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The Correlation Between Dietary Intake, Stress, Food Insecurity, Physical Activity, Sleep, and Screen Time in College Students During Covid-19

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THE CORRELATION BETWEEN DIETARY INTAKE, STRESS, FOOD INSECURITY, PHYSICAL ACTIVITY, SLEEP, AND SCREEN TIME IN COLLEGE STUDENTS DURING COVID-19

by

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Mariana Alves Olguin

DEDICATION

I dedicate this work to my grandfather Antonio and my uncle Alfredo that left this world during this pandemic. My grandfather taught me the value of hard work and family, and my uncle was an example of perseverance and faith.

I also dedicate this work to all of those who lost a loved one during this pandemic.

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College students with high stress levels are more likely to engage in unhealthy behaviors, which may negatively impact their health. During the COVID-19 pandemic, college students' lives were disrupted on multiple levels. The aim of this study was to investigate the relationship between dietary intake, perceived stress, food insecurity, sleep, screen time, and physical activity among college students during the COVID-19 pandemic. College students at the University of the Incarnate Word (N=154) completed an online survey to assess dietary choices (Dietary Screener Questionnaires (DSQ) in the NHANES 2009-10: DSQ), food insecurity (6-item Short Form of the US Household Food Security Survey), stress (Perceived Stress Scale-10), physical activity (International Physical Activity Questionnaire Short Form), screen time, and sleep. Students self-reported demographic information. Independent t-test, ANOVA test, multiple-linear regression, and Sobel test were used to analyze the data. Males consumed significantly more added sugar, whole grains, and fruits and vegetables than females ($P < .001$). Higher levels of stress ($P < .05$) and less intense physical activity ($P < .05$) were significantly related to a lower consumption of fruits and vegetables. Food insecurity was significantly related to greater stress levels ($P < .05$). Finally, regression models explained approximately 13.5% of consumption of food and vegetables. The higher college students perceived stress scores, the

more likely they are to consume less fruits and vegetables. Programs aimed at reducing stress and its potential causers, providing resources for food insecure students, promoting physical activity, and enhancing nutritional education can help improve college students' diet and life quality.

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Statement of the Problem

The purpose of this study is to explore the relationship between dietary intake, perceived stress, hours of sleep per day, average screen time per day, average physical activity hours per week, and food insecurity among college students during the COVID-19 pandemic. Our hypothesis is that increased hours of physical activity and sleep, lower hours of screen time, and increased food security will decrease perceived stress and consequently increase the intake of fruits, vegetables, and whole grains, and decrease consumption of added sugar among college students. If this is found to be true, this study could be used as a basis for new health and wellness programs, implemented by colleges and universities, to decrease stress among college students and improve their dietary intake, so future students may have a higher quality of life.

Literature Review

Obesity prevalence is steadily increasing in the United States. For instance, the percentage of individuals diagnosed with obesity in the United States has tripled from 1975 to 2016.[1] This upsurge also affects the younger adult population as evidence shows an increase of 6.7% of diagnosed cases of obesity in young American adults over the past 8 years.[2, 3] One group particularly affected by obesity is college students. According to the American College Health Association-National College Health Assessment (ACHA-NCHA), a nationally recognized research survey of college students from private and public institutions across the country found that 37.6% of students were classified as overweight or obese in 2019.[4] This is 4.1% higher than the data collected by the same survey in 2010.[5] This percentage increase represents serious health concerns, and institutions need to be urged to shift their focus to the eating habits and general health of college students. Overweight and obesity are associated with health problems, such as cardiovascular disease, type 2 diabetes, stroke, some cancers, and low quality of life.[1]

Many questions are raised due to the obesogenic tendency among young college students, which needs to be addressed before the onset of obesity and the development of consequent health problems. One particular question is determining the factors that are associated with college students' dietary choices. Evidence shows that stress, physical activity, sleep duration, screen time, and food insecurity are some of the factors associated with dietary quality of college students.[6-10]

Most college students are familiar with the term "Freshman 15," which refers to the 15-pound weight gain new students face during the first year on campus. Despite the popularity of this term, evidence shows that weight gain is not limited to the first year of college and instead continues throughout the college years.[11] One of the main factors associated with weight gain has been perceived stress.[6] Research shows a significant inverse relationship between college student's perceived stress and their diet quality, and this inverse relationship continues to exist through all college years.[12, 13] A college student's weight gain is influenced by their stress level, which affects their food choices during stressful situations.[13] When a person is under stress, their body loses homeostasis, which leads to a physiological response to regain the balance lost. One homeostatic system disrupted during a stressful situation is feeding behavior where the body shifts towards more pleasurable and palatable foods that tend to be high in fat and added sugar.[14] The consumption of these foods overtime may cause adaptive changes in the neurobiological system and lead to compulsive behaviors related to the consumption of hyperpalatable foods, which over the long term can be detrimental to an individual's overall health by contributing to weight and fat mass gain as well as metabolic dysregulation.[14] Therefore, it is important to determine different coping methods to manage stress levels other than consuming hyperpalatable foods. Although some researchers have attempted to identify factors associated with stress and

weight gain among college students, a few have explored the collective factors that encompass the routine of a college student and their joint influence on both stress and diet quality of college students.

Some of the main activities that may be part of college students' routine are studying, sleeping, socializing, spending time in front of a screen (such as television, computer, or cell phone), exercising, eating, working, participating in student organizations, or taking care of their families. In March of 2020 the World Health Organization officially acknowledged COVID-19 as a pandemic and college students' lives were drastically altered.[15] The daily routine of college students changed abruptly when work, college classes, conferences, and meetings moved to a virtual environment. This may have caused activities such as studying, socializing, and attending classes to be disrupted. Other activities such as sleeping, eating, and exercising may also have been affected.

There have been studies exploring the relationship of sleeping, exercising, and screen time with stress and diet quality, separately. The evidence shows that in most people, stress negatively impacts the amount of physical activity performed.[7] There is also evidence that increasing the time and frequency of physical activity can increase the consumption of fruits and vegetables by young adults, and vice versa.[16, 17] The researchers attributed this relationship to what is known as the "transfer effect", which refers to the process of transferring the knowledge and skills learned in an implemented intervention to change one behavior context to another behavior context.[16] Secondly, the amount of time spent in front of a screen by young adults is asserted to be one of the causes of increased occurrence of anxiety and depression levels, and low psychological well-being in that population group.[8] Screen time may be directly or indirectly affecting stress levels but there is currently not enough evidence to make this claim. High levels

of screen time can cause high sympathetic arousal and cortisol dysregulation, which can gradually impair the brain's ability to cope with stress.[18] Despite the evidence presented, there are currently mixed results in what the true relationship between stress and screen time in young adults is. Therefore, this matter in this specific population needs to be further addressed.

There is more consistent evidence which shows the relationship between screen time and diet quality. Studies demonstrates that the more time a person spends in front of a screen, the poorer his or her diet quality is, meaning that an individual sitting in front of the television, computer, or cell phone is more prone to consume foods that are high in added sugars and saturated fats.[19, 20] Lastly, there is an inverse relationship between hours of sleep and perceived stress. High levels of stress interfere with total hours of sleep, and insufficient sleep leads to higher levels of perceived stress.[9] Studies also show that an individual's amount of sleep per night is positively associated with diet quality. Possible explanations for this inverse relationship are hormone imbalance, therefore impairing appetite control, and more awake time which means more opportunities for eating.[18, 20] In conclusion, factors that play a vital part of a college student's daily routine may impact stress levels and diet quality.

In addition to the relationship that each of the three variables have with stress and diet quality; they also have a relationship among themselves. In one study, researchers investigated the different effects between physical activity and screen time with health-related quality of life (HRQOL) among Australian adults.[21] HRQOL is a multi-dimensional measurement that involves physical, mental, emotional, and social functioning.[22] The authors found that high screen time combined with no physical activity was associated with low HRQOL, and that no physical activity was associated with low HRQOL independently of the amount of screen time.[21] There is also an inverse relationship between time spent playing video games and watching television

with the amount of physical activity performed.[20] Although evidence of a relationship between these variables exists, the number of studies which include all these variables is limited. There is a strong need to understand and evaluate the relationship these variables have with stress and diet quality when combined.

In conclusion, no studies could be found that investigate how the different factors that are part of the daily life of college students interrelate, and how they affect dietary choices. There is evidence that one of the motivators for eating is the level of perceived stress. There is also evidence that physical activity, sleep, and screen time are somehow individually related to both stress and dietary choices. However, no studies were identified that looked at all these factors together. There are many factors determining a college student's eating behavior, and it is important to consider all the factors simultaneously because they all co-exist and affect one another on a daily basis. Possibly by determining which factor has the strongest influence on diet quality and how each factor is related to each other, a new protocol of actions can be developed that will benefit college students' overall health and increase their quality of life. Lastly, due to COVID-19 pandemic many people, including college students, have lost their jobs.[23] This may affect their ability to purchase food. Furthermore, food insecurity has been associated with poor diet quality, particularly concerning the consumption of fruits and vegetables and the greater access to unhealthy foods.[10] Therefore, this study also includes the assessment of food insecurity as a factor that may increase stress and decrease diet quality. Food insecurity was added to the ACHA-NCHA in 2019, and the percentage of students with high food insecurity was 44.7% and 40.8% in the Fall of 2019 and Spring of 2020, respectively.[24, 25] Although there was a slight decrease of 3.9% from one semester to another, 40% still indicates a problem among college

students. According to the ACHA-NCHA, food insecurity in college students should be taken into consideration since it is part of almost half college students' life.

The goal of this research was to explore how variables that are a part of a college student's life, and that were affected by the pandemic, interrelate and affect stress and dietary choices either alone or as a group, as well as to compare their joint influence with each individual variable's influence on stress and dietary choices. It is possible that some variables have a significant influence on stress and dietary intake while being looked at individually, but then this significance can disappear after taking into consideration other variables and their relationship with stress and dietary intake. Looking at the joint influence of these variables on both stress and dietary intake is a closer representation of reality, since different factors are simultaneously co-existing and playing a role in a student's perceived stress and dietary choices on a daily basis. This study also investigates the possible mediation effect that stress has on the relationship of variables that are a part of college student's life and their dietary intake.

Materials and Methods

This study utilized an exploratory cross-sectional design and was approved by the Institutional Review Board at the University of the Incarnate Word. To participate in the study, participants had to provide informed consent before completing the online survey. See Appendix A for Informed Consent Form. The quantitative online survey sent to participants contained validated questionnaires and questions that assessed each variable of interest in this study. The variables were dietary intake, perceived stress, food insecurity, physical activity, average sleep duration per night, average screen time per day, and demographic characteristics. The first four variables previously listed were measured by using short-version questionnaires validated in past

studies, while sleep, screen, and demographics were assessed by one-question each based on previous studies.

Recruitment

Power analysis revealed that 176 responses were necessary to achieve statistical significance. To account for dropouts, the number of participants needed increased to 190 participants. A total of 2000 undergraduate students were randomly selected by the Incarnate Word Institutional Research Office through e-mail invitations. To be eligible to participate in this study, participants had to (1) be 18 years of age or older, (2) be currently enrolled at the University of the Incarnate Word as an undergraduate student and (3) be living in the United States at the time the online survey was completed, either on-campus or off-campus. Students that were no longer enrolled at the University of the Incarnate Word or that were not present in the United States were excluded from the study. No potential students were excluded due to gender, ethnicity, race, or socioeconomic status. See Appendix B for the Screening Questionnaire used to assess the exclusion criteria.

Survey Questionnaire

The outcome variables of interest in this study were dietary habits, stress level, food insecurity, physical activity level, total hours of sleep, and screen time per day. A quantitative survey was designed containing a collection of validated questionnaires to evaluate the interrelation of different variables that are a part of a college student's life and may influence their dietary choices. See Appendix B for the survey questionnaire. The survey link was sent to students in November of 2020 and it was open for 3 months. Three reminders were emailed to participants while the survey was open.

Dietary Screener Questionnaires in the NHANES 2009-10

Dietary choices were measured through the validated food frequency questionnaire Dietary Screener Questionnaires (DSQ) in the National Health and Nutrition Examination Survey (NHANES) 2009-10. This questionnaire accesses the consumption frequency of fruits and vegetables, whole grains, dairy, added sugars, red meat, and processed meat.[26] The daily consumption of each food group was calculated following the scoring algorithms developed by previous studies.[26] See Appendix C for formulas used for calculating dietary intake. The scoring algorithms convert the screener responses to estimates of daily dietary intake for fruits and vegetables (cups equivalents), whole grains (ounces equivalents), and added sugars (teaspoons equivalents). Because there are no scoring algorithms for calculating responses for red meat and processed meat consumption, these two components were excluded from this study.

Perceived Stress Scale

Perceived stress was measured using the Perceived Stress Scale-10 (PSS-10), a validated 10 question-survey instrument.[27] This questionnaire asks how often the respondent has felt or thought a certain way in the month prior to taking the survey. Each question has five possible answers ("Never", "Almost Never", "Sometimes", "Fairly Often", "Very Often"), and each answer counts as 0, 1, 2, 3, or 4 points, respectively. However, the four positive questions 4, 5, 7, and 8 have the scores reversed ("Never" = 4, "Almost Never" = 3, "Sometimes" = 2, "Fairly Often" = 1, "Very Often" = 0). The final perceived stress score is achieved by summing all 10 questions. In this study, participants with a final score of 13 or less points were classified as low perceived stress, those that scored between 14 and 26 points were classified as moderate perceived stress, and participants with final scores of 27 or higher were classified as high perceived stress.

US Household Food Security Survey Module: Six-Item Short Form Economic Research Service, USDA September 2012

Food insecurity was measured using the US Household Food Security Survey Module: Six-Item Short Form Economic Research Service (ERS), USDA September 2012. This survey consists of 6 questions and was first implemented in 1995. The questionnaire was developed by researchers from the National Center for Health Statistics, and its validity was tested by the ERS. This survey identifies households with low and very low food insecurity with a high specificity and sensitivity and minimal bias when compared with the 18-questions version of this survey. It has been successfully used in self-administered surveys, which is like this research survey.[28] Each question is answered with an affirmative response which counts as one point. Respondents with 1 point or less are classified as having high food security, respondents with total score between 2 and 4 are classified as having low food security, and those with a total score of 5 or 6 are classified as having very low food security. The original survey assesses food insecurity in the last year, but in order to access food insecurity while the COVID-19 pandemic restrictions were taking place, those questions were modified to assess food insecurity in the last 6 months meaning that the timeframe in which food insecurity was accessed would start on May 2020 depending on when the student completed the survey.

