

Stress Associated Alterations in Dietary Behaviours of Undergraduate Students of Qassim University, Saudi Arabia

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Abstract

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BACKGROUND: Psychological stress associated eating habits among public health have now become a global concern.

AIM: This study was undertaken to investigate the levels of psychological stress among undergraduate students of Qassim University and to explore the stress associated alterations in their eating habits.

METHODS: This is a cross-sectional survey conducted on 614 undergraduate students of Qassim University, Saudi Arabia. A self-administered questionnaire was used, which included questions on socio-demography and eating habits. Level of stress was measured by a standardised questionnaire highlights the levels of non-chronic stimulation through difficulty relaxing, nervous arousal and being easily upset/agitated, irritable / over-reactive and impatient.

RESULTS: Our results show that 28.2% of total participants suffered from some extent of stress. Among stressed participants, 17.3%, 49.1%, 24.8% and 8.7% of participants suffered from mild, moderate, severe and extremely severe stress, respectively. Stressed participants were more preferred to eat junk foods such as fast foods, snacks and beverages as compared with unstressed participants ($p < 0.05$) and the junk food preference was increased with the increase of stress levels. Moreover, non-stressed participants preferred more healthy foods such as vegetarian food, fresh fruits as compared with stressed participants ($p < 0.05$). Taste and easy to access were the main reasons for the preference of junk foods by the stressed participants.

CONCLUSIONS: This is the first comprehensive study from Saudi Arabia to show stress associated dietary alterations in undergraduates of Qassim University. Data concluded that most of the young adults followed a healthy eating pattern, but a significant number from them were affected by stress. Therefore, specific intervention programs are strongly recommended for the reduction of stress and to improve their quality of life.

Introduction

Unhealthy eating habit is always a major public health issue in young adults, especially in those who experienced the transition into university life [1], [2]. During university life, young adults are usually exposed to psychological stress and lack of time, which generally alter their eating behaviours towards intake of junk foods [3], [4]. Stress alters the overall behaviour of eating which may be in either way, over- or under-eating, but continuous stress has directly or indirectly had a linked with intake of junk food preference, and now scientific evidence clearly conclude that prolonged life stress has directly linked with almost all human disorders [5], [6], [7]. Although these stress associated alterations in the eating behaviour are assumed to be temporary at this stage when persistent to older life, this might have led to

several health problems [7], [8], [9]. In our previous studies, we pointed out that stress induces wrong choices of food, which is one of the main factors responsible for the onset of number of serious health problems including serious neurological and cardiac disorders, gastric ulcers, asthma, headaches, obesity, ageing, diabetes, and also premature death [9], [10], [11].

In young adults such as university students, fast psychosocial development and physical growth occur, which make them exposed to unhealthy eating that fails them to meet daily dietary requirements [12]. Skipping of routine food intake, intake of junk food such as pizza, burgers, chicken nuggets, sausage, hot dogs, French fries, chips, cake, brownies, cookies, chocolates, muffins, doughnut, pastries, ice cream, milkshake, excessive drinking of tea, coffee, soft drinks, etc. are common poor eating patterns among

university students [1], [2], [3], [4]. Not only have these, outside factors such as jaunting in shopping malls, vending machines, fast food outlets and general stores are also making them more susceptible for taking unhealthy food [1], [13]. Now it is well documented that young adults, including university undergraduates, were unsuccessful to follow the WHO recommended health food intakes [14]. It is important for us to point out that studies also revealed that undergraduate students demonstrated early risk factors for the onset of chronic disorders just because of unhealthy poor eating behaviour [15]. In recent years, several studies have pointed that that social and psychological factors are responsible for affecting eating habits among university students [1], [16] and stress was found to be associated with poor eating habits which lead to induce serious health problems [16], [17], [18].

Therefore, the present study was hypothesised to determine the levels of stress among undergraduate students of Qassim University and to investigate whether stress associated alterations affect their eating habits.

