

The Influence of Stress on Body Mass Index among Female University Students

Nada Fahad M Alsultan¹, Malik Dham Alanazi¹, Ayat Abdunnasser Boholigah², Daham Obaid Alshammari¹, Kawthar Ali Alnahwi², Zahrah Ali Alsayafi¹, Yahya Mohammed Alzahrani¹, Lama Zaki Nasserullah², Lina Zaki Nasserullah²

1- Student, King Faisal University, 2-Student, Arabian Gulf University

Abstract:

Background: The interrelatedness between obesity and psychological problems seems to be twofold, in that clinically meaningful psychological distress might foster weight gain and obesity may lead to psychosocial problems. Stress may contribute to changes in dietary behaviors that lead to weight change, with various effects related to sex baseline body mass index, or cortisol reactivity in response to stress. **Objective:** To describe the relationship between stress, weight-related health behaviors (e.g., eating behaviors, physical activity, sedentary behavior, sleep, cigarette smoking and binge drinking), and weight status using cross-sectional data from community college students. **Methods:** This was a community-based cross-sectional study. Data were collected from representative sample of undergraduate female students in Kingdom of Saudi Arabia. A total of 208 undergraduate female students were included in this study. The study period was from October 2017 to December 2017. Data were collected by means of personal interview with the participants using a predesigned questionnaire which was distributed among students and filled by personal interviewing after a brief introduction or explanation of the idea of the research to the participants. **Results:** There was a high significant correlation between stress and BW ($P=0.004$). We found no relation between BW and academic year, fast food consumption, main meal content, muscular exercise and cause of stress. There was a high significant correlation between BW and number of meals per day ($P=0.000$), stress level ($P=0.000$) and dealing with stress ($P=0.017$). **Conclusion and Recommendations:** Factors which were significantly associated with BMI and stress should be further studied to include number of meals per day, stress level and dealing with stress. Interventions among university students should relate actual measured BMI to stress perception of the students in order to target students at risk. Universities should offer individual counselling for at risk students in order to prevent eating disorders, and should offer psychological and stress related counselling, but should also counteract unrealistic body image concerns of students by broad health communication campaigns.

Keywords: University students, BMI, Stress, Influence, Dietary behaviors, Muscular exercise

Introduction:

Obesity is one of the major non-communicable diseases in recent decades leading to huge morbidity, mortality & economic losses. Obesity is perhaps the most prevalent form of malnutrition. Overweight and obesity are the fifth leading risk of global deaths^[1]. Prevalence of obesity and an overweight status within the college student populace has become a rapidly increasing occurrence. The population with the most dramatic rise in rates of overweight and obesity appear to be within the 18 to 29 age range, with those participating in a college education representing the most prominent increase^[2]. Weight disorders are responsible for a number of health problems some of which include; for underweight: increased risk of anemia^[3], osteoporosis^[4], ‘in women it can lead to amenorrhea^[5], and for

overweight or obesity: type II diabetes, coronary heart disease, high blood pressure (hypertension), High cholesterol level (dyslipidemia)^[6]. Young adults enrolled in university or college are subjected to high levels of stress from a number of factors that can lead to maladaptive coping mechanisms such as convenience eating in the form of eating out at fast food establishments and ordering food for delivery. This form of convenience eating offers calorie dense, high in saturated fat, and processed options that promote an increase in weight status along with other deleterious health outcomes. It is usually observed that college students undergo tremendous stress during various stages of the education. It characterized many psychological changes in students^[7]. High levels of stress

may have a negative effect on physical and mental health of the medical students. This can lead to mental distress and has a negative effect on attentive functioning and learning^[8]. Psychosocial stress has also been implicated as a risk factor for high blood pressure, cardiovascular disease, and cancer^[9].

