (4.4)	325 (13.0)	959 (38.3)	911 (36.4)	196 (7.8)
Snacks <sup>b</sup>	275 (11.0)	555 (22.2)	847 (33.9)	516 (20.6)	309 (12.4)
Fast food/canned food <sup>c</sup>	178 (7.1)	464 (18.6)	831 (33.2)	618 (24.7)	411 (16.4)
Fresh fruit	160 (6.4)	361 (14.4)	1181 (47.2)	563 (22.5)	237 (9.5)
Salad/raw vegetables	109 (4.4)	451 (18.0)	902 (36.1)	565 (22.6)	475 (19.0)
Cooked vegetables	113 (4.5)	821 (32.8)	1092 (43.7)	299 (12.0)	177 (7.1)
Lemonade/soft drinks	169 (6.8)	326 (13.0)	913 (36.5)	735 (29.4)	359 (14.4)
Meat/sausage products	77 (3.1)	324 (13.0)	1689 (67.5)	364 (14.6)	48 (1.9)
Fish/sea food	24 (1.0)	46 (1.8)	732 (29.3)	1279 (51.1)	421 (16.8)
Dairy/dairy products	94 (3.8)	385 (15.4)	628 (25.1)	670 (26.8)	725 (29.0)
Cereal/cereal products <sup>d</sup>	632 (25.3)	1165 (46.6)	366 (14.6)	197 (7.9)	142 (5.7)

Analysis based on 2502 participants. <sup>a</sup>E.g., Chocolate, candy, etc., <sup>b</sup>E.g., Chips, peanuts, etc., <sup>c</sup>E.g., Pizza, hamburger, French fries, canned ravioli, etc., <sup>d</sup>E.g., Whole-wheat bread, cereals, oatmeal, etc.

**Table 2: Adherence to International Dietary Guidelines of university students at Assiut University, Egypt**

Food item/group	Adherence to guidelines <i>n</i> (%)			<i>P</i>
	Whole sample ( <i>n</i> =2502)	Males ( <i>n</i> =1119)	Females ( <i>n</i> =1303)	
Sweets <sup>a,b</sup>	1087 (43.5)	571 (51.0)	490 (37.6)	<0.001
Cake/cookies <sup>b</sup>	1107 (44.2)	563 (50.3)	515 (39.5)	<0.001
Snacks <sup>c,b</sup>	825 (33.0)	465 (41.6)	339 (26.0)	<0.001
Fast food/canned food <sup>d,b</sup>	1029 (41.1)	370 (33.1)	633 (48.6)	<0.001
Lemonade/soft drinks <sup>b</sup>	1094 (43.7)	486 (43.4)	572 (43.9)	0.817
Number of fruit/vegetables servings/day <sup>c</sup>	836 (33.4)	398 (35.6)	409 (31.4)	<b>0.030</b>
Salad/raw vegetables <sup>f</sup>	560 (22.4)	308 (27.5)	236 (18.1)	<0.001
Cooked vegetables <sup>f</sup>	934 (37.3)	358 (32.0)	551 (42.3)	<0.001
Fresh fruit <sup>f</sup>	521 (20.8)	228 (20.4)	278 (21.3)	0.562
Dairy/dairy products <sup>f</sup>	479 (19.1)	245 (21.9)	220 (16.9)	<b>0.002</b>
Cereal/cereal products <sup>g,fs</sup>	1797 (71.8)	813 (72.7)	929 (71.3)	<b>0.459</b>
Meat/sausage products <sup>h</sup>	412 (16.5)	225 (20.1)	174 (13.4)	<0.001
Fish/seafood <sup>i</sup>	802 (32.1)	371 (33.2)	402 (30.9)	0.226

