Impact of Stress on Appetite Among College Students

Abstract:

Objective: To investigate the impact of stress and gender on appetite among college students

Methods: A convenience sampling method was used where a survey was sent out to students (n=165) via email. The Perceived Stress Scale (PSS) and a modified version of Council on Nutrition Appetite Questionnaire (CNAQ) were used to assess stress and appetite respectively. T-tests were used to compare different demographic characteristics to appetite and PSS scores. A multiple linear regression model comparing stress and gender to appetite was also used.

Results: On average, males had higher appetite scores by 2.93 (CI: 1.7 - 4.1, t-test, $p<0.001$) and lower PSS scores by 3.67 (CI: 0.84 to 6.51, $p = 0.012$) compared to females. PSS scores and gender explained 23.4% of the variance in appetite scores ($F(1,127) = 9.5$, $p<0.002$). After adjusting for PSS score, males had 2.190 higher appetite scores than females ($p = 0.002$). After adjusting for gender, for every 1 unit increase in PSS scores, appetite scores decreased by 0.217 ($p<0.001$).

Conclusion and Implications: The college students surveyed responded to stress by decreasing their appetites. The results were similar in both genders, however, males had higher appetites than females on average. The decrease in appetites due to stress may be due to students' environments not having food readily available where food insecurity rates are increasing among college students. The results could demonstrate the need to extend stress management resources such as counseling services to students, CalFresh/food pantry outreach to help with food insecurity, and also nutrition education on managing appetite.

Introduction:

High stress levels are very common in college students (ACHA NCHA, 2021) and it is important to identify some of the implications of these high levels. There are many factors that can result from high stress levels, one of which is impacting how people eat. Stress has been associated with an increased unhealthy food intake, and decreased healthy food intake (Hill et al., 2022). Another study

demonstrated that women with higher perceived life stress had a decline in hunger and a decline in their desire to eat (Klatzkin et al., 2019). It is unclear how people's dietary patterns will respond to stress where it is suggested that 40–70% of people eat less when stressed, and that 30–50% eat more when stressed (Gibson, 2012). One study suggests that acute stress generally leads to restrictive eating habits while chronic stress can increase food intake (Ans et al., 2018) but a college setting can cause both acute stress from exams and assignments and chronic stress from worrying about long term goals.

A previous study demonstrated that college students experience both acute and chronic stress and that these stressors can cause unhealthy habits such as unhealthy eating behaviors (Dalton et al., 2018). Following the model of acute stress leading to undereating and chronic stress leading to overeating, it may be hard to predict whether students will decrease or increase their appetites due to stress. Regardless of whether stress increases or decreases food intake, both can be unhealthy habits. Decreased food intake can lead to malnutrition while increasing food intake can lead to eating more palatable foods higher in fats, sugars and calories which can lead to obesity and cardiovascular diseases. This poses a concern as a stressful college life can lead to unhealthy eating habits and poor health outcomes.

A low appetite can be very common in a busy lifestyle, however, there is limited research on this topic. College students in particular may be more prone to undereating as their busy lifestyle can cause them to neglect eating and decrease their appetite. Another factor that may contribute to a low appetite is poor mental health (Engel et al., 2011). This demonstrates that college students may be at risk for developing a poor appetite since a large amount of college students have symptoms of anxiety, stress, and depression (ACHA NCHA 2021).

Another factor to consider regarding how people's appetites will respond to stress is gender differences. One study found that females were significantly more likely to have binge episodes and

have more dietary restraints compared to males (Carey et al., 2019). Females may be more likely to binge eat and have a higher appetite compared to men and this may be a factor to consider when investigating how college students' appetites are correlated with stress. There is no evidence as to how college students' appetite will respond due to stress which demonstrates the current research gap. Our study will examine the effects of perceived stress on college students' appetite where we hypothesize that there is a negative relationship between the two. We will also examine the role that gender plays on appetite and stress levels.

Methods:

Study Design:

A cross sectional observational study was conducted where a survey questionnaire was distributed to college students at the California State University, Chico. Our inclusion criteria included participants who are students at the University and at least 18 years old while there were no exclusion criteria. A college student population provided us with likely stressed individuals where the impact of stress on appetite can be investigated.