International Physical Activity Questionnaire - Short Form

Physical activity was assessed using the self-administered short version of the International Physical Activity Questionnaire which assesses the seven days prior to taking the survey.[29] This questionnaire measures different types of intensity of physical activity and sitting time and is a suitable tool to use in a population of 15 years of age or older. Studies show that this survey tool has high reliability and good validity.[29] The questionnaire consists of 7 questions

and assesses the frequency (measured as days per week) and duration (total minutes per day) of 3 activity domains (vigorous physical activity, moderate physical activity, and walking). Sitting is also assessed. After converting all activity to minutes and removing outliers (activities that are less than 10 minutes or greater than 16 hours), the MET-minute (metabolic equivalent) value for each activity domain was calculated using the following formula:

(Constant per activity domain) x (minutes per day) x (days per week)

The constants for each activity domain were 3.3, 4, and 8 for walking, moderate activity, and vigorous activity, respectively.

In this study, physical activity was reported as one continuous variable and one categorical variable. Classification criteria for each type of variable were established by researchers that developed the scoring procedures for this questionnaire.[30] The continuous variable was named "Physical Activity-MET", and was measured by total MET minutes per week, which represents the amount of energy expended carrying out a physical activity. This variable was used in multiple regression analysis. The categorical variable for physical activity was named "Physical Activity" For the purposes of this study, only the vigorous activity domain was considered. Respondents were classified as either meeting the requirement for being considered highly active (High Physical Activity) or not meeting the requirements for being classified as highly active (Low Physical Activity). To be classified as highly active, the respondent should practice vigorous activities on at least 3 days per week and a minimum of 1500 MET-minute per week, a condition already established by previous studies. The rationale for using only respondents that fall into the vigorous activity domain is because people that meet this domain are practicing enough physical activity for a healthy lifestyle, and it can therefore be

a good indicator of people that are wanting or that already have a healthier life and health benefits that physical activity can provide. This variable was used for t-test analyses.

Other Variables

The independent variables included in this study were assessed by one question each; and respondents were classified into two categories for each question. The independent variables added to the survey were: Self-identified gender (male or female), ethnicity (Hispanic or Non-Hispanic), current residency (with family or without family) which will be addressed as Living Arrangement (LR), average sleep duration per night (adequate sleep - 7 hours or higher per night or inadequate sleep - 6 hours or less per night),[31] and total screen time per week (high screen time - 21 hours per week or more per week, or low screen time - 20 hours per week or less).[32] The term "screen time" in this study included time exclusively spent on a cell phone, computer, and/or TV.

The variable "Ethnicity" was initially grouped as "Hispanic" and "Non-Hispanic" due to the small number of respondents that each non-Hispanic ethnic group had, except for White that had 23.4% of participants self-identifying as such. The Non-Hispanic group included White, African American/Black, Native American, Asian/Pacific Islander and others. However, the cultural differences that these ethnic groups have among themselves might influence the student's dietary choices. Therefore, data analyses with different grouping of ethnic groups were conducted to investigate the relationship of mean dietary intake and test if there would be a significant difference of consumption when analyzing ethnicity grouped as: Hispanic and non-Hispanic; Hispanic, White, and Others; or all ethnic groups separated.

Consent of Participation

The consent of participation was included in the email invitation sent to recruit students. The consent of participation statement was "Completing and submitting this survey represents informed consent to participate in the research study" and stated that students were able to leave the survey at any time desired. The invitation also included the link to the SurveyMonkey survey. At the beginning of the survey, students were prompted to answer two questions to determine if they were currently residing in the United States and currently enrolled as a student at the university. If the participant selected yes to both questions, they would proceed to the informed consent question. Students had to select “yes” on the informed consent page, giving consent and agreeing to participate in the survey. Once “yes” was clicked, the student continued to the study questions. If “no” was clicked, indicating consent was not given, the survey closed.

An incentive was offered to participants that completed the survey through a raffle of four $50 gift cards. At the end of the survey, participants received a message saying, “you will be redirected to the raffle page after submitting this survey, please use the password XXXX to enter the raffle questionnaire where you can put your name and email address”. The gift cards were available for pick-up within one month of study completion, or an electronic gift card was sent through email if the participants chose not to pick-up the gift card on campus. By choosing the SurveyMonkey’s feature to allow the researcher to redirect respondents to another website after they finish the survey, the principal investigator was able to prevent people from giving away the link to the raffle survey to other people that have not completed the main survey.

The confidential information that participants shared in the raffle was in a password-protected folder in a password-protected computer that only the principal investigator had access to. Additionally, there was no record linking the personal information entered in the raffle survey

to the answers provided on the main survey, therefore keeping the answers of the main survey anonymous.

Data Privacy

Confidential information received electronically was kept in a password-secured archive in a password-secured computer which only the principal investigator had access to. Only researchers involved in this study and representatives of the University of the Incarnate Word Institutional Review Board had access to the records and information from this study. Additionally, there were no identifiable questions in the main survey and the Anonymous Responses collector option, which allows the researcher to choose not to track and store identifiable respondent information in survey results, was used to increase confidentiality. Lastly, SurveyMonkey, the online survey software used for this research, records respondent IP addresses in backend logs and deletes them after 13 months.

Data Analysis

The statistical analyses were completed using the SPSS software, version 26. Descriptive statistics were performed on the demographics. For the first step, independent t-test was used to measure the association between dichotomous variables and the two main variables (dietary choices and perceived stress level) at a significance level of .05, taking into consideration Levene's test for equality of variances. ANOVA analysis was used to investigate the relationship of mean perceived stress scores within the food insecurity groups, and the relationship of mean dietary intake within groups of perceived stress and within different groupings of ethnic groups. ANOVA analysis was also used to examine the relationship of mean dietary intake within groups of perceived stress, and groups of food insecurity. Tukey post hoc test with multiple comparisons was performed with the ANOVA analyses to determine which groups differ from each other at a

significance level of .05. Second, a multiple linear regression was used to create a model to estimate perceived stress and the consumption of each food group. Multicollinearity was tested with the collinearity diagnosis function in SPSS, heteroskedasticity was tested with Glejser test, and multivariate normality was assessed through Mahalanobis Distance test.

Results

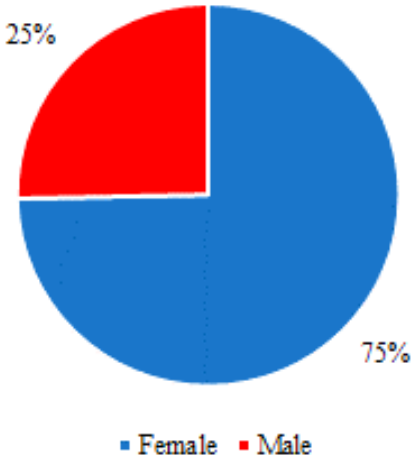
Participant Characteristics

A total of 301 UIW students completed the survey. See Appendix B for survey. All respondents were undergraduate students attending the University of the Incarnate Word, a private Hispanic serving institution in San Antonio, Texas. From the 301 respondents, 55.5% self-identified as females (n=167), 16.6% self-identified as males (n=50), 1.3% preferred not to answer (n=4), and 26.6% of participants did not answer this question (n=80). Then 45.5% of participants were Hispanics (n=137), 15.9% were White (n=48), 3.3% were Asian/Pacific Islander (n=10), 2.7% and 1% were African American/Black (n=8) and Native American (n=3), respectively, and 31.6% chose other, preferred not to answer, or did not answer at all (n=95). Additionally, 56.4% lived at home with their families (n=170), 33% lived alone or with roommates (n=99), and 10.6% of students did not answer this question (n=32). See Table 7 in Appendix D. Participants that did not respond to every survey question were excluded from the statistical analysis. After exclusion, a total of 154 participants were included in the final analysis. Figure 1 shows that 74.7% were females (n=115) and 25.3% were males (n=39). Figure 2 shows that 64.9% of participants lived at home with their families (n=100) and the remainder lived either alone or with roommates. Figure 3 shows that 62.3% were self-classified as Hispanic (n=96), 23.4% were self-classified as White, 4.5% were African American/Black, 5.8% were Asian/Pacific Islander, 1.3% were Native American, and 2.6% were self-classified as other. The

mean age of participants was 22.98 years old (SD ± 7.3). Additionally, while 54.5% of participants were food secured, 45.5% of the students in this study reported some level of food insecurity. Only 10.4% of students were classified as having low perceived stress, while 56.5% were classified as experiencing moderate stress, and 33.1% had high perceived stress. Also, 66.2% met the criteria for being considered highly active, 58.4% reported they slept 6 hours or less per night, and 19.4% spent on average more than 6 hours in front of a screen every day. See Table 8 in Appendix D.

Figure 1.

Percentage of Male and Female Respondents



The demographic characteristics of participants in this study are like the demographics of all students attending the University of the Incarnate Word. When the survey was sent to students, the percentage of students living on campus was 12.8% and 13.7% in Fall 2020 and Spring 2021, respectively. Then, during the academic year of Fall 2020, 38.2% of students were male and 61.8% were females. Also, 58.7% of students were Hispanic, 17.8% were White, 7.6% were African American/Black, 0.4% was Native American, 3% was Asian/Pacific Islander, 3.7% were Nonresident Alien, 2.4% had two or more races, and 6.4% were classified as unknown.

Figure 2.

Percentage of Participants Living with Family and without Family

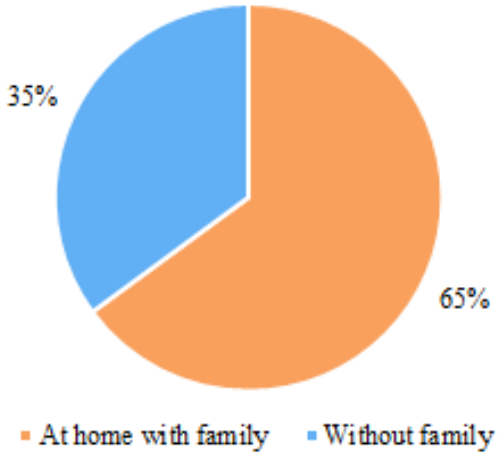


Figure 3.

Percentage of Participants' Ethnic Groups

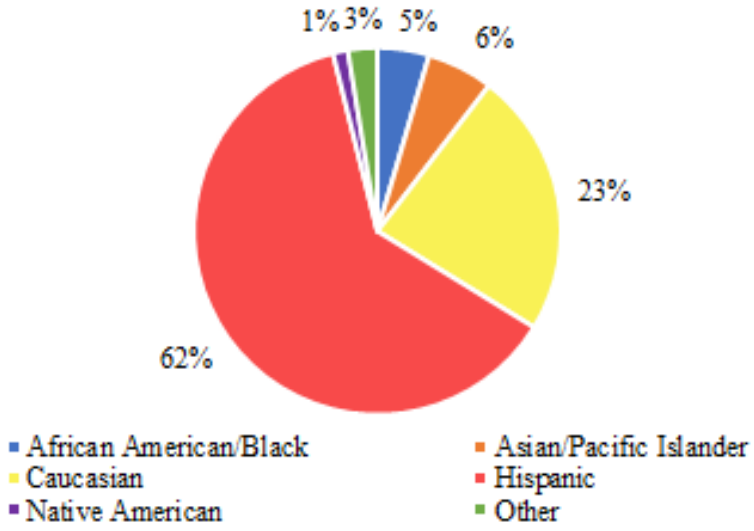
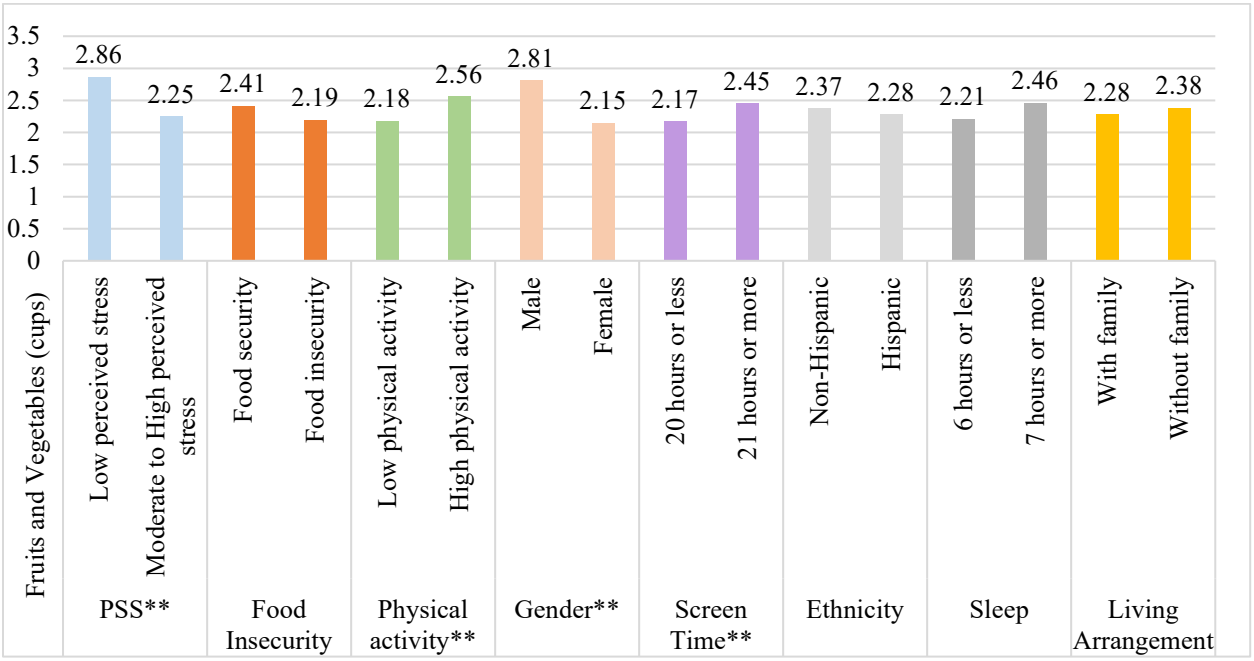


Figure 4.