Methods

Study design and studied subjects

This is a cross-sectional survey performed on undergraduate students of Qassim University from November 2018 to March 2019. Six colleges were selected, and data were obtained by using simple random sampling technique. A total of 614 students participated in the study, among them, 394 were males, and 220 participants were females. Inclusion criteria of the participants were that all participants must be undergraduate students and the participants having any chronic disorders such as diabetes, hypertension, etc. were excluded from the study. The study was carried out by the Code of Ethics of the World Medical Association (Declaration of Helsinki as revised in Tokyo 2004) for humans and was approved by the Ethical Committee of Qassim University. Written informed consent from all participants was taken before the data collection.

Collection of data

The data were collected by the distribution of questionnaire among undergraduate students of Qassim University. The distributed questionnaires have already been validated successfully among different populations, as described previously [1], [4], [19]. The questionnaire has three main sections: (section 1) social and demographic section, (section 2) assessment of stress section measures, and (section 3) behavioural habits for food selection as

described previously [1], [4]. Briefly, the social and demographic information was collected from the section of the questionnaire comprised questions on personal information such age, marital status, smoking status, parent's education level, family monthly income, residential details, general health and daily physical activities. Whereas, the levels of stress among participants were assessed by the self-report Depression Anxiety Stress Scales (DASS). The DASS was a well-validated method and was proved by many researchers among different populations [19]. In this study, we used only one section of this scale, which was 'the stress scale section' which comprised 14 questions deal with difficulty, relaxing, nervous arousal, and being easily upset/agitated, irritable/over-reactive and impatient as described previously [4], [19]. The pattern of food intake was assessed using a food frequency questionnaire (FFQ) as described previously [1], [4] with some modifications. Briefly, assessment of dietary pattern among the participants, different types of food and beverages were used to identify the dietary pattern among stress and non-stress undergraduate students. To determine whether stress-induced triggering of unhealthy food items, such as fast food, snacks, etc. the selected junk foods were further divided into three groups: fast foods (such as burgers, pizza, chicken nuggets, sausage, hot dogs, fries, etc.); snacks (such as chips, cakes, brownies, cookies, chocolates, muffins, doughnuts, pastries, ice cream, milkshake, etc.); and beverages (fruit juice, tea, coffee, soft drink, and energy drinks). Moreover, we also determine whether stress affects healthy eating behaviour, fruits and vegetables; the FFQ was designed to collect data on junk foods based on the participant's selection. Furthermore, the study also determined whether the pattern of food intake was the same or different before and after university joining.

Statistical analysis

The frequencies of distributed proportions were calculated by Statistical Data Analysis Software (SPSS, IBM, and Houston, TX, USA) using a chi-square test. And Graph Pad Prism-5 software (San Diego, CA, USA) was also used for the preparation of graphs.

Results

Social and demographic details of studied subjects

Out of 614 undergraduate students of Qassim University, 59.8% were aged between 18-20 years, whereas 40.2% were above or equal to 21 years old.

Majority of participants were unmarried (86.2%) and were non-smokers (91.4%). The complete details of social and demographic, including the status of participants' parent's education and their living and residential conditions are summarised in Table 1.

Table 1: Social and demographic details of studied subjects

Characteristics	N	Percentage
Gender		
Male	394	64.2
Female	220	35.8
Age (years)		
18-20	367	59.8
≥ 21	247	40.2
Marital status		
Single	529	86.2
Married	85	13.8
Smoking		
Smokers	53	08.6
Non-smokers	561	91.4
Father's education		
Primary or less	195	31.8
Secondary/Senior secondary	252	41.0
University or above	167	27.2
Mother's education		
Primary or less	263	42.8
Secondary/Senior secondary	246	40.0
University or above	105	17.1
Living standard		
Poor- Monthly Income < 5000 SAR	105	17.1
Average-Monthly Income 5000-15000 SAR	258	42.0
Good-Monthly Income > 15000 SAR	251	40.9
Residential details		
Day scholars (Lives / Stay with their Parents)	410	66.8
Hostlers (Lives/Stay Alone or with roommates / friends)	204	33.2

Out of all participants, our data showed that only 29.3% of participants were in excellent health, whereas 66.6% showed good health in general, and 4.1% were in extremely poor health. The calculated body mass index (BMI) results showed that 22.3% of participants were underweight, whereas 39.2% found to be obese. Not only have these, but our data also showed that 11.7% performed exercises daily, whereas 11.2% of them never performed exercises, but 50.8% also performed exercises occasionally. The complete status of their general health, calculated BMI and their routine physical activities are summarised in Table 2.

