

# Food consumption frequency and perceived stress and depressive symptoms among female university students in the UAE

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## Research article

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# Abstract

## Background

This study assessed whether perceived stress and depressive symptoms were associated with the frequency of consumption of specific food groups among female university students.

## Methods

A cross-sectional study was conducted among female university students using a simple random sampling method. The response rate was 97% yielded a total number of 385 participants. The associations between stress levels and the most/least consumed food groups, and between depressive symptoms levels and the most/least consumed food groups were assessed. The questionnaire included a 12-item self-administered food frequency questionnaire, Cohen's Perceived Stress Scale, and Beck Depression Inventory-II. The study was approved by the University Ethical Committee before data collection. One-way Analysis of Variance (ANOVA) and the independent-sample t-test were carried out to test the equality of population means across the categories of each independent variable depending on the number of categories of the independent variable.

## Results

Overall, this group of female university students fell under the mild mood disturbance category (depressive symptoms) (BDI-II) and had moderate perceived stress (PSS). Perceived stress was associated with more frequent consumption of salad/raw vegetables and cooked vegetables, and less frequent consumption of cake/cookies and meat/sausage products ( $p < .05$ ). Additionally, depressive symptoms were associated with less frequent consumption of fresh fruits and more consumption of fast food/canned food and soft drinks ( $p < .05$ ).

## Conclusions

The data showed that stress and depression were associated with different dietary preferences consistent with distinctions between stress and depression on human behavior. Specifically, the results revealed associations between soft drinks consumption and higher depressive symptoms, and between frequent consumption of salad/raw vegetables and cooked vegetables and higher perceived stress among this group of female university students.

## Background

Stress and depression could contribute to several complications including maladaptive eating behaviors either by overeating or undereating [1,2]. These inconsistencies in dietary habits are results of stress and

other reasons, and that could cause either a noticeable weight gain or weight loss among stressed or depressed persons. Eventually, these changes in eating habits can lead to lifestyle behaviors ]3[. Additionally, undergoing stressful life situations could be a risk factor for developing depression ]2[.

The relationship between the type and the frequency of dietary intake and mental health has been studied over the past years, and this growing field of study concluded that higher consumption of processed and Western food indicates higher risk of developing poor mental health ]4[. Prospective studies relied on causality to explain the nature of this relationship; unhealthy diets at baseline showed higher risk of depression and poor mental health while healthier diets at baseline showed better mental health and lower risk of depression ]5–7[. In experimental studies, when participants were exposed to a stressful situation, they tended to consume more of high-density foods and sweets ]1,8[. In addition, cross-sectional studies suggested that higher perceived stress is positively associated with higher intake of fat, sodium and carbohydrates ]9,10[. Despite that, other studies found that higher levels of stress were not associated with more sweets consumption, but it was associated with lower fruits and vegetables intake ]11[. Overall, studies that looked into food choice under stress found that people; particularly females, consume more of the food types they usually avoid for health reasons ]8[. Regarding depression and dietary habits, most studies focused on the effects of certain diets on depression. These studies showed that the adherence to certain diets that provide healthier choices of food resulted in improved mental health in depressed individuals ]12[. Evidence also suggests that certain nutrients could positively affect mood and could be used for the treatment of depression, while other nutrients could increase the risk of it ]13,14[. Moreover, it was reported that, despite the effect of the socioeconomic status, poor dietary patterns could promote depressive symptoms ]15[.

In general, studies that sought to map the relationship between mental health symptoms (stress and depressive symptoms) and diet reported that unhealthy food intake increased with perceived stress and depressive symptoms levels. Furthermore, it was found that unhealthy food consumption was linked to perceived stress in females only; however, depressive symptoms were linked to the intake of unhealthy food in both males and females ]16,17[. Similar research concluded that levels of perceived stress and depressive symptoms increased with the decrease of fresh-food intake, and the increase of ready-to-eat food and vice versa ]18[.