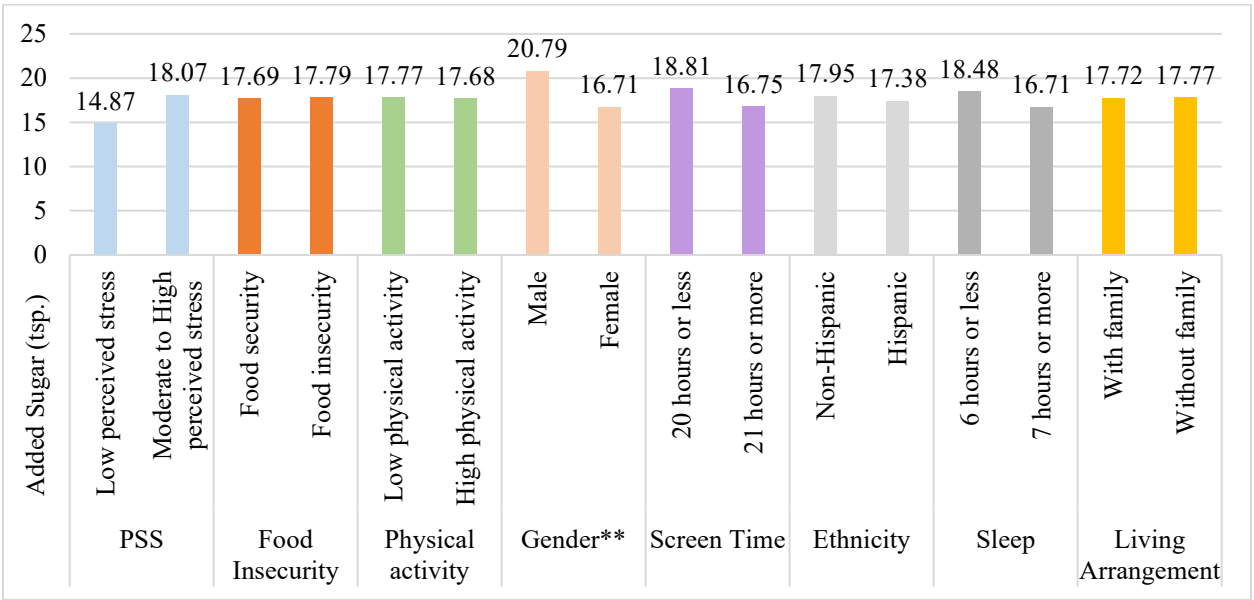
Mean Consumption of Fruits and Vegetables (cups) within Different Groups



**P-value < .05

Figure 5.

Mean Consumption of Added Sugar (tsp.) within Different Groups



**P-value < .05

Mean Differences of Dietary Intake within Groups

There was a significant difference found between the mean daily consumption of cups of fruits and vegetables between participants that were classified with low perceived stress and participants that experienced moderate to high perceived stress. Figure 4 shows that those that experienced low perceived stress (M = 2.86, SD = .63) consumed on average more fruits and vegetables than those that experienced moderate to high perceived stress (M = 2.25, SD = .72), $t(152) = 3.22$, $P < .05$. The 102 participants that reported practicing high levels of physical activity (M = 2.56, SD = .95) compared to the 52 participants that did not practice high levels of physical activity (M = 2.18, SD = .56) consumed more cups of fruits and vegetables, $t(69.57) = -2.646$, $P < .05$. Participants that spent 20 hours/week or less in front of a screen (M = 2.17, SD = .69) consumed on average more cups of fruits and vegetables than those that had screen times of 21 hours/week or more (M = 2.45, SD = .75), $t(152) = -2.382$, $P < .05$. Finally, males consumed on average more fruits and vegetables, added sugar, and whole grain than females, as Figures 4, 5, and 6 shows. Consumption of dairy was not statistically different between any of the groups observed in this study. See Table 9 in Appendix E for more details.

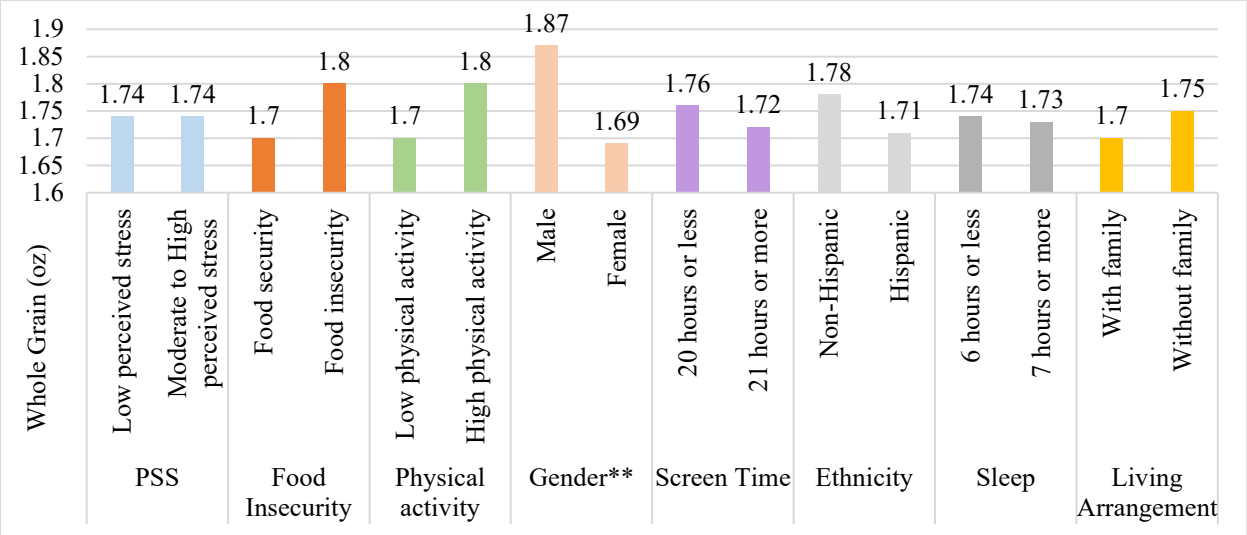
Mean Differences of Perceived Stress within Groups

When assessing the relationship of different factors that are part of college students' routines with the level of perceived stress by the college student, a significant difference in perceived stress among different groups of physical activity, gender, and amount of sleep was found. Figure 7 shows that college students that practiced low physical activity (M = 23.93, SD = .56), slept on average 6 hours or less per night (M = 25.03, SD = 6.53), had screen time of 20 hours/week or lower (M = 24.42, SD = 7.16), and that were female (M = 24.20, SD = 6.79) had higher levels of perceived stress ($P < .05$) than participants that were highly active (M = 20.79, SD

= .95), slept 7 hours or more per night (M = 25.03, SD = 6.53), spent on average 21 hours/week or more in front of a screen (M = 21.43, SD = 7.87), and were male (M = 18.95, SD = 7.67). See Table 10 in Appendix E for a summary of comparison of perceived stress scores within different groups. A one-way ANOVA was conducted to compare the effect of food insecurity in perceived stress scores. A significant difference in perceived stress levels between groups of food insecurity at the $P < .05$ level for the 3 conditions (P = .001) was found. See Table 1. Post hoc comparisons using the Tukey HSD test showed a significant difference in perceived stress scores between respondents who experienced no food insecurity (M = 21.01, SD = 7.41) and low food insecurity (M = 24.54, SD = 5.94). The same difference can be seen between students with no food insecurity and students with high food insecurity. However, the post hoc test also showed that there was no statistically significant difference between the low (M = 24.54, SD = 5.94) and high food insecurity (M = 26.32, SD = 8.12) groups in the perceived stress scores. See Table 11 and Table 12 in Appendix F for more details on the ANOVA analysis.

Figure 6.

Mean Consumption of Whole Grain (oz) within Different Groups

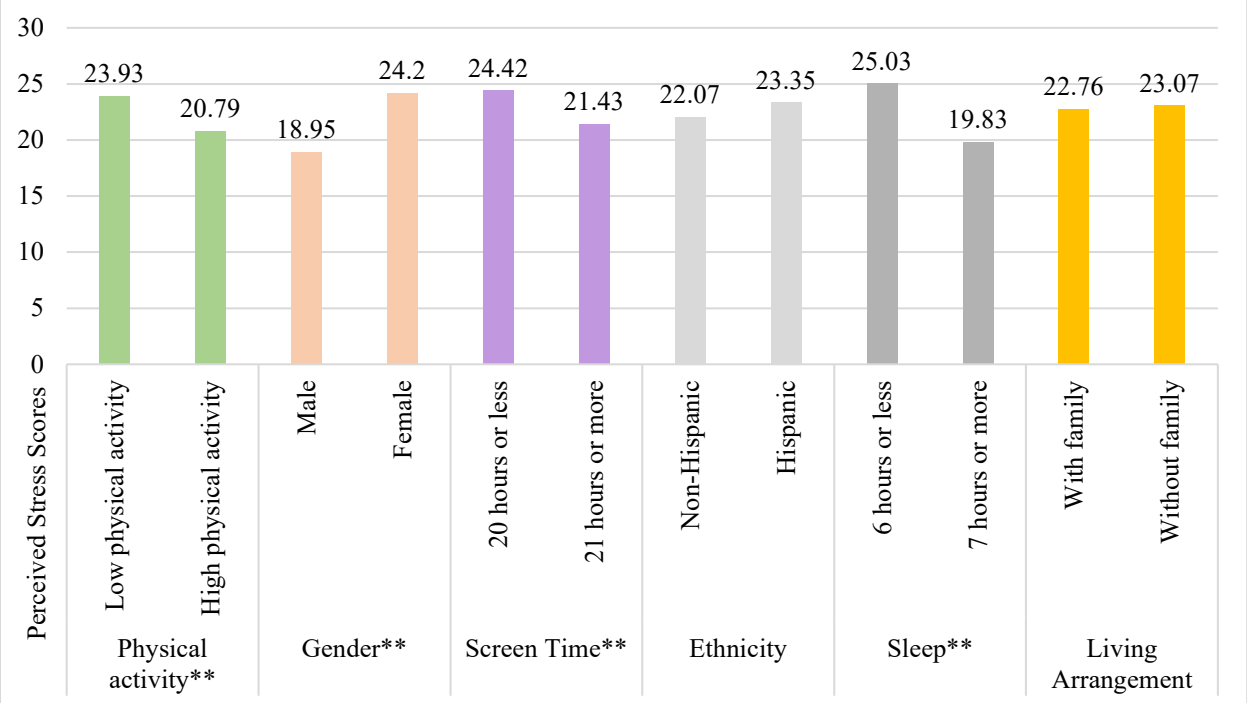


**P-value < .05

A one-way ANOVA was also conducted to compare the effect that perceived stress score has on average daily consumption of each food group. There was a significant association found between groups of perceived stress scores and consumption of fruits and vegetables ($P = .001$). See Table 2. A post hoc comparison with Tukey HSD found a significant difference of consumption of fruits and vegetables between participants that have low perceived stress ($M = 2.86$, $SD = .63$) and moderate perceived stress ($M = 2.34$, $SD = .80$), as well as between those that have low perceived stress ($M = 2.86$, $SD = .63$) and high perceived stress ($M = 2.10$, $SD = .53$). See Table 12 and Table 13 in Appendix G for further details.

Figure 7.

Mean Perceived Stress Scores within Different Groups



**P-value < .05

Table 1

Comparison of Perceived Stress Scores among Food Insecurity Groups

	No FI		Low FI		High FI	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
PSS	21.01[a]	7.41	24.54[b]	5.93	26.32[b]	8.12

Note. PSS = Perceived Stress Score. FI = Food Insecurity. SD = Standard Deviation. Different superscripts are significantly different ($P = .05$).

Table 2

Mean Difference of Dietary Intake among Perceived Stress Groups

	Low Stress		Moderate Stress		High Stress	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Fruits and Vegetables (cups)	2.86[a]	.63	2.34[b]	.80	2.1[b]	.53
Whole Grain (oz)	.89[a]	.47	.73[a]	.33	.73[a]	.23
Added Sugar (tsp)	14.87[a]	3.73	18.73[a]	9.99	16.96[a]	5.77
Dairy (cups)	1.74[a]	.44	1.73[a]	.96	1.75[a]	.85

Note. SD = Standard Deviation. Different superscripts are significantly different ($P = .05$).

Mean Differences of Dietary Intake within Different Lumping of Ethnic Groups

ANOVA analysis was used to test the mean differences of dietary intake and perceived stress among different lumping of ethnic groups. Table 3 shows that there was no statistically significant difference of diet intake and stress among Hispanics, White, and Others, with Others being Asian/Pacific Islander, African American/Black, and Native American grouped together. Moreover, Table 4 shows that there was no significant difference of dietary intake and stress between ethnic groups without any lumping. See Tables 13 to 16 in Appendix F for the ANOVA analyses.

Table 3

Comparison of Mean Dietary Intake, Perceived Stress and Food Insecurity among Three Ethnic Groups

	Hispanic		White		Others	
	Mean	SD	Mean	SD	Mean	SD
Fruits and Vegetables	2.28[a]	.69	2.35[a]	.58	2.39[a]	1.08
Whole Grain	.73[a]	.30	.76[a]	.35	.82[a]	.44
Added Sugar	17.95[a]	9.22	17.84[a]	6.26	16.64[a]	7.64
Dairy	1.71[a]	.71	1.68[a]	.48	1.93[a]	1.70
PSS	23.35[a]	7.33	22.25[a]	8.43	21.77[a]	5.51

Note. PSS = Perceived Stress Score. SD = Standard Deviation. Different superscripts are significantly different ($P = .05$).