Table 2: General health, body mass index and physical activity of studied subjects

General health	N	Percentage
Poor	25	04.1
Good	409	66.6
Very Good/Excellent	180	29.3
Body Mass Index (BMI)		
Underweight (< 18.5)	137	22.3
Normal (18.5-22.9)	236	38.4
Obese (> 23.0)	241	39.2
Physical Activity / Exercise		
Once a day	72	11.7
Every alternate day	161	26.2
Occasionally	312	50.8
Never	69	11.2

Stressed levels in studied subjects

Applying DASS measurements, out of 614 participants, stress was found in 28.2% (Figure 1). Among stressed participants, 17.3%, 49.1%, 24.8% and 8.7% of participants suffered from mild, moderate, severe and extremely severe stress, respectively. The complete stress levels with the number of participants under varying levels of stress are summarised in Table 3.

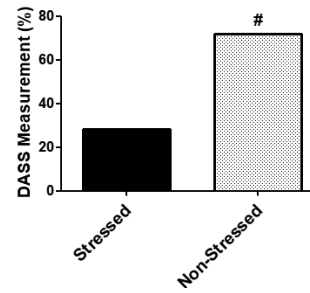


Figure 1: Stress measurements in undergraduate students (n = 614) of Qassim University. The data are shown in percentage of DASS scores; #p = 0.000 versus stressed participants

The regularity of food intake by stressed and non-stressed participants before and after university admission

Out of 173 stressed participants, 97 (56.1%) were followed regular meals pattern as they were taken regular breakfast, lunch and dinner before college admission, however, after college admission, this number was significantly reduced to 30 (17.3%) (p = 0.000).

Table 3: Stress levels among stressed participants

Stress levels	N	Percentage
Mild stressed ^α	30	17.3
Moderate stressed ^β	85	49.1
Severe stressed ^γ	43	24.8
Extremely severe stressed ^δ	15	08.7

^αp = 0.000 versus moderate stressed; ^βp = 0.000 versus severe stressed; ^γp = 0.000 versus extremely severe stressed.

Whereas, in non-stressed participants, regular meal intake before and after college admission remains be the same (p = 0.665). As 56.6% of participants showed regular follow of the meal before college admission and 54.4% of participants showed regular meal follow up after college admission. Figure 2 summaries the complete detail of stressed and non-stressed participants before and after university admission.

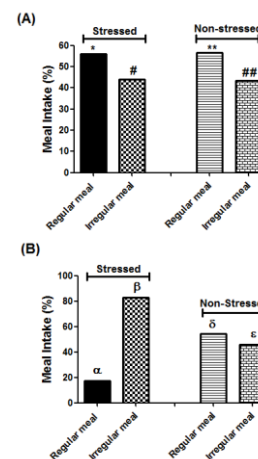


Figure 2: Behavioral habits of meal intake of participants before (A) and after (B) joining of college; *p = 0.000 versus α; **p = 0.665 versus δ; *p = 0.886 versus **; #p = 0.771 versus ##; αp = 0.000 versus δ; βp = 0.00 versus ε

Pattern of food intake by stressed and non-stressed participants

We analysed the pattern of food intake by stressed and non-stressed participants. The percentage of meal pattern once, twice, thrice and more than thrice a day by stressed participants were 12.2%, 14.3%, 54.9% and 18.6%, respectively and by non-stressed participants were 12.7%, 60.7%, 17.3% and 9.2%, respectively (Figure 3). Our novel data pointed out that the pattern of main food intake once a day was almost same in stressed and in non-stressed participants ($p = 0.873$) but this per day main meal was significantly different in twice ($p=0.000$), thrice ($p = 0.000$) or more than thrice ($p = 0.004$) a day. Figure 3 summaries the complete main meal pattern per day by stress and non-stress participants.

