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Stress, Lifestyle, and Diet in College Students: Analysis of the YEAH Study

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STRESS, LIFESTYLE, AND DIET IN COLLEGE STUDENTS:

ANALYSIS OF THE YEAH STUDY

BY

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ABSTRACT

Objective: This study explored relationships among perceived stress, BMI, waist circumference, and eating and physical activity behaviors in college students and gender differences in these relationships.

Participants: Students from fourteen universities (n=1,116) recruited for a web-based health intervention in fall of 2009.

Methods: Secondary data analysis of study sample at baseline. Associations between stress, BMI and waist circumference, diet, weight-related eating behaviors, and physical activity were explored, as were the between-gender differences in these associations.

Results: Stress was positively correlated with BMI and waist circumference in females, but not in males. Females reported higher levels of stress and scored higher on all four subscales of the Weight Related Eating Questionnaire (WREQ) compared to males. There were significant stress and gender interaction effects for routine restraint and compensatory restraint scores. Compensatory restraint score only differed between stress tertiles in males.

Conclusions: Higher stress in college students is associated with slightly higher BMI and waist circumference. Females engage in more weight-related eating behaviors than males. There is a stronger association between stress and dietary restraint behaviors in males than in females.

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PREFACE

This thesis is written in Manuscript Format. It will follow the formatting guidelines of the Journal of American College Health. Following the successful defense of this thesis, the manuscript will be submitted to the Journal of American College Health to be considered for publication.

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CHAPTER 1

Stress, Lifestyle, and Diet in College Students: Analysis of the YEAH Study

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INTRODUCTION

Chronic diseases, including cardiovascular disease, diabetes, and cancer, are some of the most common causes of morbidity and mortality in the United States. The Centers for Disease Control and Prevention (CDC) reports that 7 out of 10 deaths in the U.S. are the result of chronic illnesses, and that almost half of all adults in the country have at least one chronic disease[1]. Obesity, a major risk factor for many chronic diseases, now affects over a third of adults and one in five children[1]. Though chronic diseases are some of the most costly health problems[1, 2], modifiable behaviors such as diet[1-6] and physical activity habits[1, 2, 7, 8] can prevent, delay, or lessen the severity of many chronic diseases, either directly or indirectly through weight management.

Young adulthood is a pivotal stage of transition in life during which many health behaviors develop[9-13]. Eating habits developed in young adulthood tend have negative effects on health[14]. Steep declines in physical activity are observed in the transition from high school to college and again after leaving college[2]. Time constraints, lack of money, and health concerns affect food choices for young adults both in college and not in college, though students are more likely to view foods in terms of convenience and place less importance on nutrition[14]. This may in part be due to the stressors common to most college students[15].

Stress, which can be defined as when events or environmental circumstances exceed one's perceived ability to cope[16], can negatively affect overall health[2]. In addition to potentially harmful hormonal shifts[17], stress is associated with decreases self-efficacy to perform physical activity[18], increased consumption of high-fat and high-carbohydrate “comfort” foods[13, 19] and energy drinks[20], decreased consumption of healthful foods like fruits and vegetables[13] and can influence dietary behaviors such as restraint behaviors, emotional eating, and eating in response to external cues[11].

However, studying the relationships between stress, weight, and behaviors is complicated by contradictory outcomes and gender differences. Weight changes in college students tend to be similar for males and females, however males may lose weight when stressed, or be actively trying to gain weight[21]. While stress is typically negatively associated with physical activity, some individuals may exercise due to stress related to body image[8]. Stress related over-consumption and emotional eating may be more prevalent in females[7, 11, 21, 22], while males may vary more in their restraint behaviors[11].

The complexity of stress and health behavior interactions and the gender differences involved warrant further study. Less is known about these behavior differences in college students[13], and the importance of health behaviors developed in young adulthood make them an important population to target for behavioral interventions. The goal of this study was to examine the relationships between stress and dietary and physical activity behaviors in the college population, and to explore gender differences in these stress-behavior relationships. Improving understanding of such relationships may provide an evidence base for gender-specific approaches to reducing the potential ill effects stress may have on the health of college students.

METHODS

This study was a secondary analysis of baseline data from the Young Adults Eating and Active for Health (YEAH) study. The YEAH study was a randomized controlled trial using a 10-week web-based health intervention for college students. Participants in the YEAH study were first, second, and third year full-time students from fourteen participating universities: Tuskegee University, Purdue University, University of Florida, Kansas State University, University of Maine, Michigan State University, University of New Hampshire, Rutgers University, Syracuse University, East Carolina University, University of Rhode Island, South Dakota State University, West Virginia University, and University of Wisconsin – Madison.