The interrelatedness between obesity and psychological problems seems to be twofold, in that clinically meaningful psychological distress might foster weight gain and obesity may lead to psychosocial problems^[10]. Stress may contribute to changes in dietary behaviors that lead to weight change, with various effects related to sex^[11] baseline body mass index^[12], or cortisol reactivity in response to stress^[13]. These factors may cause some people to gain more weight under stressful circumstances, while others may gain less weight or even lose weight when stressed. A longitudinal cohort study conducted in populations outside the United States has produced mixed results. Kivimaki et al.^[12] used the Whitehall study, a prospective cohort of British civil servants, to analyze the prospective association between stress and weight change over 5 years. They found that stress was associated with weight gain among men who were overweight or obese at baseline, but a similar association was not observed among women. There is growing research on the correlation and possible physiological and behavioral mechanisms between stress and obesity risk. High stress has been linked to weight gain and adiposity and appears to inhibit successful weight loss^[13]. Hormones that activate stress response also play a role in appetite regulation and reward-seeking, which may affect health behaviors like eating behavior, cigarette smoking, and alcohol use^[14]. Stress has also been shown to influence metabolic function, including insulin resistance^[15].

Dahlin et al.^[16] showed that the prevalence of depressive symptoms among Swedish students was 12.9% and a total of 2.7% of students had made suicidal attempts^[16].

Another study conducted on medical Students of Jorhat Medical College and Hospital, Jorhat^[17] reported that; the prevalence of highly stressed students in our study is 36.2% and that of very highly stressed students is 39.1%. For simplicity, if we combine highly and very highly stressed level as stressed and average and low level as non-stressed students, then overall prevalence of stress will be 75.3%

in the study. In this study, we have not found any significant difference in prevalence of stress among male and female. The prevalence rate of obese (03.6%) and overweight (15.9%) is not very high. But found a strong correlation between psychological stress and body weight. In addition, it was found that higher stress was associated with higher prevalence of overweight/obesity, though the relationship was no longer statistically significant after controlling for a wide range of weight-related health risk behaviors. Stress levels were significantly associated with meal skipping and being a current smoker^[18].

A study carried at University of Rhode Island indicated that stress was positively correlated with BMI and waist circumference in females, but not in males. Females reported higher levels of stress and scored higher on all four subscales of the Weight Related Eating Questionnaire (WREQ) compared to males. There were significant stress and gender interaction effects for routine restraint and compensatory restraint scores^[15].

The aim of this manuscript was to describe the relationship between stress, weight-related health behaviors (e.g., eating behaviors, physical activity, sedentary behavior, sleep, cigarette smoking and binge drinking), and weight status using cross-sectional data from community college students.

Participants and Methods:

Research design:

This is a community-based cross-sectional study .

Research environment:

Data were collected from representative sample of undergraduate female students in Kingdom of Saudi Arabia

Research instruments:

A pre-designed questionnaire consisted of information regarding age, academic year, dietary habits, number of meals per-day, physical exercise (presents /absent), degree of exposure to stress (high/ medium/ low), the main cause of stress (family/ exams/ educational requirements/ social life) and how they deal with stress (by sleeping, drinking coffee or eating) . The questionnaire consisted of 13 questions designed to match the objective of the study.

Another questions asked participants what the main content of their meal is (protein/ fats/ carbohydrate).

The food delivery questions considered the dependent variables of the study. The questions were added to assess the eating out and food delivery frequency engaged in by participants.

The body weight (kg) and height (m) of each participant was measured.

The BMI was calculated (body weight in kg/height in m²), and classified BMI below 18.5 kg/m² was classified as underweight, 25–30 as overweight, and above 30 as obese.

Respondents of the study:

A total of 208 undergraduate female students were included in this study. The study period was from October 2017 to December 2017. Participants filled the self-reported pre-designed questionnaire after a brief introduction to explain the aim of the study to them.