Analysis based on 2502 participants. Bolded *P* values indicate statistical significance ( $P < 0.05$ ). <sup>a</sup>E.g., Chocolate, candy, etc., <sup>b</sup>No specific guidelines exist, 1-4 times/month or never considered as recommended, <sup>c</sup>E.g., Chips, peanuts, etc., <sup>d</sup>E.g., Pizza, hamburger, French fries, canned ravioli, etc., <sup>e</sup>3-4 servings/5 or more considered as recommended, <sup>f</sup>Several times a day/daily considered as recommended, <sup>g</sup>E.g., Whole-wheat bread, cereals, oatmeal, etc., <sup>h</sup>1-4 times/month or never considered as recommended, <sup>i</sup>Several times a day/daily/several times a week considered as recommended

**Table 3: Associations between importance of eating healthy and adherence to dietary guidelines for the whole sample of university students at Assiut University, Egypt**

Food item/group	Importance of eating healthy <i>n</i> (%)					<i>P</i>
	1. Not at all important ( <i>n</i> =76; 3.04%)	2. ( <i>n</i> =78; 3.12%)	3. ( <i>n</i> =325; 12.99%)	4. ( <i>n</i> =433; 17.31%)	5. Very important ( <i>n</i> =1590; 63.55%)	
Adherence to guidelines						
Number of fruit/vegetables servings/day	16 (22.0)	15 (19.2)	105 (32.3)	147 (34.0)	553 (34.8)	<b>0.008</b>
Salad/raw vegetables	12 (15.8)	12 (15.4)	51 (15.7)	96 (22.2)	389 (24.5)	<b>0.003</b>
Cooked vegetables	25 (32.9)	13 (16.7)	98 (30.6)	158 (36.5)	640 (40.3)	<0.001
Dairy/dairy products	7 (9.2)	9 (11.5)	59 (18.2)	74 (17.1)	330 (20.8)	<b>0.019</b>
Cereal/cereal products <sup>a</sup>	47 (61.8)	56 (71.8)	209 (64.3)	324 (74.8)	1161 (73.0)	<b>0.003</b>
Lemonade/soft drinks	41 (54.0)	40 (51.3)	169 (52.0)	192 (44.3)	652 (41.0)	<0.001
Meat/sausage products	22 (29.0)	14 (18.0)	57 (17.5)	56 (12.9)	263 (16.5)	<b>0.012</b>
Sweets <sup>b</sup>	36 (47.4)	38 (48.7)	148 (45.5)	170 (39.3)	695 (43.7)	0.280
Cake/cookies	30 (39.5)	41 (52.6)	138 (42.5)	193 (44.6)	705 (44.3)	0.504
Snacks <sup>c</sup>	22 (29.0)	23 (29.5)	110 (33.9)	134 (31.0)	536 (33.7)	0.682
Fast food/canned food <sup>d</sup>	29 (38.2)	37 (47.4)	131 (40.3)	177 (40.9)	655 (41.2)	0.797
Fresh fruit	10 (13.2)	12 (15.4)	67 (20.6)	81 (18.7)	351 (22.1)	0.147
Fish/seafood	24 (31.6)	26 (33.3)	98 (30.2)	127 (29.3)	527 (33.1)	0.567

Analysis based on 2502 participants. Bolded *P* values indicate statistical significance ( $P < 0.05$ ). <sup>a</sup>E.g., Whole-wheat bread, cereals, oatmeal, etc., <sup>b</sup>E.g., Chocolate, candy, etc., <sup>c</sup>E.g., Chips, peanuts, etc., <sup>d</sup>E.g., Pizza, hamburger, French fries, canned ravioli, etc.

dairy/dairy products ( $P = 0.019$ ), cereal/cereal products ( $P = 0.003$ ), lemonade/soft drinks ( $P < 0.001$ ), and meat/sausage products ( $P = 0.012$ ). There was a positive trend for all the above food groups (adherence increased with the increase of subjective importance of healthy eating), but not for lemonade/soft drinks and meat/sausage products which showed a decreasing trend.