College students are vulnerable to vicious cycles where poor diet choices and mental health symptoms perpetuate each other. Due to their new environment, responsibilities, financial pressure, and time management struggles, students are more prone to experience stress ]3[. Long-lasting stress was found to be associated with weight gain since it triggers eating more frequently and less healthy ]19,20[. Furthermore, depression may lead to overeating or undereating ]2,14[. However, the research on the effects of stress and depression on dietary habits and choices in the UAE or in the Middle East, specifically in the countries of the Gulf Cooperation Council (GCC), is limited and outdated. To the best of our knowledge, there have been no studies conducted on UAE college students regarding the relationship between dietary habits, depressive symptoms and perceived stress. Therefore, in this study, the

association between the frequency of food consumption and two mental health indicators (perceived stress and depressive symptoms) was assessed on female university students in the UAE.

## Methods

### Study Aim and Design

This study aims to assess the associations between the frequency of food consumption and two mental health indicators; perceived stress and depressive symptoms. A cross-sectional study was conducted following obtaining ethical clearance. After completing a written informed consent, participants were asked to complete a 12-item food frequency questionnaire, Beck Depression Inventory and Cohen's Perceived Stress Scale; all compiled in one questionnaire.

### Population And Sampling

The sample was drawn from female students at a national university in United Arab Emirates (UAE). A number of classes were chosen randomly from the list of courses of spring 2018. Data collection was done from April to May, 2018. The sample represented approximately 10% of the targeted population of 4000 students and resulted in a total sample size of 389 students. 385 questionnaires were accepted in the study resulting in a response rate of 98.9%. Before data collection, a pilot study was conducted on a sample of 10 students to check that the questionnaire was well understood and was appropriate to use with the intended sample. The pilot study participants were not included in the final data analysis reported here.

## Materials

Data was collected through a self-reported questionnaire that consisted of three sections; a 12-item food frequency questionnaire, the 10-item Cohen's Perceived Stress Scale (PSS) and Beck Depression Inventory-II (BDI-II). Weight and height were self-reported which could be a potential source of bias.

### 1. Food Frequency Questionnaire (FFQ)

The food frequency questionnaire [16] assessed the frequency of consumption of 12 food groups; sweets, cake/cookies, snacks, fast food/canned food, fresh fruits, salad/raw vegetables, cooked vegetables, soft drinks, meat/sausages products, fish/seafood, milk/ milk products, and cereal/cereal products. Students were asked to answer the question "How often do you eat the following foods?" on a 5-point scale (several times a day = 5, daily = 4, several times a week = 3, 1–4 times a month = 2, and never = 1). Cronbach's  $\alpha = 0.68$ . The FFQ was used in previous studies [11,16,17]. Although not formally validated, the FFQ we used contains food groups that are essential in studying dietary behavior, and that are in line with the contents of other validated FFQs [16].

## 2. Cohen's Perceived Stress Scale (PSS)

The PSS estimates the degree of which situations in a person's life are considered stressful through 10 items [21,22]. Students expressed their feelings and thoughts for each item during the past month on a 5-point scale (0 = Never, 1 = Almost never, 2 = Sometimes, 3 = Fairly often, and 4 = Very often). In this sample, Cronbach's  $\alpha = 0.68$ .

## 3. Beck Depression Inventory-II (BDI-II)

The BDI-II measures the behavioral manifestation of depression [23, 24]. BDI-II was created in 1996 in alignment with the DSM-IV's diagnostic criteria for major depressive episode [25]. BDI-II consists of 21 items of 4 statements each. Students were asked to choose one statement in each item that best describes their feeling during the past two weeks. The statements were scored on a 4-point scale; 0 to 3. The creators of the BDI-II have found it to have enhanced validity compared to the original BDI [23]. The Arabic version of BDI-II [26] was validated in 18 Arab countries: Palestine, Lebanon, Syria, Jordan, Saudi Arabia, Kuwait, Qatar, Bahrain, United Arab Emirates, Oman, Yemen, Egypt, Sudan, Tunisia, Libya, Algeria and Morocco with Cronbach's  $\alpha$  falling between 0.82 to 0.93 [27,28]. To compensate for the removal of item 9 (suicidal thoughts and wishes) as per the ethical committee's instructions, the scoring system was adjusted. The modified version of BDI-II consisted of 20 items and had a Cronbach's  $\alpha$  of 0.89.