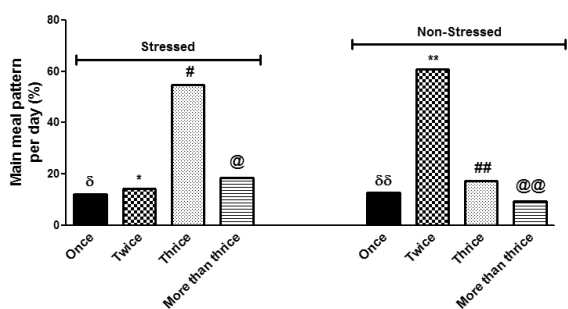


Figure 3: Main meal pattern per day by stressed ($n = 441$) and non-stressed ($n = 173$) participants; $\delta p = 0.873$ versus $\delta\delta$; $*p = 0.000$ versus $**$; $\#p = 0.000$ versus $\#\#$; $@p = 0.004$ versus $@@$

Food preferences by stressed and non-stressed participants

The consumption of vegetarian items, fresh fruits, preferred fast food, snacks and beverages by the stressed and non-stressed participants are summarised in Table 4.

Table 4: Behaviour of food preferences by stressed and non-stressed studied subjects

Characteristics	Stressed (n = 173)		Non-Stressed (n = 441)		p values
	N	%	N	%	
Consumption of VEG. items per day					
Once	11	6.3	199	45.1	0.000
Twice or more	10	5.8	204	46.2	0.000
Occasionally	150	86.7	31	7.0	0.000
Never	02	1.2	07	1.7	0.689
Consumption of FRESH fruit per day					
Once	14	8.0	92	20.9	0.000
Twice or more	35	20.2	300	68.0	0.000
Occasionally	110	63.5	30	6.8	0.000
Never	14	8.1	19	4.3	0.061
Consumption of TINNED OR FROZEN food per week					
1-2 times	40	23.1	38	8.7	0.000
More than 2 times	120	69.4	71	16.2	0.000
Occasionally	08	4.6	299	67.8	0.000
Never	05	2.8	33	7.5	0.033
Preferred FAST food					
Burger/Pizza	38	22.2	59	13.4	0.009
Chicken Nuggets/Sausage/Hot dogs	44	25.4	103	23.3	0.587
French Fries	72	41.6	150	34.0	0.078
None	19	11.0	129	29.2	0.000
Preferred SNACKS food					
Chips	30	17.3	33	7.5	0.002
Cake/Brownies/Cookies/Chocolate	47	27.0	84	19.0	0.027
Muffins/Doughnuts/Pastries	57	33.0	66	15.0	0.000
Ice-cream/milk shake	38	22.0	63	14.3	0.021
None	01	0.58	195	44.2	0.000
Preferred BEVERAGES					
Tea / Coffee	46	26.5	74	16.8	0.006
Soft drink	53	31.6	66	15.0	0.000
Energy drink	52	30.0	43	9.5	0.000
None	22	12.7	258	58.5	0.000

Abbreviation: n, the total number of participants tested; N, number of participants responded.

The data pointed out that the stressed participants were more preferred to eat junk foods such as fast foods, snacks and beverages as compared with unstressed participants ($p < 0.05$). Whereas, non-stressed participants preferred more healthy foods such as vegetarian food, fresh fruits as compared with stressed participants ($p < 0.05$). In summary, the behaviour of healthy or junk food preferences by stressed and non-stressed participants are shown in Figure 4. Our data showed that out of 173 total stressed participants, only 37.2% preferred healthy food, and the rest 62.8% preferred junk food ($p = 0.000$). Interestingly, the non-stressed participants showed almost reversed data, as shown by the stressed participants. The majority of non-stressed participants (72.8%) preferred healthy food and only 27.2% of them preferred junk food ($p = 0.000$). The data clearly showed that the majority of stressed participants preferred junk food, whereas non-stressed participants preferred healthy food.

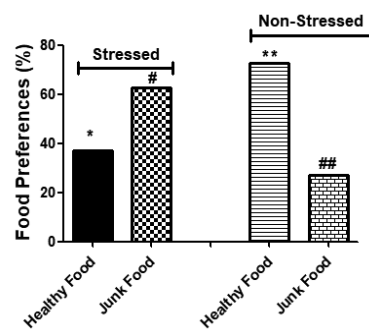


Figure 4: Food preferences by stressed ($n = 441$) and non-stressed ($n = 173$) participants. $*p = 0.000$ versus $**$; $\#p = 0.000$ versus $\#\#$; $@p = 0.000$ versus $@@$; $**p = 0.000$ versus $\#\#$

Preference of healthy and junk food by mild, moderate and severe stressed participants

As shown in Figure 5, mildly stressed participants preferred healthy food significantly higher as compared with junk food ($p = 0.009$), whereas the participants with moderate stressed they preferred more junk food as compared with healthy food, but this difference in junk food preference was significantly higher in severely stressed participants ($p = 0.000$).