Table 4 shows the same associations by gender. When participants were divided by gender, associations remained significant for both genders for lemonade/soft drinks,

meat/sausage products and cereal/cereal products, and was close to significant for cooked vegetables ( $P = 0.066$ ). Number of daily fruit/vegetable servings and salad/raw vegetables remained significant, and dairy/dairy products were borderline significant ( $P = 0.055$ ) only for men. Finally, fresh fruit appeared significant only for men.

## Discussion

We assessed students' consumption of 12 food groups and the daily consumption of fruit/vegetables; their adherence to recommended dietary guidelines; and the associations



**Table 4: Associations between importance of eating healthy and adherence to dietary guidelines for male and female university students at Assiut University, Egypt**

Food item/ group	Importance of eating healthy <i>n</i> (%)										<i>P</i> *	
	Males					Females						
	1. Not at all important ( <i>n</i> =24; 2.1%)	2. ( <i>n</i> =36; 3.2%)	3. ( <i>n</i> =144; 12.8%)	4. ( <i>n</i> =208; 18.6%)	5. Very important ( <i>n</i> =707; 63.2%)		1. Not at all important ( <i>n</i> =47; 3.6%)	2. ( <i>n</i> =40; 3.1%)	3. ( <i>n</i> =173; 13.3%)	4. ( <i>n</i> =211; 16.2%)	5. Very important ( <i>n</i> =832; 63.9%), <i>n</i> (%)	
Adherence to guidelines												
Number of daily servings of fruit/ vegetables	5 (20.8)	5 (13.9)	44 (30.6)	73 (35.1)	271 (38.3)	<b>0.009</b>	9 (19.2)	9 (22.5)	58 (33.5)	69 (32.7)	264 (31.7)	0.256
Salad/raw vegetables	6 (25.0)	7 (19.4)	25 (17.4)	55 (26.4)	215 (30.4)	<b>0.019</b>	6 (12.8)	5 (12.5)	25 (14.5)	40 (19.0)	160 (19.2)	0.390
Cooked vegetables	9 (37.5)	8 (22.2)	35 (24.3)	61 (29.3)	245 (34.7)	<b>0.066</b>	15 (31.9)	5 (12.5)	62 (35.8)	93 (44.1)	376 (45.2)	<b>&lt;0.001</b>
Dairy/ dairy products	3 (12.5)	2 (5.6)	29 (20.1)	43 (20.7)	168 (23.8)	<b>0.055</b>	3 (6.4)	7 (17.5)	29 (16.8)	30 (14.2)	151 (18.2)	0.205
Cereal/ cereal products <sup>a</sup>	17 (70.8)	29 (80.6)	90 (62.5)	147 (70.7)	530 (75.0)	<b>0.027</b>	27 (57.5)	26 (65.0)	113 (65.3)	166 (78.7)	597 (71.8)	<b>0.008</b>
Lemonade/ soft drinks	11 (45.8)	20 (55.6)	81 (56.3)	94 (45.2)	280 (39.6)	<b>0.003</b>	28 (59.6)	18 (45.0)	88 (50.9)	92 (43.6)	346 (41.6)	<b>0.042</b>
Meat/ sausage products	9 (37.5)	10 (27.8)	30 (20.8)	30 (14.4)	146 (20.7)	<b>0.040</b>	13 (27.7)	4 (10.0)	26 (15.0)	23 (10.9)	108 (13.0)	<b>0.058</b>
Sweets <sup>b</sup>	16 (66.7)	21 (58.3)	77 (53.5)	101 (48.6)	356 (50.4)	0.393	19 (40.4)	16 (40.0)	67 (38.7)	64 (30.3)	324 (39.0)	0.219
Cake/ cookies	12 (50)	24 (66.7)	67 (46.5)	99 (47.6)	361 (51.1)	0.244	17 (36.2)	15 (37.5)	70 (40.5)	87 (41.2)	326 (39.2)	0.957
Snacks <sup>c</sup>	10 (41.7)	15 (41.7)	63 (43.8)	83 (40.0)	294 (41.6)	0.972	12 (25.5)	7 (17.5)	44 (25.4)	49 (23.2)	227 (27.3)	0.542
Fast food/ canned food <sup>d</sup>	6 (25.0)	15 (41.7)	42 (29.2)	64 (30.8)	243 (34.4)	0.415	23 (48.9)	21 (52.5)	86 (49.7)	108 (51.2)	395 (47.5)	0.859
Fresh fruit	2 (8.3)	3 (8.3)	23 (16.0)	32 (15.4)	168 (23.8)	<b>0.004<sup>†</sup></b>	7 (14.9)	9 (22.5)	44 (25.4)	44 (20.9)	174 (20.9)	0.551
Fish/ seafood	4 (16.7)	10 (27.8)	44 (30.6)	65 (31.3)	248 (35.1)	0.265	18 (38.3)	14 (35.0)	49 (28.3)	58 (27.5)	263 (31.6)	0.492