Prediction of Perceived Stress Scores and Daily Dietary Intake

A multiple linear regression was calculated to predict perceived stress of college students based on physical activity, living arrangement, screen time, sleep hours, and food insecurity (Model A). See Table 5. A significant regression found and it explained 21.4% of the variance ($R^2 = .214$, $F(4, 146) = 7.912$, $P < .05$). Participants' predicted stress score is equal to 32.403 + (-1.234 ∗ Physical Activity) + (-.578 ∗ LR) + (-2.078 ∗ Screen Time) + (-3.883 ∗ Sleep) + (.963 ∗ Food Insecurity), where physical activity was coded as 1 = low physical activity, 2 = high physical activity, LR was coded as 1 = without family, 2 = with family, screen time was coded as 1 = 20 hours/week or less, 2 = 21 hours/week or more, sleep was coded as 1 = 6 hours/night or less, 2 = 7 hours/night or more, and FI was the total score from the food insecurity survey (scores range from 0 to 6).

Table 4

Comparison of Mean Dietary Intake, Perceived Stress among Five Ethnic Groups

	Hispanic		White		Asian/Pacific Islander		African American/Black		Native American	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
FV	2.28[a]	.69	2.35[a]	.58	2.07[a]	.30	2.63[a]	1.07	2.55[a]	1.22
Whole Grain	.73[a]	.30	.76[a]	.35	.64[a]	.26	.62[a]	.19	1.17[a]	.56
Added Sugar	17.95[a]	9.22	17.84[a]	6.26	12.53[a]	1.51	16.49[a]	4.95	22.63[a]	12.65
Dairy	1.71[a]	.71	1.68[a]	.48	1.27[a]	.30	1.96[a]	2.02	1.14[a]	.36
PSS	23.35[a]	7.33	22.25[a]	8.43	21.33[a]	7.12	22.00[a]	3.26	24.00[a]	1.41

Note. FV = Fruits and Vegetables. PSS = Perceived Stress Score. SD = Standard Deviation. Different superscripts are significantly different ($P = .05$).

Sleep and food insecurity were significant predictors of perceived stress. A second multiple linear regression was calculated to predict perceived stress score based on the same variables excluding food insecurity (Model B). See Table 5. A significant regression was found and it explained 13.4% of variance ($R^2 = .134$, $F(4, 146) = 6.815$, $P < .05$). Sleep was the only significant predictor of perceived stress in this model. After removing outliers, there was no multicollinearity, no multivariate outliers, and no heteroscedasticity of residuals in neither multiple linear regression.

Sleep and food insecurity were significant predictors of perceived stress. A second multiple linear regression was calculated to predict perceived stress score based on the same variables excluding food insecurity (Model B). See Table 5. A significant regression was found [$F(4, 146) = 6.815$, $P < .05$], with an R^2 of .134. Sleep was the only significant predictor of perceived stress in this model. After removing outliers, there was no multicollinearity, no multivariate outliers, and no heteroscedasticity of residuals in neither multiple linear regression.

Table 5

Summary of Multiple Regression Analysis for Variables Predicting Perceived Stress Level of College Students

	Model A			Model B		
Variable	**B**	**SE B**	**β**	**B**	**SE B**	**β**
Constant	32.403*	3.685	-	37.376*	3.469	-
Physical Activity	-1.234	1.247	-.079	-2.263	1.244	-.144
LR	-.578	1.193	-.037	-1.383	1.204	-.089
Screen Time	-2.078	1.125	-.141	-1.878	1.159	-.128
Sleep	-3.883*	1.144	-.259	-4.455*	1.166	-.297
FI	.963*	.297	.254	-	-	-
R^2		.214			.157	
Adjusted R^2		.187			.134	
F		7.912*			6.815*	

*P-value < .05

Note. LR = Living Arrangement. FI = Food Insecurity. Model A is the linear regression model predicting PSS including food insecurity as an independent variable. Model B is the linear regression model predicting PSS without including food insecurity in the model. Both models are statistically significant. Physical Activity is separated into "low physical activity" and "high physical activity." LR is separated into the groups "living with family" and "living without family." Screen Time is separated between "low screen time" and "high screen time."

Multiple linear regression was also used to predict consumption of different food groups based on perceived stress, physical activity, living arrangement, screen time, sleep hours, and food insecurity (Model D). See Appendix G for all models. The only significant model at $P < .05$ level was the one predicting consumption of fruits and vegetables [F (6, 144) = 3.709, $P < .05$], with an R^2 of .134. See Table 6.

Table 6

Summary of Multiple Regression Analysis for Predicting Daily Consumption of Fruits and Vegetables

	Model C			Model D		
Variable	**B**	**SE B**	**β**	**B**	**SE B**	**β**
Constant	1.695*	.319	-	2.402*	.383	-
Physical Activity	.131	.108	.105	.104	.105	.083
LR	.034	.103	.027	.021	.100	.017
Screen Time	.229*	.097	.196	.184	.095	.157
Sleep	.025	.099	.021	-.060	.100	-.050
FI	-.030	.026	-.100	-.009	.026	-.031
PSS	-	-	-	-.022*	.007	-.274
R^2		.075			.134	
Adjusted R^2		.043			.098	
F		2.345*			3.709*	

*P-value < .05

Note. LR = Living Arrangement. FI = Food Insecurity. PSS = Perceived Stress Score. Model C is predicting Fruits and Vegetables without including PSS. Model D is predicting Fruits and Vegetables with all variables included in model C, and PSS added as a predicting variable.

Participants' consumption of fruits and vegetables is equal to 2.402 + (.104 ∗ Physical Activity) + (.021 ∗ LR) + (.184 ∗ Screen Time) + (-.060 ∗ Sleep) + (-.009 ∗ Food Insecurity) + (-.022 ∗ PSS), where physical activity was coded as 1 = low physical activity, 2 = high physical activity, living arrangement is coded as 1 = without family, 2 = with family, screen time is coded as 1 = 20 hours/week or less, 2 = 21 hours/week or more, sleep is coded as 1 = 6 hours/night or less, 2 = 7 hours/night or more, FI is the total score from the food insecurity survey, and PSS is the total score from the PSS Survey (score ranging from 0 to 40 points). Perceived stress was a significant predictor of consumption of fruits and vegetables. In these two models, there was no

multicollinearity, no multivariate outliers, and heteroscedasticity of residuals was treated with removing outliers and HC3 method.

Discussion

In this study, male college students consumed more fruits and vegetables, whole grains, and added sugar than female college students. This difference could be attributed to the fact that males consume in general more food than females, or to food-related conflict that women go through. For example, the pressures to be thin in early adolescence could be carried into the college years.[33] There is also evidence that women have higher levels of leptin than men, an appetite regulation hormone that decreases energy intake.[34] However, there are contradictory results seen in other studies. Previous studies have shown that women consume more fruits and vegetables, whole grains, and dairy than men.[35-37] These differences were attributed to women being more aware and having better knowledge of nutrition than men.[35, 38] Since nutritional knowledge was not assessed in this study, this hypothesis could not be tested. Another reason for the different results could be the discrepancy between the disproportionate number of men (N = 39) and women (N = 115) that participated in this study, which could have favored a specific dietary pattern depending on the group of males that completed the survey. Perhaps the male participants in this study were more health-aware, which could have led to bias when reporting more food consumption, including fruits and vegetables and whole grains, than females. But again, since this survey did not assess the nutrition knowledge background of participants, it is not possible to test this hypothesis as well.

Despite the difference in food intake between genders, both dietary patterns of males and females do not follow the dietary guidelines set by the US Department of Agriculture (USDA) and the Department of Health and Human Services. The recommended amounts of food groups

established in the *Dietary Guidelines for Americans 2020-2025* are evidence-based recommendations with the goal to increase health, decrease the development of chronic diseases, and consequently, improve quality of life.[39] The recommendation for a healthy dietary pattern for US adults ages 19 to 59 years old following a diet of 2,000 calories per day includes 2 ½ cups/day of vegetables, 2 cups/day of fruits, 3 oz/day of whole grains, and 3 cups/day of dairy.[40] Participants in the current study consumed an average of 2 ½ cups/day of fruits and vegetables, .80 oz/day of whole grains, and 1 ¾ cups/day of dairy, which were below the recommended dietary intake recommendations for a healthy diet. This result follows the same dietary intake pattern assessed by the NHANES 2015-1016, in which researchers observed that respondents between the ages of 19 and 30 years consumed on average 1 ½ cups/day of vegetables, 1 cup/day of fruits, 1 oz/day of whole grains, and 1-2 cups/day of dairy.[41] Although the data collected from this study utilized different survey tools than the NHANES 2015-2016 study, the pattern of being below the recommended amounts for healthy foods is the same. These results show that this population continues to have a risk of developing chronic diseases by not following the dietary guidelines established by the USDA.[39]

The present study also revealed that males consumed on average 20.79 teaspoon/day of added sugars, and females consumed 16.71 teaspoon/day of added sugars. The *Dietary Guidelines for Americans 2020-2025* recommends to limit added sugars to 10 percent of the total calories per day.[39] In a 2,000 calories per day that would be equivalent to 200 calories of added sugars or 12 teaspoons of added sugars. Furthermore, the American Heart Association (AHA) recommends the daily consumption of added sugars to be limited to 9 teaspoons/day and 6 teaspoons/day for men and women, respectively.[42] All respondents of this survey reported a consumption of added sugars that was greater than the recommended amount by the AHA. It was

not possible to determine if respondents of this survey followed the recommendation of added sugars by the *Dietary Guidelines for American 2020-2025* since the total calories consumption of each participant was not assessed in this study. High consumption of added sugars can lead to insulin and leptin resistance, weight gain, and in extreme cases, obesity, which consequently reduces heart health. High consumption of added sugars also causes alterations in the brain, as evidence shows, like changes caused by drug addiction, meaning that high added sugar consumption can lead to high cravings and withdrawal symptoms while trying to reduce the amount of sugar.[43] High consumption of added sugars is a trend happening not only in the US, but in other countries as well, especially in the young adult population, due to the many transitions that happen during this age period.[44] Research shows that young adults are aware of the harms that come with high sugar consumption and low diet quality, but the pleasurable taste and the idea that young adults are not at risk for chronic diseases causes this population to continue the high consumption of added sugars.[45]

The present study revealed that college students that practiced more physical activity consumed more fruits and vegetables than students that practiced less physical activity. This result agrees with previous studies that showed physical activity as one positive predictor of consumption of fruits and vegetables by college students.[46] One possible explanation for the association found in this study is that students who are more physically active are more concerned about their health and more aware of factors, such as following a healthy diet, that play a role in a person's well-being. However, the literature shows that the consumption of fruits and vegetables and the practice of physical activity decrease over the course of the college years, and only a few students maintain a healthy lifestyle during the years of college.[47] Another study showed that this positive association between physical activity and fruits and vegetables is not

consistent throughout the years, meaning that promotion of one behavior should not be assumed to influence the other.[48] Therefore, based on findings of this study and past literature, universities should constantly promote both a healthy diet and physical activity to their students, either together or separately.

Additionally, this study showed associations between perceived stress and various factors. The perceived stress levels differed based on the student's gender, physical activity level, screen time, sleep hours, and food insecurity level. Females reported higher levels of perceived stress than males. Although there is no evidence to explain why this happened, it could be postulated that the COVID-19 pandemic played a role in women reporting higher levels of stress than men. According to the US Bureau of Labor Statistics, since the beginning of the pandemic, 2.5 million women left the job market in comparison to 1.8 million men.[49] At the end of 2020, CARE International found that more women reported more income loss during the pandemic than men throughout the world. Researchers attributed this occurrence to more women working in the informal sector, which was the most affected by pandemic restrictions, and having less access to unemployment benefits.[50] Additionally, the American Psychological Association reported that women are more likely to experience stress because of money and economic than men.[51] This study also found that more women reported suffering from food insecurity and mental illness than men.[50] Also, women might be struggling more with mental health due to the cultural expectations that females are the more nurturing sex and better at providing childcare and care for the home.[52] Therefore, for female students that are also mothers, there could be the added stress of taking care of a child (or children) and taking care of a house. Pregnant females could also have had the added stress of going through a life changing process of bearing a child and going through physical and hormonal changes that males do not go through. Unfortunately,

factors such as pregnancy, having children, family support, or unemployment were not assessed in this study.

Moreover, students that were more physically active, spent 21 hours per week or more in front of a screen, and slept 7 hours per night or more experienced less stress than those that exercised less, spent 20 hours per week or less in front of a screen, and slept 6 hours or less per night. These results agree with a previous study that observed that college students, during stressful times, decrease physical activity and have lower sleep quality.[53] However, it does not agree with previous studies in relation to screen time. In 2017, a study showed that screen time (television and computer) of four hours/day or more was associated with moderate or severe depression level among US adults.[52] Other studies also show a positive relationship between having a screen time of 21 hours/week or more and being diagnosed as overweight and/or obese or having a low health related quality of life.[54, 55] One possible explanation for high screen time being associated with lower perceived stress in the present study could be the COVID-19 pandemic and the social restrictions that were taking place when the study was conducted. Because of the COVID-19 pandemic, many restaurants, bars, public places, and events were closed and/or canceled. Therefore, there is a high possibility that, for many students, screen time was the only means of social interaction during the COVID-19 pandemic. Some students could have been isolating themselves from their families because someone in their house could be in the high-risk group so physical contact with the world would be less. Additionally, at the time that the survey was distributed, travel restrictions were still in place, so the internet could have been the college student's only contact with the outside world. Another possible explanation for high screen time being associated with lower perceived stress could be that the college students in this study were spending more time in the screen due to studying and completing homework,

and in this case, these activities could potentially be decreasing the stress that comes with school work.

Furthermore, in this study college students that experienced any level of food insecurity (low or high food insecurity) had higher levels of perceived stress than college students who did not experience any food insecurity. In March of 2020, a national survey was sent to low-income adults in the United States assessing food insecurity and its association with mental health. Researchers observed a significant relationship between these two variables. Participants with higher levels of food insecurity were more likely to be screened for high stress, depression, and anxiety than those with low levels of food insecurity.[56] Those results were like the ones observed in this research, in which higher levels of stress were associated with food insecurity.