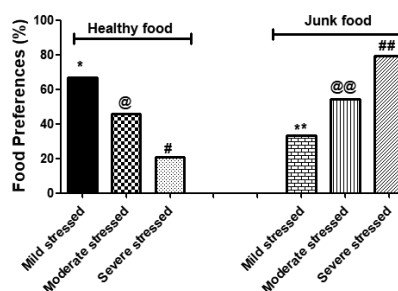


Figure 5: Food preferences by mild ($n = 30$), moderate ($n = 85$) and severe ($n = 58$) stressed participants. $*p = 0.009$ versus $**$; $@p = 0.283$ versus $@@$; $\#p = 0.000$ versus $\#\#$; $**p = 0.000$ versus $\#\#$

The data showed in Figure 5, clearly indicated that the preference for junk food was increased with the increase in stress levels, whereas the healthy food preference was decreased with the increase in stress levels.

Reason for junk food preferences by stressed and non-stressed participants

To find out the reason why the studied participants preferred unhealthy junk food, out of all studied stressed participants, 37.6% responded to the option of taste, whereas 17.9%, 19.6% and 24.8% replied for easy to access, relaxation and influenced by others, respectively. Whereas 20.9% of non-stressed participants responded to the option of taste, and 44.4%, 14.3% and 20.4% of them replied for easy to access, relaxation and influenced by others, respectively (Table 5). The data pointed out that taste and easy to access were the main reasons for the preference of junk foods by the stressed participants.

Table 5: Reason for junk food preferences by stressed and non-stressed studied subjects

Characteristics	Stressed (n = 173)		Non-Stressed (n = 441)		p-values
	N	%	N	%	
Reason for junk food preferences					
Taste	65	37.6	92	20.9	0.000
Easy access	31	17.9	196	44.4	0.000
Relaxation	34	19.6	63	14.3	0.101
Influence by others	43	24.8	90	20.4	0.229

Discussion

This is the first comprehensive study from Saudi Arabia to show the association of stress and dietary behaviours among undergraduate students of Qassim University. It is now well established that as long as humans have been around, there must be stress [20]. It is now scientifically proved that stress plays a vital role in the onset of almost all major depressive disorders [9], [10]. In our previous studies, we proved on an animal model that stress is of two types: Acute and chronic stress and which also has been well validated by various other investigators [21], [22]. Acute stress is generated from specific situations which may keep humans in a poor sense of control, but sometimes this stress can be good also as it keeps individuals alert, motivated and primed to respond [6], [9], [12]. This happens due to the secretion of stress-associated hormones, which help humans to control the situation [9], [11], [23]. Now it is well documented that up to 70% of seriously diseased populations are believed to be affected by chronic stress [9], [10]. In case of young adults including university students, we believed that they experienced both types of stress, when they are having in a situation of acute stress, which we might think that this

is good for them to make them alert, motivated and make them ready to respond against any bad situations. However, when this stress becomes prolonged, then it becomes chronic for them and has been associated with several disorders [9], [10]. In the present study, we demonstrated that a significant number of undergraduates were having some levels of stress. These results were fully supported by number of studies performed in various regions of the globe [24], [25], [26], [27], [28], [29], [30], [31]. A study performed at Kuwait University undergraduate students showed that more than 40% of the young adults suffered from some level of stress [4]. In another study performed on students of Malaysian University showed stress on 36% of the participants [24].

Furthermore, another study demonstrated 43% stress in the students of first-year tertiary education in Hong Kong [25]. Importantly, a much higher stress level was reported in students from western countries and other Middle Eastern countries such as 84% in Australia [26], 61% in Iran [27] and 70% in Jordan [28]. Moreover, studies have also reported that the first-year students were at an increased risk of poor mental health [25] with the prevalence of stress decreasing as students progressed to higher years [29]. Not only have these, but the results of this study were also supported by the various other studies performed on different other universities students across the globe [18], [30], [31] and thus the data obtained from this study further provide additional evidence on the prevalence of stress among university students. It is also important to point out that the differences in the occurrence of stress observed among university students in different countries may be due to the differences in the methodology used to determine stress. Another reason may be the socio-cultural characteristics of the participated young adults.