Analysis based on 2502 participants. Bolded *P* values indicate statistical significance. \*Chi-square test; <sup>†</sup>Fisher's exact test was performed when cells had <5 counts. <sup>a</sup>E.g., Whole-wheat bread, cereals, oatmeal, etc., <sup>b</sup>E.g., Chocolate, candy, etc., <sup>c</sup>E.g., Chips, peanuts, etc., <sup>d</sup>E.g., Pizza, hamburger, French fries, canned ravioli, etc.

between the importance of eating healthy and dietary guidelines adherence. The current study is the first to have undertaken in-depth dietary research among university students in Egypt.

For our whole sample, cereal/cereal products had the highest percentages for guidelines adherence in agreement with Nigeria, whereas adherence to cereals guidelines was highest as regards the students' food choices.<sup>[27]</sup> We also found that sweets, cake/cookies, snacks, fast food/canned food, and lemonade/soft drinks but no snacks had relatively satisfactory percentages of adherence to guidelines. Among fruits and vegetables, cooked vegetables had the highest guidelines

adherence, whereas meat/sausage products, fish/seafood, and dairy/dairy products had low adherence. Thus, generally for our whole sample, apart from cereal/cereal products, no food group had a guideline adherence level of >45% (range 44%–19%). Similar results have been observed in Spain where only 53% adhered to the Mediterranean diet, and >91% needed “diet changes” to acquire healthier dietary patterns.<sup>[28]</sup> Our observed highest guidelines adherence is alarming, and educational/health stakeholders need to encourage better eating habits for such university student samples.

Over the past decades, food consumption patterns in Egypt have changed, with the nutrition transition occurring

with abundant dietary energy availability, urbanization, and moderate fat intakes.<sup>[29]</sup> Perhaps such changes are reflected in our sample, where for fast food/canned food consumption, less than half the sample adhered to the guidelines. While students often select fast food due to its palatability, availability, and convenience,<sup>[21]</sup> in Malaysia, only 21% of university students consumed fast food often.<sup>[30]</sup> The changing food consumption patterns in Egypt are also reflected in our sample's daily fruit/vegetables, where only a third of our students adhered to the dietary guidelines in terms of the number of daily fruit/vegetables servings. Our low adherence levels for daily fruit/vegetables servings agree with Hong Kong and Malaysia,<sup>[16,30]</sup> and others have also reported that few students eat  $\geq 5$  or more servings of fruits and vegetables per day.<sup>[31]</sup> Daily fruit/vegetables are important "physiological antioxidants" that protect the body from detrimental free radicals.<sup>[32]</sup> Certainly, high consumption of fruits and vegetables are features of the Mediterranean food pattern that has advantages in cardiovascular disease prevention.<sup>[33]</sup>

There seems to be no studies in Egypt on the diet quality of university students, with two exceptions conducted on different populations than ours rendering direct comparisons with our findings difficult. The first survey<sup>[34]</sup> reported unhealthy dietary patterns of adolescents; the second found that 34.1% of students ate snacks daily, and students practiced many faulty meal patterns.<sup>[35]</sup> Such findings suggest that healthy eating habits among young people are challenging, and this age group is of particular significance for dietary interventions.