The sample size was calculated using the sample size equation: $n = z^2 p(1-p) / e^2$, considering target population less than 1000, and study power 95%, and the prevalence of obesity 50%. The minimum required sample was 200 students. Systematic random sampling technique was followed by interviewing every 2nd student.

Data were collected by means of personal interview with the participants using a predesigned questionnaires which were distributed among students filled by personal interviewing after a brief introduction or explanation of the idea of the research to students. Sampled students filled out the self-reported predesigned questionnaires to collect demographic and socioeconomic data.

Ethical considerations:

Approval to carry the study was taken from the health affairs administrator of Arar city. Participants were informed that participation is completely voluntary. And written consent was obtained from each participant before being subjective with them. No names were recorded on the questionnaires. All questionnaires kept safe.

Statistical treatment:

Descriptive statistics and testing of hypothesis were used for the analysis. The data were analyzed using SPSS V.16.0 (SPSS Inc; Chicago, IL, USA). The Chi-square test was used to examine the association between

different variables. $P < 0.05$ was considered as statistically significant.

Results:

The total number of the study participants was 104 female students. About 36.5% of participants have 3 meals per day, 34.6% have two meals, 6.7% have five or more and only 8% have one meal per day. 76% of the participants responded yes to fast food consumption. Only 2% of students reported protein as main meal content, 51.9% carbohydrate and 22.1% fat. Only 46.2% perform muscular exercise. Regarding stress level; 44.2% describes stress as medium, 25% low, 23.1% high and only 7.7% very high. 47.1% of students reported exams as the main cause of stress, 21.2% social life, 17.3% family and 14.4% for educational requirements. 18.3% of respondents deal with stress by eating, 34.6% by sleeping, 24% drink coffee and 5.8% by smoking. 73.1% of respondents found relation between BW and stress. About half students had normal BMI, 24% were overweight, 15.4% obese and 9.6% underweight.

There was high significant correlation between stress and BW ($P = 0.004$). We found no relation between BW and academic year, fast food consumption, main meal content, muscular exercise and cause of stress. There was high significant correlation between BW and number of meals per day ($P = 0.000$), stress level ($P = 0.000$) and dealing with stress ($P = 0.017$)

Figure (1): BMI distribution among the studied students

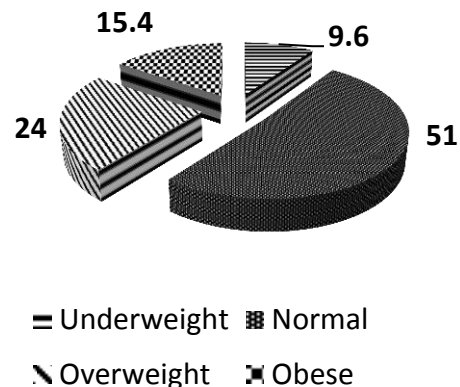


Table (1): Eating habits and stress related variables and BMI group in the studied female students

Number of Meals per day		
One	5	4.8
Two	36	34.6
Three	38	36.5
Four	18	17.3
Five or more	7	6.7
Fast food consumption		
No	25	24.0
Yes	79	76.0
Main meals content		
Carbohydrate	54	51.9
Fat	23	22.1
Protein	27	26.0
Performing muscular exercise		
No	56	53.8
Yes	48	46.2
Stress level		
High	24	23.1
Low	26	25.0
Medium	46	44.2
very high	8	7.7
Cause of stress		
Educational requirements	15	14.4
Exams	49	47.1
Family	18	17.3
Social life	22	21.2
Dealing with stress		
Sleep	36	34.6
drink coffee	25	24.0
Eat	19	18.3
Smoke	6	5.8
Other	18	17.3
Relation between BW and stress		
No	28	26.9
Yes	76	73.1
BMI group		
Underweight	10	9.6
Normal	53	51.0
Overweight	25	24.0
Obese	16	15.4