## Main Variables And Statistical Analysis

The FFQ consisted of 12 items, and was measured on a five-point scale (several times a day = 5, daily = 4, several times a week = 3, 1-4 times a month = 2, and never = 1).

In order to compare the results to other studies [16], and by taking into consideration the least moderate correlations (Spearman  $> 0.2$ ) among the items of each subscale and factor analysis, and based on theoretical considerations regarding the content of foods, it was decided to combine some food groups into subscales. The following subscales are used: Unhealthy Foods subscale that consist of sweets, cake/cookies, snacks, and fast food, and Fresh Food subscale that consists of fresh fruits, salads/raw vegetables and cooked vegetables. All remaining food groups were left as separate subscales. The subscales' scores were created as mean scores of the corresponding items.

The BDI-II score (BDI-II Sum) was computed by summing up the responses to all 20 items that measure this mental health indicator. The Perceived Stress Score variable (PSS Sum) was generated by summing all responses to all items of Cohen's Perceived Stress Scale after reversing scores to the four positively stated items (statements 4, 5, 7, and 8). The reversing was done by recoding the 4 statements using 0 for 4, 1 for 3, 2 kept as 2, 3 for 1, and 0 for 4.

The normality for all score variables was checked from Kurtosis and Skewedness, histogram, and Q-Q plots. It was noticed that all variables were approximately normally distributed

The independent associations between food groups (FFQ) and perceived stress (PSS) and depressive symptoms (BDI-II) were studied in two separate linear regression models; univariable and multivariable. The newly created variables FFQ Sum, PSS Sum, BDI-II Sum served as dependent variables in the study and were used for subsequent data analyses. Socio-demographic and anthropometric variables served as independent variables.

The collected data was coded, entered, and analyzed using the Statistical package SPSS version 25. Statistical tests with  $p$ -values  $< 0.05$  were considered statistically significant. Descriptive statistics was computed to describe all items of the questionnaire.

One-way Analysis of Variance (ANOVA) and the independent-sample t-test were carried out to test the equality of population means across the categories of each independent variable depending on the independent variable number of categories.

Multiple linear regression analysis was used to predict each of the outcome variables using the predictors: marital status, age, BMI, exercise, stress and depressive symptoms.

## Results

### Sociodemographic Characteristics

The study population consisted mainly of Emiratis who made 97.1% of the sample. The age range was 17–24 years. Based on the self-reported height and weight, half of the students had normal BMI while 16.4% were overweight, and 15.1% were obese. The mean scores were computed for the Unhealthy Food and Fresh Food subscales, and among this group of students, both Unhealthy Food and Fresh Food subscales had an average consumption (on a scale from 1 to 5). Overall, this group of students fell under the categories of “mild mood disturbances” and “moderate stress” for depressive symptoms and stress respectively.

### Association between food intake and Perceived stress or Depressive symptoms

Associations between the consumption of each food group and stress and depression were assessed separately using linear regression. Table 1 shows that the significant associations between food groups and perceived stress and depressive symptoms were not equal, while there are 4 associations for perceived stress, only 3 associations were found for depressive symptoms. Furthermore, negative associations were observed with perceived stress and cake/cookies and meat/sausage products on one hand, and with depressive symptoms and fresh fruits on the other hand. Additionally, positive associations were observed with perceived stress and salad/raw vegetables and cooked vegetables, and with depressive symptoms and soft drinks and fast food/canned food.

For every unit increase in PSS, the cake/cookies consumption will decrease by 0.106, and the meat/sausage products consumption will decrease by 0.130. On the other hand, the salad/raw vegetables consumption will increase by 0.103 and cooked vegetables consumption will increase by 0.107. Regarding depressive symptoms, for every unit increase in BDI-II, the fresh fruits consumption will decrease by 0.122, and the fast/canned food consumption will increase by 0.114 while soft drinks consumption will increase by 0.124.