After demonstrated stress among the undergraduates of Qassim University, we investigated the regularity of food intake by stressed and non-stressed students before and after joining the university. Out of 173 stressed students, 56.1% were followed regular meals pattern as they were taken regular breakfast, lunch and dinner before college admission, however, after college admission, this number was significantly reduced to 17.3%. Whereas in non-stressed students, regular meal intake before and after admission remains be the same. These data pointed out that after joining university, the regularity of food intake among stressed students was disturbed, suggesting that the occurrence of stress among students during university life affect their food intake. Moreover, we also analysed the pattern of food intake in stressed and non-stressed students. Our novel data pointed out that the pattern of main food intake once a day was almost same in stressed and in non-stressed participants but this per day main meal was noticeable differ in twice, thrice or more than

thrice a day. They are increased of main meal twice a day in non-stressed students as compared with stressed students, indicating that non-stressed students followed the normal pattern of taking the main meal. However, main meal intake more than twice a day by stressed students, suggesting that the abnormal pattern of main meal taking by stressed students. These findings have further been supported by other studies showing an abnormal pattern of food intake in various other universities students [32], [33]. Arsiwalla *et al.* were examined interactions between stress and eating regulation in the prediction of weight-related outcomes and body fat among young adults [32]. Whereas, Nastaskin *et al.* in another study provided evidence that diet self-efficacy and perceived stress levels relate to nutrient intake in young adult, and that increasing diet self-efficacy and reducing perceived stress in a young adult may lead to the healthier eating habits [33].

Furthermore, the present study also determined that the stressed undergraduates preferred to eat junk foods such as fast foods, snacks and beverages. Whereas, non-stressed students preferred healthy foods such as vegetarian food, fresh fruits. Specifically, the study pointed out that out of 173 total stressed students, only 37.2% preferred healthy food, and the rest 62.8% preferred junk food. Interestingly, the non-stressed students showed almost reversed data, as shown by the stressed students. The 72.8% of non-stressed students preferred healthy food and only 27.2% of them preferred junk food. The data clearly showed that the majority of stressed students preferred junk food, whereas non-stressed students preferred healthy food. Not only have these, we further characterized the preference of junk food by mild, moderate and severe stressed students, our data showed that students with mild stressed preferred healthy food as compared with junk food, whereas the students with moderate stressed preferred more junk food as compared with healthy food, but this difference of junk food preference was remarkably higher in students with severe stressed. These data are suggesting that the preference for junk food was positively associated with increased levels of stress. To determine the reason why stressed students preferred junk food, out of all studied stressed students, 37.6% responded to the option of taste, whereas 17.9%, 19.6% and 24.8% replied for easy to assess, relaxation and influenced by others, respectively. These data are indicating that taste and easy to access were the main reasons for the preference of junk foods by the stressed students. These findings have also been supported by other studies that showed an association between stress and poor dietary pattern among young adults [4], [34]. Therefore, these findings are very important for the development of specific programs to decrease the levels of stress and to improve the food pattern, especially for young adults. Although some evidence exists indicating an educational intervention to increase dietary knowledge might be useful [34], but

at the same time, environmental interventions should also be needed.

In conclusion, to the best of our knowledge, this is the first comprehensive study from Saudi Arabia to show stress associated dietary alterations among undergraduates of Qassim University. In general, most of the students studied in this study followed a healthy eating pattern, but still, stress was significantly associated with a large number of participants. Results show a clear difference in the food selection by the stressed and non-stressed students, indicating that stress has a direct association with the dietary pattern among studied young adults. These results strongly recommend specific intervention programs to reduce stress and to improve their food choices.

Authors' contributions

EA participated in study design, coordination and data collection, AMA, BHA and AFA data collection and data interpretation, NR has consulted for data interpretation and manuscript drafting. All authors have read and approved the final manuscript.

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