Additionally, college students that had low perceived stress consumed on average more cups of fruits and vegetables than those that had moderate to high perceived stress. However, there was no significant difference of consumption between moderate and high stress, meaning that moderate or high perceived stress would be associated with lower consumption of fruits and vegetables. Previous studies observed a decrease of consumption of fruits and vegetables and an increase of "snack-type" foods during stressful situations among college students.[57-59]

The multiple regression analysis revealed the importance that food insecurity has on predicting perceived stress. In table 8, model A included food insecurity as a predictor of perceived stress, while model B did not include food insecurity. Model A could predict 21.4% of perceived stress score variance, and model B could predict 15.7%. The percentage of prediction from model A is higher than what model B can predict by 5.7%, which can be considered a significant difference in prediction. Model A showed that perceived stress increased when college students experienced food insecurity. Perceived stress decreased as college students

performed more vigorous physical activity, lived without their families, spent more time in front of the screen, and slept more hours. However, only sleep and food insecurity were significant in this model. This could mean that universities should develop programs to decrease stress by focusing on these two factors. Below is the formula for predicting perceived stress scores:

$$32.403 + (-1.234 * \text{Physical Activity}) + (-.578 * \text{LR}) + (-2.078 * \text{Screen Time}) + (-3.883 * \text{Sleep}) + (.963 * \text{Food Insecurity})$$

This study also revealed the importance that perceived stress has on predicting consumption of fruits and vegetables. Model C predicted fruits and vegetables while excluding perceived stress, and the formula could predict 7.5% of variance of cups of fruits and vegetables. Meanwhile, model D included perceived stress as one of the predicting variables and the model could predict 13.4% of fruits and vegetables variance. Although the percentage of prediction from both models are low, there is a difference of 5.9% of prediction from including or excluding perceived stress, and stress should be considered an influencing factor when assessing other areas of their student's lives such as dietary habits. Despite the low prediction percentage, this model showed that the consumption of fruits and vegetables increased as the college student was physically active, lived without their families, spent more time in front of the screen, and slept on average more hours. The consumption of fruits and vegetables decreased as college students experienced food insecurity and high stress levels. Only perceived stress was significant in this model. Below is the formula for predicting intake of fruits and vegetables (cups):

$$2.402 + (.104 * \text{Physical Activity}) + (.021 * \text{LR}) + (.184 * \text{Screen Time}) + (-.060 * \text{Sleep}) + (-.009 * \text{Food Insecurity}) + (-.022 * \text{PSS})$$

Furthermore, model C showed that, when excluding perceived stress, only screen time was a significant predictor of consumption of fruits and vegetables. However, when including

perceived stress as a predicting variable, screen time became a non-significant predictor. Yet, it was not possible to conduct a mediation analysis in this case since screen time was not a significant predictor of perceived stress as model A shows, see Table 15.

Implications and Applications

This study sheds more light on the dietary habits of college students. College students are not following the dietary recommendations established by USDA. The recommendations exist to reduce the risk factors for diet-related chronic diseases that can potentially decrease life quality. Universities need to prioritize the health and wellness of college students by focusing on nutritional education and changing the dietary habits of the students. It is necessary to teach the components and benefits of a healthy diet, and to continue to reinforce those teachings throughout the college experience so it becomes part of a college student's daily routine. A healthy diet is a strong factor in a healthy life, but as this study shows the dietary habits of young adults still need improvement. One explanation for the fact that college students in this study are not following the recommendations set for a healthy diet could be a lack of knowledge of what a healthy diet constitutes of. However, since nutritional knowledge was not assessed in this research, this assumption cannot be proved. There are other possible reasons that could affect dietary intake but that were not assessed in this study as well, such as taste, preparation knowledge, cost of foods, and lack of time. Universities could develop programs for students and families to educate them on healthy dietary habits. These programs could also teach students how to prepare healthy snacks, how to read food labels, portion control, and how to create a healthy plate. Universities could additionally offer free fruits as snacks, such as bananas or apples, that were not eaten in the cafeteria or are about to expire. Vending machines could include more healthy snacks options. Universities could also provide more information on how

to build a healthy plate through flyers or pamphlets distributed on tables or placed in the walls of the campus cafeteria or restaurants. Universities could also hire a registered dietitian nutritionist to speak to students and/or to offer cooking demonstrations of healthy meals and easy-to-prepare snacks. Additionally, a registered dietitian nutritionist could be available at the university health services to assist students, faculty, and staff with dietary habits. Furthermore, the way that college students perceive the university environment might affect their dietary choices. In a 2016 study, researchers observed that college students who perceived their food environment as healthy consumed more fruits and vegetables than students that did not.[60] Researchers measured students' perception by using the College Environment Behavioral Perception Survey, a 28-question survey that assesses students' perspective of campus safety and maintenance, as well as availability and promotion of healthy foods and physical activity.[61] This survey is good as an assessment of students' perceptions. The survey asks if there are healthy foods in vending machines, signs in the vending machines informing which foods are healthy, and low-cost healthy foods available on campus. These are all good ideas that universities could use in order to promote healthy eating.

Another factor looked at in this study, which could affect college students' dietary habits, is perceived stress. In this study, 89.6% of students reported moderate to high stress levels and greater stress was associated with lower consumption of fruits and vegetables. Universities should consider developing and implementing programs that could potentially decrease stress levels. Students with high stress levels might look for comfort foods that are usually high in fat and added sugars. Teaching students about different coping strategies and implementing programs for stress relief might help decrease stress levels among students and help them to reduce eating unhealthy foods as a stress coping mechanism. Universities can also address

factors that are part of college student's lives that can affect stress level. For example, physical activity was related to lower levels of stress and greater consumption of fruits and vegetables, therefore students might benefit from programs that incentive physical activity. Additionally, averaging 7 hours of sleep or more was also associated with lower stress levels. At the University of the Incarnate Word, the class Dimension of Wellness is mandatory for all students, and it briefly teaches the importance of sleep. Still most of students in this study reported an average sleep duration of 6 hours or less, therefore, one could recommend that further action is needed in order to promote sufficient sleep and its importance. There are many possible reasons why college students are not getting enough sleep. Despite the present study not assessing the possible reasons for less sleep, previous studies have found a relationship between better sleep and more social activities, going outdoors more frequently, better time management, and suitable stress-relieving measures.[62, 63] These factors could be included as a part of the Dimensions of Wellness class or other programs provided by the university. Furthermore, women reported higher stress levels than males did. Policies and programs addressing possible stressors for women could be beneficial. Unfortunately, possible reasons as to why women reported higher levels of stress than men were not assessed in this study.

Additionally, evidence shows that food insecurity has an impact on diet quality. People who experience food insecurity tend to consume less fruits and vegetables and more processed foods than those who are food secured.[10] However, in this study there was no significant difference of dietary intake between college students that experienced food insecurity and those that did not. On the other hand, perceived stress increased if a college student was food insecured. There is the possibility that hunger on its own increases stress. A study in rats showed an increase of cortisol, a stress hormone, when levels of blood glucose are low.[64] However, there

are other factors related to food insecurity that could be associated with stress. In the study conducted in May 2020, researchers observed the same association between food insecurity and stress, and they also found relationships of food insecurity with worries about COVID-19 on a person's health, income, and ability to feed one's family.[56] Concerns about health, income, and one's family are already stressors by themselves without including the hunger factor. In the current study, possible causes of food insecurity and their relationship with stress were not studied, and there is a possibility that food insecurity is not affecting stress by itself. Therefore, addressing only college student's food insecurity might not be enough to decrease their stress. Perhaps it is necessary to also address factors related to food insecurity. Universities could organize a food pantry for college students and their families, especially when the household income is below poverty level. Also, career services departments from universities could develop workshops on how to get back into the job market for students and family members that lost their jobs during the pandemic.

This study underscores the importance of socialization among college students in stress management and dietary habits. It also highlights that a college student's social life does not need to happen only in-person, but online as well. The amount of socialization could have played a role in decreasing stress levels of college students. Students who were spending 21 hours or more per week in front of the screen reported less stress and consumed more fruits and vegetables than those spending 20 hours or less per week, which could be explained by the internet being the only means of communication with families and friends when social restrictions were taking place. This could also translate as the need for universities to continue to develop various events, either online or in-person. These programs could target all students despite their different interests, and that will bring students together through a common interest

they have. For example, there could be an event that brings cultures from different countries for those that are interested in traveling or for those that are from the country. There could also be an event for people that love to read, such as a theme party where students are dressed as the characters of the book, or an event for those that are interested in videogames. Developing events that bring together students with a common interest might be an opportunity for students to create friendship bonds and improve their social satisfaction.

Furthermore, this study showed the importance of bringing various factors together when trying to improve the quality of life of college students. For example, physical activity had a significant relationship with stress and consumption of fruits and vegetables when observed by itself. However, when creating models that predict stress or fruits and vegetables intake that included physical activity and other factors that are part of a college student's routine, physical activity was not a significant factor in the model. The only factors that were significant predictors of stress were food insecurity and sleep, and the only significant factor for predicting consumption of fruits and vegetables was perceived stress. That means that physical activity, living arrangement, and screen time were not significant factors in predicting perceived stress. It also means that physical activity, living arrangement, screen time, sleep, and food insecurity were not significant factors in predicting consumption of fruits and vegetables. However, these results do not take away the importance of the variables that were not significant in managing stress and developing a healthy dietary habit, but it shows that other factors had a bigger influence when trying to predict stress and consumption of fruits and vegetables. Based on the models created in this study, universities need to focus more on decreasing food insecurity among college students and promoting the importance of a healthy sleep routine, while creating different approaches to decrease college students' stress during the academic semester. Most

college events focus on students' socialization and getting ready for the job market, but perhaps it is time to focus more on other factors, such as food insecurity, sleep, and stress, in order to improve college students' quality of life and allow them to take the most advantage from their college years and its teachings.

Limitations

Limitations for this study were the lack of control for the current nutritional and health knowledge of the participants and for biological factors that can affect stress. Another limitation is the lack of data on weight and height. Collecting this data would have allowed the researcher to calculate the recommended daily calories for each participant, to establish the exact daily recommendations set by *The Dietary Guidelines 2020-2025* for food groups, and then determine if the participants were consuming below, at, or above those recommendations. Additionally, there are other known factors that influence the dietary choices of college students. One study found that students who endorsed healthy aesthetic factors, such as health and physical appearance, as important when making food choices would consume more fruits and vegetables and fiber and less added sugars. Meanwhile, students that had reported a busy life, price, and taste preferences as important factors would consume less fruits and vegetables and grains, and more added sugars.[65]

Furthermore, this study did not look at additional factors that can affect stress and diet, such as acute or chronic diseases, family situation, financial or employment status, self-image, stress coping mechanisms, food allergies and preferences. Additionally, gender identification or sexual orientation could play a role in stress depending on the people surrounding the student and the possible resistance they might have in accepting new genders or sexual orientations. This study did not assess other factors that could have played a role in dietary habits, such as family

nutritional knowledge, being an athlete, food allergies or intolerances, and culture or religion. Other limitations to this study were the possible bias that comes with a self-administered questionnaire and a food frequency questionnaire. Another limitation might be the number of students and the lack of diversity of gender and ethnic groups, which limits generalizability to other populations. Finally, this study was conducted during the COVID-19 pandemic and the results may have been different than when college students are not facing the consequences of a pandemic, like social and travel restrictions, use of masks, social distancing, online classes, unemployment, and loss of a loved one.

Future Directions

Universities need to find way to promote healthy dietary habits among the student population and track the progress of the students to evaluate if the program is successful or needs modification. The College Environment Behavioral Perception Survey can be distributed at the end of every year to assess the students' perspective on the campus environment and the results can be used to make necessary changes for the upcoming academic year. Future studies could follow the same methodology as the current study but instead of using a food frequency questionnaire they could use the diet quality index in order to reduce bias and the limitations that come with food frequency questionnaires. Additionally, future studies should include more males and students from different ethnic backgrounds.

In the future, research should look at factors that could be related to the variables assessed in this study. For example, future studies could look at factors that are related to sleep, and after observing which factors have a significant relationship, they could use the results to develop programs or classes to address those factors specifically. Another example for future

studies would be to look at what factors cause stress in female college students and identify the best action(s) to address those problems.

Another recommendation for the future is to re-assess college students with the same questionnaire in order to assess any changes that may occur after the COVID-19 pandemic ends. For example, future studies should evaluate the relationship between screen time and stress after the COVID-19 pandemic restrictions are over. This study found a different result than expected and there is the possibility that social interactions played a role in the current study. However, social restrictions are currently being lifted, classes are set to be face-to-face Fall 2021, and screen time might lead to more stress or it might continue to be an important mean for socialization and a good mechanism for managing stress. Future studies could include other factors that are a part of college student's routine, such as commuting, family demands, work, being an athlete, or participating in students' organizations, as well as control for previous nutritional knowledge.

Conclusions

Results from this study indicate the importance of offering different support systems for college students in order to allow them to enjoy all opportunities and teachings from their college years. Quality of life can be affected by stress, diet, and other factors which are interrelated among themselves. In order to offer a good college experience for all students and help develop well-rounded future professionals, universities need to address the various factors that might impact student success. Stress is present in most college students' lives and plays a major role in academic success. Previous studies have already shown an inverse relationship between stress and GPA.[66, 67] However, academic performance is not the only stressor that college students go through, especially during a pandemic. During the time of this survey, social distancing, wearing

masks, and closure of establishments were still prevalent. The factors observed in this study, such as diet, physical activity, sleep, screen time, and food insecurity, were found to be associated with stress, which was observed in previous studies. [7, 9, 14, 18]

This study could be a basis for new programs to be developed and implemented by universities in order to lower stress among college students and to improve their dietary intake. Based on the results from this study, programs that college students would most likely benefit from would encourage physical activity, focus on women's mental health, educate students on the importance of sleep, address food insecurity, help decrease the students' stress, and provide to students different coping mechanisms when dealing with stress. These programs could potentially decrease stress among college students and improve their dietary intake, thereby increasing their quality of life.