Table 1  
Food groups and PSS and BDI-II (univariable analysis)

Food group	PSS		BDI-II	
	P-Value	Estimate*	P-Value	Estimate*
Sweets	0.369	-0.046	0.517	0.033
Cake/cookies	<b>0.039</b>	-0.106	0.296	-0.054
Snacks	0.417	-0.042	0.534	0.032
Fast food/canned food	0.333	-0.049	<b>0.025</b>	0.114
Fresh fruits	0.059	-0.097	<b>0.017</b>	-0.122
Salad/raw vegetables	<b>0.045</b>	0.103	0.209	0.064
Cooked vegetables	<b>0.038</b>	0.107	0.096	0.086
Soft drinks	0.697	0.020	<b>0.015</b>	0.124
Meat/sausage products	<b>0.011</b>	-0.130	0.159	-0.072
Fish/sea food	0.055	-0.098	0.322	-0.051
Milk/milk products	0.324	-0.051	0.951	-0.003
Cereal/cereal products	0.251	-0.059	0.984	-0.001
Unhealthy Food Subscale	0.127	-0.078	0.377	0.045
Fresh Food Subscale	0.295	0.054	0.685	0.021
*Estimates are the Standardized Coefficients. Change in food consumption for every one-unit change in the PSS or BDI-II.				

Multiple linear regressions were used to assess associations between the consumption of all food groups together and both PSS and BDI-II (Table 2). It was found that the consumptions of Unhealthy Food, Fresh Food, fish/sea food, milk/milk products, and cereal/cereal products were not significantly associated with perceived stress and depressive symptoms among this group of university students. In addition, increased consumption of soft drinks was significantly associated with higher depressive symptoms, while increased consumption of meat/sausage products was significantly associated with lower perceived stress.

Table 2  
Food groups, PSS and BDI-II (multivariable analysis)

Food Subscale	PSS <sup>1</sup>		BDI-II <sup>2</sup>	
	P-Value	Estimate*	P-Value	Estimate*
Unhealthy food Subscale**	0.129	-0.086	0.928	0.005
Fresh food Subscale***	0.087	0.093	0.364	0.049
Soft drinks	0.147	0.083	<b>0.012</b>	0.145
Meat/sausage products	<b>0.048</b>	-0.114	0.126	-0.088
Fish/sea food	0.146	-0.085	0.279	-0.063
Milk/milk products	0.819	0.013	0.668	0.025
Cereal/cereal products	0.565	-0.032	0.810	0.014

\*Estimates are the Standardized Coefficients. Change in food consumption for every one-unit change in the PSS or BDI-II.

\*\* Unhealthy food Subscale: mean of four items (sweets, cakes/cookies, snacks, fast food).

\*\*\* Fresh Subscale: mean of three items (fresh fruits, salads, cooked vegetables).

## Unhealthy Food consumption

Table 3 displays the results of the multiple linear regression model for Unhealthy Food consumption. It contains marital status, age, BMI, exercise, BDI-II Sum, and PSS Sum. These variables described only about 3% of the variation in the Unhealthy Food consumption subscale ( $R^2 = 0.028$ ) but it is not statistically significant ( $P = 0.141$ ). The only variable which had a significant effect on the Unhealthy Food consumption was Exercise ( $P = 0.042$ ).

Table 3  
General linear model for Unhealthy Food consumption

Variable	$\beta$	S.E.	P-value	95% Confidence Interval for $\beta$	
				Lower Bound	Upper Bound
Corrected model	-	-	.141	-	-
Intercept	3.392	.424	.000	2.558	4.226
Marital Status	.103	.137	.451	-.166	.373
Students Age	-.011	.021	.599	-.051	.030
BMI	-.011	.041	.793	-.091	.070
Exercise	-.040	.019	<b>.042</b>	-.078	-.002
BDI-II	.007	.005	.167	-.003	.016
PSS	-.015	.009	.085	-.032	.002
R <sup>2</sup> = 0.028					

## Discussion

The objective of this study was to assess whether perceived stress and depressive symptoms were associated with the frequency of consumption of specific food groups among female university students. As mentioned previously, habits that are formed during youth are likely to be sustained throughout later adulthood [3]. Therefore, studying the complex relationship between food choice and mental state could help us understand how the frequency of consumption of certain food groups could be influenced by stress or depression or vice versa.