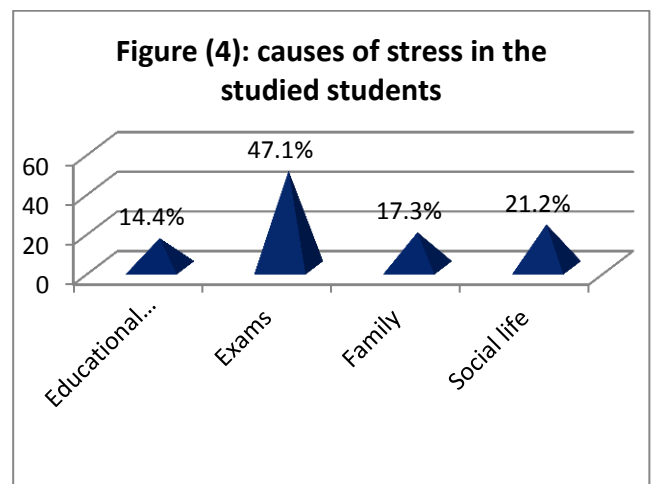
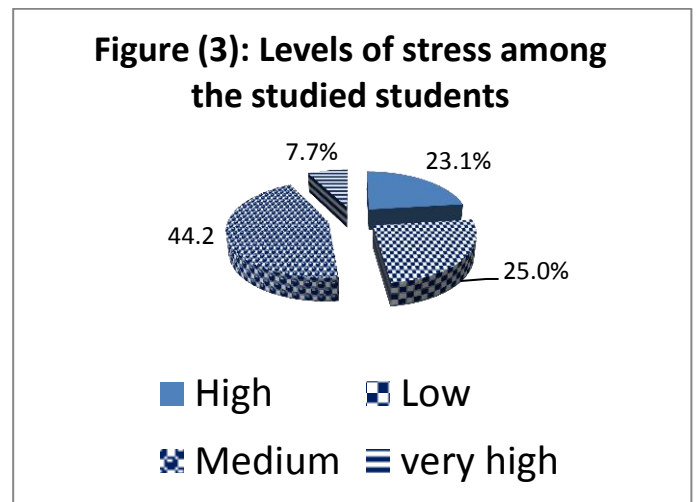
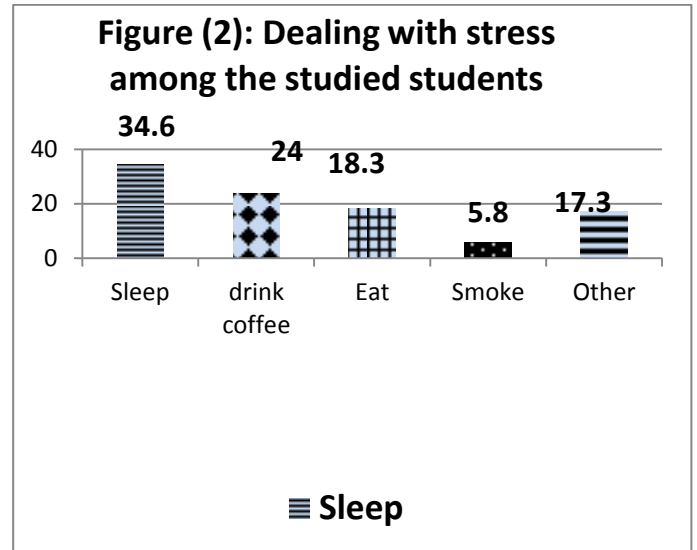


Table (2): The relationship between BMI group, academic year, eating habits and stress related variables in the studied female students