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Appendices

Appendix A

Email Invitation

Dear Sir or Madam,

You are invited to participate in a research study about the diet quality, perceived stress, sleep, screen time, physical activity, and food insecurity during a pandemic among college students here at the University of the Incarnate Word. The information obtained from this survey will be used by UIW students from the Department of Nutrition to find the relationship between these variables and explore the influence that each variable has on an individual's eating behavior. Filling out this 58-question survey (29 questions mandatory and 29 questions non-mandatory) will take only 35-50 minutes. Your participation is completely voluntary, and you may decline to take this survey if you choose. Please note there is no direct benefit that will accrue to you from taking this survey; however, your participation will contribute greatly to our knowledge and future research on what influences eating behaviors. This study could be a base to start building a protocol of actions that people can perform while working at home, to decrease stress, improve diet quality, and consequently improve life quality.

Things you should know-

Your responses to this survey will be anonymous and the research findings from the data collected will be reported in aggregate form. Since we are not collecting any personally identifying information from you, your responses will not be linked back to you.

Taking the survey-

Completing and submitting this survey represents informed consent to participate in the research study. You may choose to opt out of the study at any time. To do so, you may refuse to complete the survey. To take the survey, please click on the link below and follow the directions. This survey will be available for your response until Spring 2021.
https://www.surveymonkey.com/r/QSLQQSK

If you have questions at any time about the study or survey, you may contact either Mariana Alves Olguin at alvesolg@student.uiwtx.edu or Beth Senne-Duff at beths@uiwtx.edu

For questions about your rights as a research participant or to discuss problems, complaints or concerns about a research study, or to obtain information or offer input, contact the UIW Institutional Review Board (IRB) at (210) 805-3036. This research and survey tool has been approved by the UIW IRB (IRB (210) 805-3036).

Thank you in advance for your time.

Sincerely,

Mariana Alves Olguin, Graduate Student

UIW IRB APPROVED
Approval # 20-11-004
Date Approved: 11/13/2020

Appendix B

Screening and Data Collection Questionnaire

1) Are you currently living in the USA? Yes No

2) Are you a current student at UIW? Yes No

Please read the Informed Consent Page in your invitation and answer below.

3) I agree to participate in this study of my own free will. I am 18 years of age or older.

Yes No

4) Where do you currently live?

College Dorms
At home with family
Off-Campus apartment with roommates
Off-Campus apartment without roommates
Other

5) How many hours of sleep do you average per night?
6 hours or less
7 hours or more

6) How many hours per day do you spend in front of the screen? (For screen time include the time spent in the television, computer, cell phone, and video games)?
9 hours or more per day
6 to 9 hours per day
3 to 6 hours per day
Less than 3 hours per day

7) For each of these statements, please choose whether the statement was often true, sometimes true, or never true for (you/your household) in the last 6 months—that is, since last May
   a. "The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more."
      [ ] Often true [ ] Sometimes true [ ] Never true [ ] DK or Refused
   b. "(I/we) couldn't afford to eat balanced meals."
      [ ] Often true [ ] Sometimes true [ ] Never true [ ] DK or Refused Home situation

c. In the last 12 months, since last (name of current month), did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?
[ ] Yes [ ] No (Skip AD1a) [ ] DK (Skip AD1a)

d. [IF YES ABOVE, ASK] How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?
[ ] Almost every month [ ] Some months but not every month [ ] Only 1 or 2 months [ ] DK

e. In the last 6 months, did you ever eat less than you felt you should because there wasn't enough money for food?
[ ] Yes [ ] No [ ] DK

f. In the last 6 months, were you every hungry but didn't eat because there wasn't enough money for food?
[ ] Yes [ ] No [ ] DK

8) For the next 10 statements, please choose how often the statement was true.

	Never	Almost Never	Sometimes	Fairly Often	Very Often
In the last month, how often have you been upset because of something that happened unexpectedly?					
In the last month, how often have you felt that you were unable to control the important things in your life?					
In the last month, how often have you felt nervous and "stressed"?					
In the last month, how often have you felt confident about your ability to handle your personal problems?					
In the last month, how often have you felt that things were going your way?					
In the last month, how often have you found that you could not cope with all the things that you had to do?					
In the last month, how often have you been able to control irritations in your life?					

In the last month, how often have you felt that you were on top of things?					
In the last month, how often have you been angered because of things that were outside of your control?					
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?					

Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

9) During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?
   How much time did you usually spend doing vigorous physical activities on one of those days?
   Number of days per week: _____
   Average minutes per day: _____
10) During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.
   How much time did you usually spend doing moderate physical activities on one of those days?
   Number of days per week: _____
   Average minutes per day: _____

11) During the last 7 days, on how many days did you walk for at least 10 minutes at a time?
   How much time did you usually spend walking on one of those days?
   Number of days per week: _____
   Average minutes per day: _____

12) During the last 7 days, how much time did you spend sitting on a week day?
   Average minutes per day: _____

13) What is your gender?
   a) Female
   b) Male
   c) Prefer not to answer

14) What is your age in years? _____

15) What is your ethnicity?

a) African American/Black
b) Asian/Pacific Islander
c) White
d) Hispanic
e) Native American
f) Other
g) Prefer not to answer

The next 29 questions are not mandatory. However, filling them out will increase the information gathered by the researcher and will lead to a more in-depth analysis of different factors that are part of the routine of college students. The total time to complete these questions should be between 10-15 minutes.

These questions are about the different kinds of foods you ate or drank during the past month, that is, the past 30 days. When answering, please include meals and snacks eaten at home, at work or school, in restaurants, and anyplace else.

16) During the past month, how often did you eat hot or cold cereals?
    a. Never
    b. 1 time last month
    c. 2-3 times last month
    d. 1 time per week
    e. 2 times per week
    f. 3-4 times per week
    g. 5-6 times per week
    h. 1 time per day
    i. 2 or more times per day
17) During the past month, what kind of cereal did you usually eat? (limit to 2)

    _____
18) If there was another kind of cereal that you usually ate during the past month, what kind was it? (if none leave blank) _____
19) During the past month, how often did you have any milk (either to drink or on cereal)? Include regular milks, chocolate or other flavored milks, lactose free milk, buttermilk. Please do not include soy milk or small amounts of milk in coffee or tea. Mark one
    a. Never
    b. 1 time last month
    c. 2-3 times last month
    d. 1 time per week
    e. 2 times per week
    f. 3-4 times per week
    g. 5-6 times per week
    h. 1 time per day
    i. 2-3 times per day
    j. 4-5 times per day
    k. 6 or more times per day
20) During the past month, what kind of milk did you usually drink?
    a. Whole or regular milk

b. 2% fat or reduced fat milk
c. 1%, ½%, or low-fat milk
d. Fat free, skim or nonfat milk
e. Soy milk
f. Other kind of milk

21) If other, please specify which one (if this does not apply to you, leave in blank)_____

22) During the past month, how often did you drink regular soda or pop that contains sugar? Do not include diet soda.
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2-3 times per day
j. 4-5 times per day
k. 6 or more times per day

23) During the past month, how often did you drink 100% pure fruit juices such as orange, mango, apple, grape and pineapple juices? Do not include fruit-flavored drinks with added sugar or fruit juice you made at home and added sugar to.
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2-3 times per day
j. 4-5 times per day
k. 6 or more times per day

24) During the past month, how often did you drink coffee or tea that had sugar or honey added to it? Include coffee and tea you sweetened yourself and presweetened tea and coffee drinks such as Arizona Iced Tea and Frappuccino. Do not include artificially sweetened coffee or diet tea.
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day

i. 2-3 times per day
j. 4-5 times per day
k. 6 or more times per day

25) During the past month, how often did you drink sweetened fruit drinks, sports or energy drinks, such as Kool-Aid, lemonade, Hi-C, cranberry drink, Gatorade, Red Bull or Vitamin Water? Include fruit juices you made at home and added sugar to. Do **not** include diet drinks or artificially sweetened drinks.
    a. Never
    b. 1 time last month
    c. 2-3 times last month
    d. 1 time per week
    e. 2 times per week
    f. 3-4 times per week
    g. 5-6 times per week
    h. 1 time per day
    i. 2-3 times per day
    j. 4-5 times per day
    k. 6 or more times per day
26) During the past month, how often did you eat fruit? Include fresh, frozen or canned fruit. Do not include juices.
    a. Never
    b. 1 time last month
    c. 2-3 times last month
    d. 1 time per week
    e. 2 times per week
    f. 3-4 times per week
    g. 5-6 times per week
    h. 1 time per day
    i. 2 or more times per day
27) During the past month, how often did you eat a green leafy or lettuce salad, with or without other vegetables?
    a. Never
    b. 1 time last month
    c. 2-3 times last month
    d. 1 time per week
    e. 2 times per week
    f. 3-4 times per week
    g. 5-6 times per week
    h. 1 time per day
    i. 2 or more times per day
28) During the past month, how often did you eat any kind of fried potatoes, including French fries, home fries, or hash brown potatoes?
    a. Never
    b. 1 time last month
    c. 2-3 times last month
    d. 1 time per week

e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

29) During the past month, how often did you eat any other kind of potatoes, such as baked, boiled, mashed potatoes, sweet potatoes, or potato salad?
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

30) During the past month, how often did you eat refried beans, baked beans, beans in soup, pork and beans or any other type of cooked dried beans? Do not include green beans.
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

31) During the past month, how often did you eat brown rice or other cooked whole grains, such as bulgur, cracked wheat, or millet? Do not include white rice.
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

32) During the past month, not including what you just told me about (green salads, potatoes, cooked dried beans), how often did you eat other vegetables?
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week

f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

33) During the past month, how often did you have Mexican-type salsa made with tomato?
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

34) During the past month, how often did you eat pizza? Include frozen pizza, fast food pizza, and homemade pizza.
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

35) During the past month, how often did you have tomato sauces such as with spaghetti or noodles or mixed into foods such as lasagna? Do not include tomato sauce on pizza.
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

36) During the past month, how often did you eat any kind of cheese? Include cheese as a snack, cheese on burgers, sandwiches, and cheese in foods such as lasagna, quesadillas, or casseroles. Do not include cheese on pizza.
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week

h. 1 time per day
i. 2 or more times per day

37) During the past month, how often did you eat red meat, such as beef, pork, ham, or sausage? Do not include chicken, turkey or seafood. Include red meat you had in sandwiches, lasagna, stew, and other mixtures. Red meats may also include veal, lamb, and any lunch meats made with these meats.
    a. Never
    b. 1 time last month
    c. 2-3 times last month
    d. 1 time per week
    e. 2 times per week
    f. 3-4 times per week
    g. 5-6 times per week
    h. 1 time per day
    i. 2 or more times per day
38) During the past month, how often did you eat any processed meat, such as bacon, lunch meats, or hot dogs? Include processed meats you had in sandwiches, soups, pizza, casseroles, and other mixtures. Processed meats are those preserved by smoking, curing, or salting, or by the addition of preservatives. Examples are: ham, bacon, pastrami, salami, sausages, bratwursts, frankfurters, hot dogs, and spam.
    a. Never
    b. 1 time last month
    c. 2-3 times last month
    d. 1 time per week
    e. 2 times per week
    f. 3-4 times per week
    g. 5-6 times per week
    h. 1 time per day
    i. 2 or more times per day
39) During the past month, how often did you eat whole grain bread including toast, rolls and in sandwiches? Whole grain breads include whole wheat, rye, oatmeal and pumpernickel. Do not include white bread.
    a. Never
    b. 1 time last month
    c. 2-3 times last month
    d. 1 time per week
    e. 2 times per week
    f. 3-4 times per week
    g. 5-6 times per week
    h. 1 time per day
    i. 2 or more times per day
40) During the past month, how often did you eat chocolate or any other types of candy? Do not include sugar-free candy.
    a. Never
    b. 1 time last month

c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

41) During the past month, how often did you eat doughnuts, sweet rolls, Danish, muffins, pan dulce, or pop-tarts? Do not include sugar-free items.
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

42) During the past month, how often did you eat cookies, cake, pie or brownies? Do not include sugar-free kinds.
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

43) During the past month, how often did you eat ice cream or other frozen desserts? Do not include sugar-free kinds.
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week
f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

44) During the past month, how often did you eat popcorn?
a. Never
b. 1 time last month
c. 2-3 times last month
d. 1 time per week
e. 2 times per week

f. 3-4 times per week
g. 5-6 times per week
h. 1 time per day
i. 2 or more times per day

Appendix C

Formulas for Calculating Dietary Intake

1) Formulas for Daily Intake of Fruits and Vegetables (cups)

$E = b_0 + (3) + (4) + (5) + (6) + (7) + (8) + (9) + (10) + (11) + (12)$

Values for b_0 for Fruits and Vegetables according to Gender

Males	Females
1.753279	1.602535

Values for Fruits according to Age and Gender (3)

Age (years)	Males	Females
18-25	.836732 * df * .99	.779829 * df * .76
26-35	.836732 * df * .76	.779829 * df * .733333
36-45	.836732 * df * .721667	.779829 * df * .71
46-60	.836732 * df * .94	.779829 * df * .71
61-69	.836732 * df * .764	.779829 * df * .71

Note. Df = Daily frequency

Values for 100% Fruit Juice according to Age and Gender (4)

Age (years)	Males	Females
18-25	.279756 * df * 1.305	.291685 * df * .99
26-35	.279756 * df * 1.305	.291685 * df * .94
36-45	.279756 * df * 1.06	.291685 * df * .826667
46-60	.279756 * df * 1.00	.291685 * df * .783750
61-69	.279756 * df * .981667	.291685 * df * .62

Note. Df = Daily frequency

Values for Salad according to Age and Gender (5)

Age (years)	Males	Females
18-25	1.33521 * df * .25	1.490937 * df * .28
26-35	1.33521 * df * .3	1.490937 * df * .28
36-45	1.33521 * df * .265	1.490937 * df * .4025
46-60	1.33521 * df * .38	1.490937 * df * .44
61-69	1.33521 * df * .33	1.490937 * df * .396667

Note. Df = Daily frequency

Values for Fried Potatoes according to Age and Gender (6)

Age (years)	Males	Females
18-25	-.572394 * df * .55	-.656475 * df * .535
26-35	-.572394 * df * .56	-.656475 * df * .535
36-45	-.572394 * df * .64	-.656475 * df * .435
46-60	-.572394 * df * .55	-.656475 * df * .4175