Our results from the univariable analysis showed that consumption of cake/cookies and meat/sausage products was negatively associated with stress while consumption of salad/raw vegetables and cooked vegetables was positively associated with stress. This result does not line-up with findings from cross-sectional studies conducted on different populations that reported higher consumption of sweets, snacks and fast food with higher stress levels, or higher consumption of fruits/vegetables with lower stress levels [11,16]. Nevertheless, a study that was conducted in Palestine found similar results to the current study. It was found that among females, the consumption of cake/cookies was negatively associated with stress, and among males all food groups except for cereal/cereal products were negatively associated with stress [29]. The latter study suggested that lower consumption of cake/cookies with higher stress could be linked to the fact that people consume foods high in carbohydrates (CHO) to relieve their stress. This could be interpreted by the fact that highly palatable foods high in CHO and fat such as cake/cookies enhance opioid levels in the brain which was linked to feelings of pleasure, and they were eaten as a reward after stress; hence, students' stress level was lower when they consumed

these foods ]29,30[. However, this suggestion is built on the assumption that students with lower stress levels who consumed more cake and cookies were stressed before and consumed more of this food group to relieve the symptoms. This is a weak assumption and cannot be confirmed with the current study design.

Another possible explanation could be based on the behavioral differences that stress and depression have on people. Recall that the consumption of fast food/canned food and soft drinks was found in the current study to be positively associated with depressive symptoms while consumption of fresh fruits was negatively associated with it. These results are consistent with what similar studies found regarding these food groups and depressive symptoms ]16,17[. Depression reflects the behavioral changes in people with higher depressive symptoms. Unlike stress, depression creates feelings of emptiness and hopelessness, pointlessness of efforts and severe reduction in perception of self-efficacy ]31–33[. As such, making an effort to eat healthier food to persons with depression would not be of significance, and hence the tendency we report here to consume more of the easily accessible foods that fall under unhealthy food groups in the high-depression group. The high-stress group, on the other hand, may still consider it important, and possible, to eat healthily, and hence the positive link between higher levels of stress and healthier eating behaviors. It may be of interest in the future to investigate the extent to which there is a discrepancy between the wish to eat healthily and the actual dietary behavior of the high-stress group. Importantly, it would be of interest to unearth the extent to which higher discrepancy (between the wish and the actual dietary behavior) is linked, via dissonance, to the levels of stress reported in this group.

The results of the multivariable analysis showed that there was only one significant association with stress, and one with depressive symptoms. The consumption of meat/sausage products was negatively associated with stress while the consumption of soft drinks was positively associated with depressive symptoms. This is not similar to findings from studies which found positive associations with Unhealthy Food (sweets/snacks/cookies/fast food) and stress and depression, nor studies that found negative associations with Healthy Food (fruits/vegetables) and stress and depression ]16,17[. However, Yassin, Sarsour and Alharazin found that stress was negatively associated with Unhealthy Food consumption among males only, which is similar to the insignificant result this study found regarding the Unhealthy Food subscale and stress ]29[. First, the explanation of negative association found between meat/sausage products consumption and stress is not known though it could mean that lower stress leads to an increased consumption of protein. Future studies could investigate this association further. Second, the positive association found between soft drinks consumption and depressive symptoms could be related to the behavioral changes of people with higher depressive symptoms as mentioned previously.

Finally, the general linear regression model controlled for confounding variables showed that the only variable that predicted Unhealthy Food consumption was exercise. It showed that with higher consumption of Unhealthy Food, the frequency of exercise decreased. Previous studies found that individuals who reported higher level of physical activity had lower levels of stress and depression; hence,

there may be an indirect association between the two mental health indicators and Unhealthy Food consumption ]34,35[. Unhealthy Food consumption could be more affected by other variables not included in this study and that should be investigated in futures studies. Chief amongst these is socio-economic variables, and the related variables of parents' levels of education and other social influences.