As for gender, we observed a mixed pattern of findings. Men had higher guideline adherence levels for many food items (sweets, cake/cookies, snacks, number of daily servings of fruit and vegetables, raw vegetables, dairy/dairy products, and meat/sausage products); women had higher adherence for cooked vegetables; and there were no gender differences for adherence for cereal/cereal products, fish/seafood, lemonade/soft drinks. Similar mixed patterns were observed in Nigeria;<sup>[27]</sup> but in Hong Kong, nutritional habits did not differ by students' gender.<sup>[16]</sup> Further research could explore these gender differences to improve students' dietary habits.

In our study, there was a significant positive trend between the increase of one's subjective feelings of the importance of eating healthy, and adherence to dietary guidelines, for the number of daily fruit and vegetable servings, salad/raw vegetables cooked vegetables, dairy/dairy products, and cereal/cereal products. In addition, these relationships exhibited a "stepladder" appearance (dose-response/gradient). These findings suggest that when students regard eating healthy as important, they are likely to adhere to the guidelines for some but not all food groups. When college students are provided with relevant information regarding the benefits of healthy eating and given clear indications as to which foods are considered "healthy," it is assumed that

students will become more aware of available healthy food choices.<sup>[36]</sup> However, in real life, this seems to be different. In Canada, among students who had completed at least one nutrition course, no student consumed the "Traditional Healthy Mediterranean Diet Pyramid" minimum number of portions of legumes, seeds and nuts, of olive oil, or of whole grains.<sup>[12]</sup> Likewise, in Pakistan, students had sufficient knowledge regarding good dietary habits but failed to apply this knowledge into practice;<sup>[37]</sup> and in China, students exhibited poor eating habits.<sup>[38]</sup> Frequently, students engage in unhealthy dieting, high fast-food intake, and low fruits/vegetables intake whilst being aware of the negative consequences of such habits.<sup>[39]</sup> Our findings suggested that in terms of adherence, students' high regard of the importance of eating healthy might: (1) influence adherence to some but not all food groups, and (2) play a more critical role than the student's actual academic discipline at university. Future research could explore the relationships between importance of eating health; discipline of university study; knowledge of good dietary habits; and actual food consumption.

This study has limitations. Participants' self-reported the importance of eating healthy and dietary food consumption where responses may be subject to sociability and social desirability. For some food groups, we did not assess serving sizes. The food frequency questionnaire was not compared against objective methods of food consumption measurement. Nonetheless, the tool was comparable to other published food frequency questionnaires that have been validated. Future research would need to consider such limitations. Despite these limitations, the current research has strengths. The sample comprised a large number of students ( $\approx 10\%$  from each faculty); drawn from across 11 faculties; and with nearly equal proportions of males and females. For the analysis, we used the WHO Mediterranean dietary guidelines that are appropriate for Egypt as an Eastern Mediterranean country; and also excluded students who did not answer all the food frequency questions to avoid any potential effects that any missing values could have on the observed estimates of adherence and on the associations examined. In addition, we analyzed males and females separately to avoid confounding effects of gender. We are not aware of any previous study in Egypt of university students' nutrition quality and adherence to dietary guidelines that undertook such tasks.

## Conclusions

Guidelines, recommendations, and diet quality indices relating to food patterns allow us to identify healthy lifestyles. With the exception of cereal/cereal products, none of the food groups we examined had guidelines adherence level of  $>45\%$ , and the food pattern of the Egyptian university students showed a low quality, with an intermediate-low guideline adherence. University-based nutritional-educational programs and

prevention/intervention efforts to promote healthier eating habits and encourage better diet quality and adherence to dietary guidelines should (1) specifically target the foods that exhibited low adherence rates; (2) consider the gender differences in adherence; and (3) note the relationships between guidelines adherence and the subjective importance of eating healthy and their gender differences.

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