Variable	BMI group				Total (n=104)	P value
	Underweight (n=10)	Normal (n=53)	Overweight (n=25)	Obese (n=16)		
Academic year	0	14	8	6	28	0.177
	.0%	26.4%	32.0%	37.5%	26.9%	
Regular	10	39	17	10	76	
	100.0%	73.6%	68.0%	62.5%	73.1%	
Number of meals daily						
Three	1	24	11	2	38	0.000
	10.0%	45.3%	44.0%	12.5%	36.5%	
Two	8	21	5	2	36	
	80.0%	39.6%	20.0%	12.5%	34.6%	
Four	0	6	6	6	18	
	.0%	11.3%	24.0%	37.5%	17.3%	
Five or more	0	0	2	5	7	
	.0%	.0%	8.0%	31.2%	6.7%	
One	1	2	1	1	5	
	10.0%	3.8%	4.0%	6.2%	4.8%	
Fast food consumption						
No	2	15	5	3	25	0.781
	20.0%	28.3%	20.0%	18.8%	24.0%	
Yes	8	38	20	13	79	
	80.0%	71.7%	80.0%	81.2%	76.0%	
Main meals content						
Carbohydrate	4	31	12	7	54	0.444
	40.0%	58.5%	48.0%	43.8%	51.9%	
Protein	3	15	6	3	27	
	30.0%	28.3%	24.0%	18.8%	26.0%	
Fat	3	7	7	6	23	
	30.0%	13.2%	28.0%	37.5%	22.1%	
Performing muscular exercise						
No	8	26	11	11	56	0.130
	80.0%	49.1%	44.0%	68.8%	53.8%	
Yes	2	27	14	5	48	
	20.0%	50.9%	56.0%	31.2%	46.2%	
Stress level						
Medium	5	30	10	1	46	0.000
	50.0%	56.6%	40.0%	6.2%	44.2%	
Low	3	12	10	1	26	
	30.0%	22.6%	40.0%	6.2%	25.0%	
High	2	10	4	8	24	
	20.0%	18.9%	16.0%	50.0%	23.1%	
Very high	0	1	1	6	8	
	.0%	1.9%	4.0%	37.5%	7.7%	
Cause of stress						
Exams	5	25	12	7	49	0.951
	50.0%	47.2%	48.0%	43.8%	47.1%	
Social life	2	13	4	3	22	
	20.0%	24.5%	16.0%	18.8%	21.2%	
Family	2	8	6	2	18	
	20.0%	15.1%	24.0%	12.5%	17.3%	
Educational requirement	1	7	3	4	15	
	10.0%	13.2%	12.0%	25.0%	14.4%	
Dealing with stress						
Sleep	4	15	10	7	36	0.017
	40.0%	28.3%	40.0%	43.8%	34.6%	
drink coffee	2	18	4	1	25	
	20.0%	34.0%	16.0%	6.2%	24.0%	
Eat	0	7	7	5	19	
	.0%	13.2%	28.0%	31.2%	18.3%	
Other	1	10	4	3	18	
	10.0%	18.9%	16.0%	18.8%	17.3%	
Smoke	3	3	0	0	6	
	30.0%	5.7%	.0%	.0%	5.8%	
Relation between BW and stress						
No	4	21	2	1	28	0.004
	40.0%	39.6%	8.0%	6.2%	26.9%	
Yes	6	32	23	15	76	
	60.0%	60.4%	92.0%	93.8%	73.1%	

Discussion:

Obesity is emerging as a serious problem throughout the world, not only among adults, but also children, teenagers and young adults^[1]. It is associated with a large number of debilitating and life-threatening disorders such as cardiovascular, metabolic and other non-communicable disease^[19]. Of the factors contributing to obesity, stress seems to be particularly important as stressful condition leads to irregularity in diet, lack of exercise and addiction, each being considered independent factors leading to obesity^[20]. A nationally representative study found that psychosocial stress increased the risk of future weight gain among adults ages 25 to 74 years with higher baseline body mass index (BMI) but not for adults with lower baseline BMI^[21]. This is a community-based cross-sectional study carried out among 104 of females student. The aim of the study was to describe the relationship between stress, weight-related health behaviors (e.g., eating behaviors, physical activity, sedentary behavior, sleep, cigarette smoking and binge drinking), and weight status using cross-sectional data from community college students.