Since this study is cross-sectional, causations cannot be derived from it, and it is susceptible to bias; hence, future studies could focus on conducting clinical or controlled experiments.

## **Conclusion**

This study reflects how stress and depression are linked to behavioral differences regarding food consumption among female students. In contrast to stress, the presence of feelings of hopelessness symptomatic of depression would lower the significance of consuming healthier food. Additionally, eating cake/cookies relieved stress; as a result, it was negatively associated with perceived stress. However, assessing the presence of pre-existing stress that affected food consumption is not within the scope of this study; therefore, such interpretation should be further investigated. Furthermore, future studies could look into the relationship between stress and food consumption in this population again and investigate the reasons behind such relationship. The current study suggests identifying nutritional issues when addressing perceived stress or depressive symptoms among female university students. Moreover, improving the mental state of students could also improve their food choice and intake.

## **Abbreviations**

### **FFQ**

Food Frequency Questionnaire

### **BDI**

Beck Depression Inventory

### **PSS**

Perceived Stress Scale

### **CHO**

Carbohydrates

## **Declarations**

The authors declare that they have no competing interests

### **Ethical clearance**

The study was reviewed and approved by the Research Ethics Committee of Zayed University. A written informed consent of the participants was obtained before data collection. All participants received detailed information on data confidentiality, anonymity and security. Participation in this study is voluntary, and all data will remain stored in a locked cabinet. No name will be mentioned, participants will

be identified by codes. If for any reason participant experience unpleasant or uncomfortable feelings, she can stop and take a break, or stop participating completely.

### **Human informed consent**

Dear students, I am Ohoud Ahmad from the college of Natural and Health Sciences. I am conducting a research about “Food consumption frequency, Depressive symptoms, Perceived stress and Restrained eating”, and I would like to invite you to participate in this cross-sectional study. The main objective for this study is to estimate the frequency of food consumption in relation to perceived stress and depressive symptoms and restrained eating levels among Zayed University students.

If you agree to participate, please fill in the attached questionnaire that consists of four parts (Food consumption frequency questionnaire, Beck Depression Inventory II, Cohen’s perceived stress scale, Three-Factor Eating Questionnaire R-18). This questionnaire takes about 15-20 minutes to be completed. Your participation in this study is voluntary, and all data will remain stored in a locked cabinet at my supervisor’s office, and it will be destroyed after the study is completed. No name will be mentioned, and students will be identified by codes. If for any reason you experience unpleasant or uncomfortable feelings, or have any more questions about your experience, feel free to stop and take a break, or stop participating completely.

If you have any further questions, please contact me: [201510933@zu.ac.ae](mailto:201510933@zu.ac.ae), or my supervisors: [Haleemah.AISabah@zu.ac.ae](mailto:Haleemah.AISabah@zu.ac.ae), [Rola.Mechli@zu.ac.ae](mailto:Rola.Mechli@zu.ac.ae), [Ehab.Hermena@zu.ac.ae](mailto:Ehab.Hermena@zu.ac.ae).

If you feel you need any support, please contact the Student Counseling Center: 04 4021477, [counseling@zu.ac.ae](mailto:counseling@zu.ac.ae)

### **Consent for publication**

Not applicable

### **Availability of data and materials**

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

### **Competing interests**

The authors declare that they have no competing interests.

### **Funding**

Not applicable

### **Authors’ contributions**

OM wrote the initial draft of the manuscript, compiled the instruments in one questionnaire and performed data collection. HA supervised the project and provided guidance and advice when needed. LS performed data analysis and wrote the initial draft of the statistical analysis and results. EH provided guidance regarding the mental health indicators and the instruments used to assess them in addition to contributing to the discussion. RM provided guidance regarding the food frequency questionnaire and suggested the adjustments of the BDI-II scoring system to compensate for the obligatory removal of one item.

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