Instruments of Measurements:

The study utilized the 10-item perceived stress scale (PSS) as a measure of stress among students (Cohen et al., 1983). The PSS is the most widely used instrument for measuring the perception of stress where this survey instrument analyzes how unpredictable, uncontrollable, and overloaded respondents find their lives to be. Respondents are asked about how often they felt a certain way in the past month. Each question is based on a 5-item scale with responses ranging from Never (0) to very

often (4) with some items that are reversed in score. Total scores range from 0 - 40 where a higher score indicates higher levels of stress.

This study also utilized modified questions from the Council on Nutrition Appetite Questionnaire (CNAQ) to assess participants' appetite (Council on Nutrition Appetite Questionnaire, 1999). This survey tool is generally used in a clinical setting to assess appetite and predict weight loss where this study utilizes the questionnaire to assess appetite in college students. The tool we created has 8 questions each with unique responses such as scales ranging from "Very good" to "Very poor," and "All the time" to "Never." This tool asks questions related to appetite, hunger, fullness, food taste, nausea after eating, mood, and how many meals people eat per day. Each question had scores ranging from 0-4 and total scores range from 0 - 32 where higher scores indicate a better appetite.

Additionally, demographics such as age, gender, employment status, basic needs use, and ethnicity were collected.

Recruitment of Participants:

Participants were recruited using convenience sampling by CSU Chico faculty through emails. Some faculty may provide an extra credit incentive to their students for participating in this study. This project will be reviewed by the Institutional Review Board (IRB) of the CSU, Chico. At the beginning of the survey, participants will be presented an informed consent form that ensures anonymity and that participation is voluntary. Participants were asked if they consent to participate in the study before viewing any survey questions. Participants were required to answer all questions, but they were allowed to select "Prefer not to answer." The data collected was stored in a safe place and will be deleted once the project is completed.

Data Analysis:

Various demographic variables were dichotomized including ethnicity (white and non-white), gender (male and female), employment (employed and unemployed), and basic needs use (use basic needs resources and don't use basic needs resources). Any category with less than 5 responses was excluded from analysis. PSS questions were converted to numeric variables and a PSS score was calculated by taking the sum of the 10 questions of each participants' responses. If a participant did not answer any of the 10 questions or answered "Prefer not to answer," that participant was excluded from analysis. Likewise, appetite scale questions were converted to numeric variables and an appetite score was calculated by taking the sum of the 8 questions of each participants' responses. If a participant did not answer any of the 8 questions or answered "Prefer not to answer," that participant was excluded from analysis. One-hundred and sixty-five total responses were collected and 18 participants did not finish the survey but were included in the analysis if they answered the question under investigation.

Statistical Methods:

The first hypothesis predicted stress scores and appetite scores had a negative relationship in college students. The independent variable for this hypothesis was PSS scores while the dependent variable was appetite scores. Since both variables are numeric, the appropriate statistical method was linear regression where a P value less than 0.05 was deemed significant. An R^2 value determined the proportion of variance in appetite levels that can be explained by perceived stress where values can range from 0 to 1. Scores closer to 0 demonstrate less variability is explained by the regression model and scores closer to 1 demonstrate more variability is explained by the regression model.

In the second hypothesis, gender was predicted to have an impact on appetite scores. The independent variable in this hypothesis was gender where the dependent variable was appetite scores. An independent sample T-test was used to analyze the difference of mean appetite scores between males and females where a P-value less than 0.05 was deemed significant. Gender was also added to the

regression model to determine the impact of stress on appetite after controlling for differences caused by gender. Wald's test was used on various demographic variables to determine if any variables add to the model where only gender significantly added to the model.

Results:

Demographics:

Demographic counts and proportions are displayed in table 1. The majority of participants were female (n = 105, 62.5%) compared to male (n=40, 25%). The majority of participants were white (n=80, 47.6%) and Hispanic (n=42, 25%). The majority of participants were Freshman (n=57, 33.9%) with a relatively even distribution among Sophomores (n=30, 17.9%), Juniors (n=33, 19.6%) and Seniors (n=28, 16.7%). The majority of participants were unemployed (n=91, 54.2%) or worked part-time (n=51, 30.3%). The majority of participants do not use food assistance programs (n=84, 50%) and a notable amount use CalFresh (n=26, 15.4%) and use a food pantry (n=37, 22%).