Our study found that, as regards stress level; 44.2% describes stress as medium, 25% low, 23.1% high and only 7.7% very high. 73.1% of respondents found relation between BW and stress ($p=0.004$). In India another study conducted among total 138 medical students of Jorhat Medical College and Hospital, Jorhat found that overall prevalence of stress 75.3%, the prevalence of high and very highly stressed students are 50 (36.2%) and 54 (39.1%) respectively, and they found a strong correlation between psychological stress and body weight, greater the psychosocial stress more is the body weight ($p=0.007$)^[17]. Another study was carried out among 973 students from 13 college campuses across the U.S. who had participated in the 15-month YEAH study; 28.1% reported low stress level, 26.3% moderate, 21.9% high and 23.8% very high, the study found that there were no significant differences found between stress and categorical body mass index scores ($p = 0.539$), nor between BMI and eating out frequency ($p = 0.672$)^[22]. Another study was done among 1116 participants reported that 29.3% had low stress level, 38.4% intermediate and 32.1% high, Stress was

positively correlated with BMI in females, but not in males^[15].

As regards body weight, our study showed that, about half students had normal BMI, 24% were overweight, 15.4% obese and 9.6% underweight. Another study reported ; 3.6% students were obese and only 15.9% students were overweight^[17]. Additional study carried out among total of 114 medical students reported; an overall prevalence of overweight was calculated to be 17.5%, prevalence of obesity was 3.4%^[1]. Furthermore, it was demonstrated reported that (69.5%.) of participants fell within the normal BMI while 21.9% were overweight, and 8.5% were obese^[22]. Also, a study reported that 69.6% of participants were with normal BMI, 22.1% over weight and only 8.2% obese^[15]. In Egypt at Ain Shams University, study involved 317 students; revealed that 41.3% of the students were of normal weight while 9.5% of the sample were underweight, 36.9% were overweight and 12.5% were obese, obese individuals ate more during feeling of stress compared to non-obese and the difference was statistically significant^[23]. Another study undertaken among 100 subjects showed that among the subjects, the normal weight (52%) has the highest prevalence followed by the overweight (28%) with the underweight (7%) being the lowest^[24].

According to causes of stress our study reported that 47.1% of students considered exams as the main cause of stress, 21.2% social life, 17.3% family and 14.4% for educational requirements. Another study among medical students found that academic problems were a major cause of stress among all students^[25].

Our study reported that only 2% of students regard protein as main meal content, 51.9% carbohydrate and 22.1% fat. Another study showed that about 76% of the participants were on diet that has carbohydrate as the main component while only 24% were on diet that has protein as the major component^[24].

Regarding making exercise this study, revealed that only 46.2% perform muscular exercise. This was close to another study which reported 46% of the students engaged in any form of exercise while 54% of the total students do not engage in any form of exercise^[24]. Previous study done by *stiegler et al.*^[26] showed that lack of exercise can cause an increase in body weight and the research work

also done by **Cris *et al.*** [27] confirmed that higher amount of activity is necessary for the maintenance of body weight.

Conclusion:

Several important conclusions can be drawn from the results of this study. Factors which were significantly associated with BMI and stress should be further studied to include number of meals per day, stress level and dealing with stress). Interventions among university students should relate actual measured BMI to stress perception of the students in order to target students at risk. Furthermore, interventions should, depend on the relationship between stress perception and BMI amongst students, focus on exercise, healthy lifestyle, healthy food choices, altering BMI, important stressors and quality of life.

Recommendations:

Universities should offer individual counselling for at risk students in order to prevent eating disorders, and should offer psychological and stress related counselling, but should also counteract unrealistic body image concerns of students by broad health communication campaigns. Moreover, the association between quality of life and BMI highlights the importance of supporting students throughout their studies, and provide healthy environments, both within the context of university and in their general life.

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