61-69	-.572394 * df * .53	-.656475 * df * .445

Note. Df = Daily frequency

Values for Other Potatoes according to Age and Gender (7)

Age (years)	Males	Females
18-25	.266937 * df * .845	.075593 * df * .57
26-35	.266937 * df * .85	.075593 * df * .54
36-45	.266937 * df * .88875	.075593 * df * .59
46-60	.266937 * df * .77	.075593 * df * .54
61-69	.266937 * df * .81	.075593 * df * .53

Note. Df = Daily frequency

Values for Dried Beans according to Age and Gender (8)

Age (years)	Males	Females
18-25	.957201 * df * .65	.503731 * df * .48
26-35	.957201 * df * .56	.503731 * df * .495
36-45	.957201 * df * .73	.503731 * df * .43
46-60	.957201 * df * .63	.503731 * df * .47
61-69	.957201 * df * .655	.503731 * df * .34

Note. Df = Daily frequency

Values for Other Vegetables according to Age and Gender (9)

Age (years)	Males	Females
18-25	.974069 * df * .525	.456919 * df * .4925
26-35	.974069 * df * .545	.456919 * df * .4775
36-45	.974069 * df * .555	.456919 * df * .5
46-60	.974069 * df * .56	.456919 * df * .5
61-69	.974069 * df * .57	.456919 * df * .51

Note. Df = Daily frequency

Values for Pizza according to Age and Gender (10)

Age (years)	Males	Females
18-25	-1.484133 * df * .22	-.688108 * df * .175417
26-35	-1.484133 * df * .26	-.688108 * df * .17
36-45	-1.484133 * df * .24	-.688108 * df * .17
46-60	-1.484133 * df * .24	-.688108 * df * .16
61-69	-1.484133 * df * .25	-.688108 * df * .15

Note. Df = Daily frequency

Values for Salsa according to Age and Gender (11)

Age (years)	Males	Females
18-25	1.149177 * df * .11	-1.568485 * df * .14
26-35	1.149177 * df * .17	-1.568485 * df * .14
36-45	1.149177 * df * .17	-1.568485 * df * .17
46-60	1.149177 * df * .12	-1.568485 * df * .09
61-69	1.149177 * df * .09	-1.568485 * df * .11

Note. Df = Daily frequency

Values for Tomato Sauce according to Age and Gender (12)

Age (years)	Males	Females
18-25	.234135 * df * .56	.339691 * df * .47
26-35	.234135 * df * .605	.339691 * df * .505
36-45	.234135 * df * .68	.339691 * df * .47
46-60	.234135 * df * .496667	.339691 * df * .4425
61-69	.234135 * df * .47	.339691 * df * .4875

Note. Df = Daily frequency

2) Formula for Daily Intake of Dairy (cups):

$E = b_0 + (13) + (14) + (15) + (16)$

b_0 values for Dairy according to Gender

Male	Female
.946226	.890477

Values for Pizza according to Age and Gender (13)

Age (years)	Male	Female
18-25	1.19755 * df * 1.13	1.096476 * df * .896667
26-35	1.19755 * df * 1.125	1.096476 * df * .87
36-45	1.19755 * df * 1.16	1.096476 * df * .78
46-60	1.19755 * df * 1.29	1.096476 * df * .795
61-69	1.19755 * df * 1.2	1.096476 * df * .64

Note. Df = Daily frequency

Values for Cheese according to Age and Gender (14)

Age (years)	Male	Female
18-25	.61467 * df * .89	.518081 * df * .67
26-35	.61467 * df * .76	.518081 * df * .67
36-45	.61467 * df * .74	.518081 * df * .6625
46-60	.61467 * df * .72875	.518081 * df * .67
61-69	.61467 * df * .74	.518081 * df * .625

Note. Df = Daily frequency

Values for Milk according to Age and Gender (15)

Age (years)	Male	Female
18-25	.62799 * df * 1.150833	.508564 * df * 1.00
26-35	.62799 * df * 1.0625	.508564 * df * 1.00
36-45	.62799 * df * 1.25	.508564 * df * 1.00
46-60	.62799 * df * 1.00	.508564 * df * .855
61-69	.62799 * df * .94	.508564 * df * .75

Note. Df = Daily frequency

Values for Frozen Dessert according to Age and Gender (16)

Age (years)	Male	Female
18-25	3.041808 * df * .21	2.102278 * df * .17
26-35	3.041808 * df * .24	2.102278 * df * .18
36-45	3.041808 * df * .26	2.102278 * df * .21
46-60	3.041808 * df * .26	2.102278 * df * .23
61-69	3.041808 * df * .2325	2.102278 * df * .19

Note. Df = Daily frequency

3) Formula for Daily Intake of Added Sugar (teaspoon):

$E = b_0 + (17) + (18) + (19) + (20) + (21) + (22) + (23) + (24) + (25) + (26)$

b_0 values for Added Sugar according to Gender

Male	Female
10.06361	9.98989

Values for Frozen Dessert according to Age and Gender (17)

Age (years)	Male	Female
18-25	2.313536 * df * 4.81	1.058834 * df * 3.53
26-35	2.313536 * df * 4.82	1.058834 * df * 4.79
36-45	2.313536 * df * 4.9175	1.058834 * df * 3.79
46-60	2.313536 * df * 4.845	1.058834 * df * 4.33
61-69	2.313536 * df * 4.405	1.058834 * df * 3.476667

Note. Df = Daily frequency

Values for Soda according to Age and Gender (18)

Age (years)	Male	Female
18-25	.644058 * df * 9.596667	.676036 * df * 7.88
26-35	.644058 * df * 9.56	.676036 * df * 7.88
36-45	.644058 * df * 9.803333	.676036 * df * 7.88
46-60	.644058 * df * 9.92	.676036 * df * 7.655
61-69	.644058 * df * 7.88	.676036 * df * 7.58

Note. Df = Daily frequency

Values for Sugar/Honey in Coffee/Tea according to Age and Gender (19)

Age (years)	Male	Female
18-25	3.681715 * df * .99	2.958761 * df * .6875
26-35	3.681715 * df * .745	2.958761 * df * .62
36-45	3.681715 * df * .66	2.958761 * df * .495
46-60	3.681715 * df * .495	2.958761 * df * .014167
61-69	3.681715 * df * .49	2.958761 * df * .00

Note. Df = Daily frequency

Values for Sports Drinks according to Age and Gender (20)

Age (years)	Male	Female
18-25	.495203 * df * 9.025	.4531 * df * 6.67
26-35	.495203 * df * 8.665	.4531 * df * 6.12
36-45	.495203 * df * 9.15	.4531 * df * 5.41
46-60	.495203 * df * 6.51	.4531 * df * 4.592
61-69	.495203 * df * 5.055	.4531 * df * 3.2

Note. Df = Daily frequency

Values for Candy according to Age and Gender (21)

Age (years)	Male	Female
18-25	1.673119 * df * 2.81	1.781276 * df * 2.3
26-35	1.673119 * df * 2.605	1.781276 * df * 1.97
36-45	1.673119 * df * 3.2875	1.781276 * df * 2.28
46-60	1.673119 * df * 2.62	1.781276 * df * 2.12
61-69	1.673119 * df * 2.325	1.781276 * df * 2.385

Note. Df = Daily frequency

Values for Doughnuts according to Age and Gender (22)

Age (years)	Male	Female
18-25	.658999 * df * 4.05	-.064991 * df * 3.59
26-35	.658999 * df * 2.9875	-.064991 * df * 2.68
36-45	.658999 * df * 3.265	-.064991 * df * 2.715
46-60	.658999 * df * 3.12	-.064991 * df * 2.6
61-69	.658999 * df * 3.12	-.064991 * df * 2.38

Note. Df = Daily frequency

Values for Cookie, pie, cake, brownie according to Age and Gender (23)

Age (years)	Male	Female
18-25	.624016 * df * 4.65	.275522 * df * 3.225
26-35	.624016 * df * 4.16	.275522 * df * 3.15
36-45	.624016 * df * 4.04	.275522 * df * 3.05
46-60	.624016 * df * 3.74	.275522 * df * 2.95
61-69	.624016 * df * 3.295	.275522 * df * 2.45

Note. Df = Daily frequency

Values for First Tercile for Added Sugar Cereal according to Age and Gender (24)

Age (years)	Male	Female
18-25	-9.586924 * df * .00	-13.976705 * df * .00
26-35	-9.586924 * df * .00	-13.976705 * df * .00
36-45	-9.586924 * df * .00	-13.976705 * df * .00

46-60	-9.586924 ∗ df ∗ .00	-13.976705 ∗ df ∗ .00
61-69	-9.586924 ∗ df ∗ .00	-13.976705 ∗ df ∗ .00

Note. Df = Daily frequency

Values for Second Tercile for Added Sugar Cereal according to Age and Gender (25)

Age (years)	Male	Female
18-25	.405884 ∗ df ∗ 2.08	.782372 ∗ df ∗ 1.97
26-35	.405884 ∗ df ∗ 2.08	.782372 ∗ df ∗ 2.05
36-45	.405884 ∗ df ∗ 2.57	.782372 ∗ df ∗ 1.96
46-60	.405884 ∗ df ∗ 2.1225	.782372 ∗ df ∗ 1.8655
61-69	.405884 ∗ df ∗ 1.835	.782372 ∗ df ∗ 1.59

Note. Df = Daily frequency

Values for Third Tercile for Added Sugar Cereal according to Age and Gender (26)

Age (years)	Male	Female
18-25	.769045 ∗ df ∗ 4.705	.865238 ∗ df ∗ 3.425
26-35	.769045 ∗ df ∗ 4.315	.865238 ∗ df ∗ 3.685
36-45	.769045 ∗ df ∗ 4.445	.865238 ∗ df ∗ 3.3
46-60	.769045 ∗ df ∗ 4.75	.865238 ∗ df ∗ 3.34
61-69	.769045 ∗ df ∗ 3.71	.865238 ∗ df ∗ 2.83

Note. Df = Daily frequency

4) Formula for Daily Intake of Whole Grain (oz):

$E = b_0 + (27) + (28) + (29) + (30) + (31) + (32)$

b_0 values for Whole Grain according to Gender

Male	Female
-.331871	-.354237

Values for First Tercile for Whole Wheat Cereal according to Age and Gender (27)

Age (years)	Male	Female
18-25	-.000736 ∗ df ∗ 50.75	-.001394 ∗ df ∗ 43.56
26-35	-.000736 ∗ df ∗ 48.565	-.001394 ∗ df ∗ 46.13
36-45	-.000736 ∗ df ∗ 63.916667	-.001394 ∗ df ∗ 43.75
46-60	-.000736 ∗ df ∗ 56	-.001394 ∗ df ∗ 41.44
61-69	-.000736 ∗ df ∗ 51.905	-.001394 ∗ df ∗ 60.9

Note. Df = Daily frequency

Values for Second Tercile for Whole Wheat Cereal according to Age and Gender (28)

Age (years)	Male	Female
18-25	.005708 ∗ df ∗ 87.5	.004205 ∗ df ∗ 61.815
26-35	.005708 ∗ df ∗ 89.23	.004205 ∗ df ∗ 73.125

36-45	.005708 * df * 152.5	.004205 * df * 131.63
46-60	.005708 * df * 175.5	.004205 * df * 175.5
61-69	.005708 * df * 175.5	.004205 * df * 165

Note. Df = Daily frequency

Values for Third Tercile for Whole Wheat Cereal according to Age and Gender (29)

Age (years)	Male	Female
18-25	.018721 * df * 54.75	.018847 * df * 42
26-35	.018721 * df * 58.53	.018847 * df * 43.515
36-45	.018721 * df * 56	.018847 * df * 41.125
46-60	.018721 * df * 56.31	.018847 * df * 41.44
61-69	.018721 * df * 46.38	.018847 * df * 30.135

Note. Df = Daily frequency

Values for Brown Rice according to Age and Gender (30)

Age (years)	Male	Female
18-25	.003872 * df * 176.53	.004398 * df * 147
26-35	.003872 * df * 197.5	.004398 * df * 142.6283
36-45	.003872 * df * 172.3	.004398 * df * 136.4575
46-60	.003872 * df * 164	.004398 * df * 133.88667
61-69	.003872 * df * 158.10333	.004398 * df * 119.5

Note. Df = Daily frequency

Values for Whole Wheat Bread according to Age and Gender (31)

Age (years)	Male	Female
18-25	.007856 * df * 59.166667	.007039 * df * 52
26-35	.007856 * df * 57.435	.007039 * df * 52
36-45	.007856 * df * 56	.007039 * df * 50
46-60	.007856 * df * 56	.007039 * df * 48
61-69	.007856 * df * 52	.007039 * df * 43

Note. Df = Daily frequency

Values for Popcorn according to Age and Gender (32)

Age (years)	Male	Female
18-25	.008064 * df * 42.5	.013032 * df * 29.315
26-35	.008064 * df * 45.19	.013032 * df * 28.175
36-45	.008064 * df * 55.13	.013032 * df * 26
46-60	.008064 * df * 43.53	.013032 * df * 39.67
61-69	.008064 * df * 44	.013032 * df * 25.41

Note. Df = Daily frequency

Appendix D

Participants Demographics and Behavioral Characteristics

Table 7

Selected Demographic of the Sample Population before Exclusion

		Number	Percent
Gender			
	Female	167	55.5
	Male	50	16.6
	Prefer not to answer	4	1.3
	Missing answer	80	26.6
	Total	301	100.0
Ethnicity			
	African American/Black	8	2.7
	Asian/Pacific Islander	10	3.3
	White	48	15.9
	Hispanic	137	45.5
	Native American	3	1.0
	Other	8	2.7
	Missing answer	80	26.6
	Total	301	100.0
Living Arrangement			
	College Dorms	45	15.0
	At home with family	170	56.5
	Off-Campus apartment with roommates	24	8.0
	Off-campus apartment without roommate	22	7.3
	Other	8	2.7
	Missing answer	32	10.6
	Total	301	100.0

Table 8

Selected Demographic and Behavioral Characteristics of the Final Sample Population after Exclusion

		Number	Percent
Gender			
	Female	115	74.7
	Male	39	25.3
	Total	154	100.0
Ethnicity			
	African American/Black	7	4.5

Asian/Pacific Islander	9	5.8
White	36	23.4
Hispanic	96	62.3
Native American	2	1.3
Other	4	2.6
Total	154	100.0
Living Arrangement		
College Dorms	25	16.2
At home with family	100	64.9
Off-Campus apartment with roommates	15	9.7
Off-campus apartment without roommate	9	5.8
Other	5	3.2
Total	154	100.0
Food Insecurity		
None	84	54.5
Low	48	31.2
High	22	14.3
Total	154	100.0
PSS		
Low	16	10.4
Moderate	87	56.5
High	51	33.1
Total	154	100.0
Physical Activity		
Low Physical Activity	52	33.8
High Physical Activity	102	66.2
Total	154	100.0
Screen Time/day		
Less than 3 hours	74	48.1
3 to 6 hours	50	32.5
6 to 9 hours	29	18.8
9 hours or more	1	0.6
Total	154	100.0
Sleep amount/night		
6 hours or less	90	58.4
7 hours or more	64	41.6
Total	154	100.0

Note. PSS = Perceived Stress Score.