Table 1

Participant Demographics: (n=165)

		n	%
Gender:			
	Male	40	25.0
	Female	105	62.5
	Non-binary	1	0.60
	Prefer not to answer	2	1.2
	Missing	18	10.7

Table 1

Participant Demographics: (n=165)

Race			
	Asian or Pacific Islander	20	11.9
	Black or African American	4	2.4
	Hispanic or Latino	42	25.0
	White or Caucasian	80	47.6
	Other (Please Specify)	3	1.8
	Prefer not to Answer	1	0.60
	Missing	18	10.7
Class Standing			
	Freshman	57	33.9
	Sophomore	30	17.9
	Junior	33	19.6
	Senior	28	16.7
	Graduate	2	1.2
	Missing	18	10.7

Table 1

Participant Demographics: (n=165)

Employment Status			
	Employed full-time (32 hrs/week or more)	2	1.2
	Employed part-time (less than 32 hrs/week)	51	30.3
	Unemployed	91	54.2
	Other (Please Specify)	6	3.6
	Missing	18	10.7
Program Participation			
	I do not participate in a food assistance program	84	0.50
	CalFresh/Foodstamps	26	15.4
	WIC	4	2.4
	Hungry Wildcat Pantry/other food pantry	37	22.0
	Other	3	1.8

Table 1 Participant Demographics: (n=165)		
Prefer not to answer	6	3.6
Missing	18	10.7

Table 1. Participant Demographics. Proportions and counts of various participants' demographic information are displayed.

Factor Analysis:

Factor analysis was used with an oblique rotation to check for the reliability of the PSS scale and the appetite scale (Table 2). Two factors explained 58% of the variance in the PSS questions. Factor 1, compromised of 6 Likert questions, explained 43.3% of the variance with factor loadings ranging from 0.672 - 0.805. Factor 2, compromised of 4 Likert questions, explained 14.5% of the variance with factor loadings ranging from 0.660 to 0.806. The Cronbach's alpha was 0.852 for these items. Removing any question did not have any notable impact on the Cronbach's alpha.

Three factors explained 63.0% of the variance in appetite scores. Factor 1, comprised of 4 different questions, explained 32.8% of the variance with factor loadings ranging from 0.588 to 0.762. Factor 2, compromised of 3 questions, explained 17.7% of the variance with factor loadings ranging from 0.505 to 0.789. Factor 3, compromised of 1 question, explained 12.6% of the variance with a factor loading of 0.936. The value of Cronbach's alpha for the appetite scale was 0.670. Removing any question did not have much of an impact on the Cronbach's alpha.

Table 2 Factor Analysis			
	Number of Factors	Variance Explained	Cronbach's Alpha
PSS	2	58%	0.852
Appetite Scale	3	63%	0.670

Table 2. Factor Analysis. Factor analysis was conducted to check the reliability of the PSS scale and the appetite scale.

Bivariate Analysis:

Various demographic factors were compared to appetite scores and PSS scores (Table 3). On average, males had higher appetite scores by 2.93 (CI: 1.7 - 4.1, t-test, $p<0.001$) and lower PSS scores by 3.67 (CI: 0.84 to 6.51, $p = 0.012$) compared to females. A simple linear regression model demonstrated that PSS scores explained 16% of the variance in appetite scores ($F(1,133) = 26.441$, $p<0.001$). For every one unit increase in PSS score, appetite scores decreased by 0.246 (95% CI: 0.152 to 0.341 ($p<0.001$).

Table 3

Independent Sample T Test

Independent Variable	Dependent Variable	Mean Difference	95% CI	P value
Gender (males compared to females)	Appetite Score	2.93	1.74 to 4.11	<0.001**
Ethnicity (white compared to non-white)	Appetite Score	0.390	-0.881 to 1.66	0.545
Employment Status (employed compared to unemployed)	Appetite Score	-0.928	-2.23 to 0.376	0.162
Basic Needs (Use basic needs vs don't use)	Appetite Score	-0.80	-2.07 to 0.459	0.210
Gender (males compared to	PSS Score	-3.67	-6.51 to -0.84	0.012*

females)				
Ethnicity (white compared to non-white)	PSS Score	0.619	-1.64 to 2.88	0.589
Employment Status (employed compared to unemployed)	PSS Score	1.68	-0.651 to 4.01	0.156
Basic Needs (Use basic needs vs don't use)	PSS Score	2.76	0.481 to 5.03	0.018*

Table 3. Independent Sample T-Test. Independent sample T-Tests were conducted to compare means of PSS scores and Appetite scores between various demographic factors.

*$p \leq 0.05$

**$p \leq 0.01$

Multivariate Analysis:

A multiple regression model (Table 4) demonstrated that PSS scores and gender explained 23.4% of the variance in appetite scores ($F(1,127) = 9.5$, $p<0.002$). After adjusting for PSS score, males had 2.190 higher appetite scores than females ($p = 0.002$). After adjusting for gender, for every 1 unit increase in PSS scores, appetite scores decreased by 0.217 ($p<0.001$).

The model was a good fit for the data. The residuals were standardized, Cook's distance was less than 1, the residuals were roughly distributed, and the Durbin-Watson was 1.760. It is important to note that there was an association between PSS scores and gender (Independent sample T-Test, $p = 0.012$), however, the tolerance for the multiple regression model was 0.943 and the VIF was 1.060 indicating that the assumption of multicollinearity was also met.

Table 4

Linear Regression

	Model 1			Model 2		
Covariates	B	Beta	p value	B	Beta	P value
PSS	-0.252	-0.420	<0.001**	-0.217	-0.361	<0.001**
Gender (males compared to females)	NA	NA	NA	2.190	0.247	0.002**
R2	0.177			0.232		
F change	27.5			9.5		
df	1, 128			1, 127		
p value	<0.001**			0.002**		
Wald's test for gender	NA			0.002**		

Table 4. Linear Regression. Simple linear regression and multiple linear regression were conducted to compare PSS scores to appetite scores.

*p ≤ 0.05

**p ≤ 0.01

Discussion:

The hypotheses in question were as follows: appetite will decrease as stress levels increase in college students and females will have higher appetites when compared to males. Our results supported the first hypothesis where stress and appetite scores had a significant negative relationship (linear regression $R^2 = 0.16$, $p<0.001$). These findings go against previous research where one quantitative study, asking college females how they respond to stress, reported that 63% (n = 139) of women had increased appetites when stressed and 37% (n = 82) had decreased appetites (Kandiah et. al., 2006).

In another study, participants watched a stressful film and found that stress significantly increased food consumption in woman but decreased food consumption in men (Grunberg and Straub, 1992). Our findings demonstrated that both genders had decreased appetites as stress increases, but on average, males had higher appetites than females (t-test, $p<0.001$). In our study, after adjusting for gender, PSS scores and appetite scores were still significantly associated with each other ($p<0.001$). These results demonstrate that stress and gender are both factors that can impact appetite, however, our low R^2 of 23.4%, indicates that there was a lot of variance in the data. Considering only 23.4% of variance in appetite is explained by stress and gender, there are other more prominent factors associated with appetite.

Grunberg and Straub indicated that the impact of stress on appetite may also depend on the individuals' environment and the food they have available. One reason why our findings may differ than their study is because students may not have access to a lot of food as food security rates are rising from increased college costs (Freudenberg et al., 2019). Although students are stressed, their environment may not have a lot of food available for them which could result in decreased appetites. Whereas, if students had more food around them, this may cause increased cravings and appetites for these foods.

The results from this present study support the "feast-or-famine" theory, characterized by increased binge eating during periods of food abundance and decreased energy expenditure during times of famine. While this present study did not assess binge eating symptoms, one study demonstrated that food insecure individuals had greater binge eating symptoms when more food was accessible to them (Hazzard et. al., 2022). Another study performed in mice demonstrated that mice reduce their energy expenditure during food shortages and reduce their satiation to prepare for efficient refeeding (Yang et. Al. 2021). The results from these two studies may help explain why the results from this study differ from the studies by Kandiah et. al. and Grunberg and Straub. College students may be intrinsically suppressing their appetites due to stress and possibly due to food shortages from food insecurity.

Conclusion:

This study used a convenience sampling method for data collection and had a low sample size indicating that these results are not generalizable to all college students. The survey used also had various sections where some response fatigue may have occurred. There is still much research needed

to understand the conflicting results and the factors associated with appetite. This study suggests that stress and gender explain 23.4% of the variance in college students' appetites, but there seems to be more prominent factors explaining differences in appetites among college students. More research is needed to understand the connection between appetite, food security, and stress. However, interventions teaching how to increase appetite and manage stress could help improve students' diets and health outcomes. Future research can explore the impact of food security on appetite and metabolic rates to identify if students are innately decreasing their appetites and metabolic rates due to food shortages.

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