Appendix E

Comparison of Food Groups Intake and Perceived Stress among Different Groups

Table 9

Comparison of Average Consumption of Different Food Groups within PSS, Physical Activity, Gender and Food Insecurity.

Dependent Variable	Independent variable		Mean	SD	t-value	df	P-value
Fruits and Vegetables (Cups)							
	PSS	Low perceived stress	2.86	.63	3.22	152	.002**
		Moderate to High perceived stress	2.25	.72			
	Food Insecurity	Food security	2.41	.83	1.866	152	.064
		Food insecurity	2.19	.57			
	Physical activity	Low physical activity	2.18	.56	-2.646*	69.57	.01**
		High physical activity	2.56	.95			
	Gender	Male	2.81	.89	4.313*	49.79	<.001**
		Female	2.15	.59			
	Screen Time	20 hours or less	2.17	.69	-2.382	152	.018**
		21 hours or more	2.45	.75			
	Ethnicity	Non-Hispanic	2.37	.80	.734	152	.464
		Hispanic	2.28	.69			
	Sleep	6 hours or less	2.21	.58	-2.134	152	.34
		7 hours or more	2.46	.89			
	LR	With family	2.28	.65	.827	152	.409
		Without family	2.38	.87			
Added Sugar (tsp.)							

	PSS	Low perceived stress	14.87	3.73	-1.455	152	.148
		Moderate to High perceived stress	18.07	8.69			
	Food Insecurity	Food security	17.69	9.60	-.071	152	.943
		Food insecurity	17.79	6.66			
	Physical activity	Low physical activity	17.77	8.80	.063	152	.950
		High physical activity	17.68	7.53			
	Gender	Male	20.79	10.63	2.231*	50.41	.030**
		Female	16.71	7.22			
	Screen Time	20 hours or less	18.81	9.79	1.534	152	.127
		21 hours or more	16.75	6.71			
	Ethnicity	Hispanic	17.38	6.78	-.405	152	.686
		Non-Hispanic	17.95	9.22			
	Sleep	6 hours or less	18.48	8.42	1.3	152	.196
		7 hours or more	16.71	8.25			
	LR	With family	17.72	9.06	.034	152	.973
		Without family	17.77	6.99			
Whole Grain (oz)							
	PSS	Low perceived stress	.89	.47	1.857	152	.065
		Moderate to High perceived stress	.73	.31			
	Food Insecurity	Food security	.74	.35	-.413	152	.950
		Food insecurity	.76	.29			
	Physical activity	Low physical activity	.74	.35	-.413	152	.680
		High physical activity	.76	.29			

	Gender	Male	.92	.38	3.91	152	<.001**
		Female	.69	.29			
	Screen Time	20 hours or less	.69	.29	-1.927	152	.054
		21 hours or more	.79	.36			
	Ethnicity	Non-Hispanic	.78	.38	1.02	152	.309
		Hispanic	.73	.30			
	Sleep	6 hours or less	.75	.31	.208	152	.835
		7 hours or more	.74	.36			
	LR	With family	.73	.36	.752	152	.453
		Without family	.78	.28			
Dairy (Cups)							
	PSS	Low perceived stress	1.74	.44	.004	152	.997
		Moderate to High perceived stress	1.74	.91			
	Food Insecurity	Food security	1.70	.86	-.681	152	.497
		Food insecurity	1.80	.92			
	Physical activity	Low physical activity	1.70	.86	-.681	152	.497
		High physical activity	1.80	.92			
	Gender	Male	1.87	.50	1.076	152	.284
		Female	1.69	.97			
	Screen Time	20 hours or less	1.76	.94	.307	152	.759
		21 hours or more	1.72	.82			
	Ethnicity	Hispanic	1.71	.71	.442	152	.659
		Non-Hispanic	1.78	1.11			
	Sleep	6 hours or less	1.74	.87	.065	152	.948
		7 hours or more	1.73	.89			
	LR	With family	1.70	.62	-.328	152	.453
		Without family	1.75	.99			

*Levene's test for equality of variance < .05

**P-value < .05, mean difference statistically significant

Note. SD = Standard Deviation. PSS = Perceived Stress Score. Df = Degree of Freedom. LR = Living Arrangement.

Table 10

Comparison of Perceived Stress Scores within Different Variables Groups

Dependent Variable	Independent Variable		Mean	SD	t-value	df	P-value
Perceived Stress Score							
	Physical activity	Low physical activity	23.93	.56	2.551	152	.012**
		High physical activity	20.79	.95			
	Gender	Male	18.95	7.67	-4.039	152	<.001**
		Female	24.20	6.79			
	Screen Time	20 hours or less	24.42	7.16	2.557	152	.012**
		21 hours or more	21.43	7.87			
	Ethnicity	Hispanic	23.35	7.33	-1.05	152	.295
		Non-Hispanic	22.07	7.41			
	Sleep	6 hours or less	25.03	6.53	4.602	152	<.001**
		7 hours or more	19.83	7.43			
	LR	With family	22.76	7.92	.252	152	.801
		Without family	23.07	6.24			

**P-value < .05, mean difference statistically significant

Appendix F

ANOVA and Post-Hoc Tables

Table 11

Comparison of Mean Perceived Stress Scores among Food Insecurity Groups

		Sum of squares	Df	Mean square	F	Sig.
Food Insecurity	Between groups	685.72	2	342.86	6.81	.001*
	Within Groups	7601.68	151	50.34		
	Total	8287.40	153			

*P-value < .05

Note. df = Degree of freedom. Food insecurity groups are "No Food Insecurity", "Low Food Insecurity", and "High Food Insecurity".

Table 12

Tukey HSD Results – Mean Difference of Perceived Stress Scores among Food Insecurity Groups

Dependent variable						95% Confidence Interval	
PSS	**(I) FI**	**(J) FI**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**Lower Bound**	**Upper Bound**
	No FI	Low FI	-3.53*	1.28	.018	-6.57	-.49
		High FI	-5.31*	1.69	.006	-9.33	-1.28
	Low FI	No FI	3.53*	1.28	.018	.49	6.57
		High FI	-1.78	1.83	.595	-6.10	2.55
	High FI	No FI	5.31*	1.69	.006	1.28	9.33
		Low FI	1.78	1.83	.595	-2.55	6.10

*The mean difference is significant at the .05 level.

Note. PSS = Perceived Stress Score. FI = Food Insecurity.

Table 13

Comparison of Average Consumption of Different Food Groups among the Perceived Stress Score Groups

Dependent Variables	PSS	Sum of squares	df	Mean square	F	Sig.
Fruits and Vegetables (cup)	Between groups	7.10	2	3.55	7.11	.001*

	Within Groups	75.34	151	.49		
	Total	82.44	153			
Dairy (cup)	Between groups	.01	2	.004	.01	.994
	Within Groups	117.79	151	.78		
	Total	117.81	153			
Added Sugar (tsp.)	Between groups	248.19	2	124.09	1.79	.170
	Within Groups	10465.02	151	69.30		
	Total	10713.21	153			
Whole Grain (oz)	Between groups	.38	2	.19	1.72	.183
	Within Groups	16.84	151	.11		
	Total	17.22	153			

*P-value < .05, mean difference statistically significant

Note. PSS = Perceived Stress Scores. df = degree of freedom. tsp. = teaspoon. Perceived Stress Score groups are low perceived stress, moderate perceived stress, and high perceived stress.

Table 14

Tukey HSD Results - Mean Difference of Consumption of Fruits and Vegetables among Perceived Stress Groups

Dependent variable						**95% Confidence Interval**	
Fruits and Vegetables (cup)	**(I) PSS**	**(J) PSS**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**Lower Bound**	**Upper Bound**
	low	moderate	.52*	.19	.021	.06	.97
		high	.76*	.20	.001	.28	1.24
	moderate	low	-.52*	.19	.021	-.97	-.06
		high	.24	.12	.137	-.06	.53
	high	low	-.76*	.20	.001	-1.24	-.28
		moderate	-.24	.12	.137	-.53	.06

*The mean difference is significant at the .05 level.

Note. PSS = Perceived Stress Score.

Table 15

Comparison of Mean Dietary Intake and Perceived Stress Scores among 3 Ethnic Groups

		Sum of squares	**Df**	**Mean square**	**F**	**Sig.**
Fruits and Vegetables	Between groups	.32	2	.16	.29	.746
	Within Groups	82.12	151	.54		

	Total	82.44	153			
Whole Grain	Between groups	.169	2	.08	.75	.475
	Within Groups	17.05	151	.11		
	Total	17.22	153			
Added Sugar	Between groups	31.20	2	15.60	.22	.802
	Within Groups	10682.01	151	70.74		
	Total	10713.21	153			
Dairy	Between groups	1.04	2	.52	.67	.513
	Within Groups	116.77	151	.77		
	Total	117.81	153			
PSS	Between groups	62.83	2	31.41	.58	.563
	Within Groups	822.57	151	54.47		
	Total	8287.40	153			

*P-value < .05

Note. PSS = Perceived Stress Score. df = Degree of freedom. The 3 ethnic groups are "Hispanic", "White", and "Others".

Table 16

Comparison of Mean Dietary Intake and Perceived Stress Scores among Five Ethnic Groups

		Sum of squares	**Df**	**Mean square**	**F**	**Sig.**
Fruits and Vegetables	Between groups	1.51	4	.38	.82	.514
	Within Groups	66.58	145	.46		
	Total	68.01	149			
Whole Grain	Between groups	.582	4	.14	1.51	.204
	Within Groups	14.02	145	.09		
	Total	14.59	149			
Added Sugar	Between groups	305.04	4	76.26	1.13	.344
	Within Groups	9780.11	145	67.45		

	Total	10085.15	149			
Dairy	Between groups	2.75	4	.69	1.232	.300
	Within Groups	80.95	145	.56		
	Total	83.71	149			
PSS	Between groups	65.16	4	16.29	.29	.882
	Within Groups	8058.71	145	55.58		
	Total	8123.87	149			

*P-value < .05

Note. PSS = Perceived Stress Score. df = Degree of freedom. The five ethnic groups are "Hispanic", "White", "Asian/Pacific Islander", "African American/Black", and "Native American"

Appendix G

Multiple Linear Regression for Predicting Food Groups Intake

Table 17

Summary of Multiple Regression Analysis for Predicting Daily Consumption of Dairy

	Model E			Model F		
Variable	**B**	**SE B**	**β**	**B**	**SE B**	**β**
Constant	2.098*	.444	-	1.941*	.552	-
Physical Activity	-.013	.150	-.008	-.007	.151	-.004
LR	-.021	.144	-.013	-.018	.144	-.011
Screen Time	-.086	.136	-.054	-.076	.138	-.048
Sleep	-.105	.138	-.065	-.086	.144	-.053
FI	-.037	.036	-.090	-.041	.037	-.101
PSS	-	-	-	.005	.010	.045
R^2		.014			.016	
Adjusted R^2		-.020			-.025	
F		.419			.386	

*P-value < .05

Note. FI = Food Insecurity. PSS = Perceived Stress Score. LR = Living Arrangement. Model E is predicting Dairy without including PSS. Model F is predicting Dairy with all variables included in model E, and PSS added as a predicting variable.

Table 18

Summary of Multiple Regression Analysis for Predicting Daily Consumption of Whole Grain

	Model G			Model H		
Variable	**B**	**SE B**	**β**	**B**	**SE B**	**β**
Constant	.679*	.188	-	.890*	.232	-
Physical Activity	-.004	.064	-.005	-.012	.063	-.016
LR	-.027	.061	-.039	-.031	.061	-.044
Screen Time	.112	.057	.166	.098	.058	.146
Sleep	-.039	.058	-.057	-.065	.060	-.094

FI	.002	.015	.012	.008	.016	-.142
PSS	-	-	-	-.007	.004	-.142
R^2		.030			.045	
Adjusted R^2		-.004			.006	
F		.886			1.143	

*P-value < .05

Note. FI = Food Insecurity. PSS = Perceived Stress Score. LR = Living Arrangement. Model G is predicting Whole Grain without including PSS. Model H is predicting Whole Grain with all variables included in model G, and PSS added as a predicting variable.

Table 19

Summary of Multiple Regression Analysis for Predicting Daily Consumption of Added Sugar

	Model I			**Model J**		
Variable	**B**	**SE B**	**β**	**B**	**SE B**	**β**
Constant	23.058*	4.694	-	24.883*	5.827	-
Physical Activity	.486	1.588	.027	.416	1.597	.023
LR	-.446	1.519	-.025	-.479	1.524	-.027
Screen Time	-1.926	1.396	-.115	-2.118	1.453	-.126
Sleep	-2.001	1.433	-.119	-1.618	1.517	-.095
FI	-.089	.378	-.021	-.035	.393	-.008
PSS	-	-	-	-.056	.106	-.049
R^2		.024			.026	
Adjusted R^2		-.010			-.015	
F		.712			.638	

*P-value < .05

Note. FI = Food Insecurity. PSS = Perceived Stress Score. LR = Living Arrangement. Model I is predicting Added Sugar without including PSS. Model J is predicting Added Sugar with all variables included in model I, and PSS added as a predicting variable.