Subjects in the YEAH study were recruited as a convenience sample through large university lecture classes, campus e-mail networks, social networking sites, flyers, informational tables set up at campus common facilities, and student newspapers. To participate in the study, students had to meet the following criteria: body mass index $\geq$ 18.5; free from life-threatening illnesses or medical conditions that would contraindicate participation in the nutrition and fitness intervention; not majoring in nutrition, exercise science, or health promotion; not concurrently enrolled in a nutrition course; ready access to computer with Internet connectivity. These data, along with other demographic variables, were collected by trained study personnel at each research site.

Perceived Stress

Stress was measured using the Cohen Perceived Stress Scale, a validated[13] 14-item questionnaire that measures to what extent respondents consider their life situations to be stressful, unpredictable, uncontrollable, and overwhelming. Responses use the Likert scare format from 0 (Never) to 4 (Very Often). A sum stress score is then generated, ranging in value from 0 to 56. In addition, a single item was used to assess self-reported stress-management skills, using behavioral stages of change based on the transtheoretical model. For the purposes of analyses, the Cohen stress score was used both as a continuous variable using the sum scores and as a categorical variable dividing subjects into tertiles of stress scores reflecting lower, intermediate, and higher perceived stress.

Fruits and Vegetables

Intake of fruits and vegetables was measured by the National Cancer Institute's (NCI) Fruit and Vegetable Screener. The screener is a validated[23] 19-item questionnaire that assesses the respondent's fruit and vegetable intake for the previous month as cups.

Fat

Fat intake was assessed using the NCI Fat Screener. This instrument is a validated[24, 25] 17-item questionnaire that estimates how often the respondent consumed several fat-containing foods over the past 12 months. From the responses to the questionnaire, percent of estimated energy intake from fat can be calculated using steps outlined on the NCI Fat Screener website.

Sugar-Sweetened Beverages (SSB's)

Intake of SSB's, which include sugar-sweetened soda, fruit drinks, energy drinks, sport drinks, and sweetened iced tea, was assessed using an eight item survey developed by West, et al. This instrument has not yet been validated, however it was adapted for college students from surveys used in other populations[26]. The questionnaire determines frequency of consumption of SSB's (zero to four or more per day) and portion sizes of each beverage category. From frequency and portion sizes, total intake is then converted to kilocalories per day from SSB's.

Eating Behaviors

The Weight-Related Eating Questionnaire (WREQ) is a validated[27] questionnaire for assessing eating behaviors. The questionnaire consists of 16 items across four subscales, each measuring one of four correlated-but-independent constructs of eating behaviors. The four constructs measured are: 1) routine restraint (three items), which relates to consistent restriction of dietary intake; 2) compensatory restraint (three items), which relates to the tendency towards restrictive eating patterns following excessive intake; 3) susceptibility to external cues (5 items), which refers to eating in response to orosensory cues with little or no consideration for hunger; and 4) emotional eating (5 items), referring to consumption in response to negative feelings. Each item is measured on a Likert scale ranging from 1 (least exhibition of behavior) to 5 (most exhibition of behavior), and each of the four subscales are scored as the average of all items within the subscale.

Physical Activity

Physical activity was assessed using the validated[28] 9-item International Physical Activity Questionnaire (IPAQ), which assessed walking, moderate-intensity activities, and vigorous activities, including frequencies in days per week and duration in minutes over the past week. Categories of activities were converted to metabolic equivalents (MET), which were then used along with frequencies and durations to calculate MET minutes per week. For analyses, the vigorous activity MET-minutes per week and the total activity MET-minutes per week (which includes the vigorous as well as walking and moderate activity) for all subjects were used.

Anthropometrics

Anthropometric measurements were conducted according to standard procedures[29]. Each measurement was taken twice and recorded. If both measurements were within the specified range the average was recorded, measurements were repeated until two were within range. Assessors were trained using the YEAH "Physical Assessment Manual", video, and practice measurements. Weight in kilograms (kg) was assessed by digital scales (SECA 700, Hamburg, Germany) to the nearest 0.1 kg, with both measurements between 0.2 kg of each other, and the average of the two were recorded. Height was measured by a wall-mounted stadiometer (SECA 240, Hamburg, Germany) in centimeters. Participants were advised to remove their shoes, stand straight with feet together and heels, buttock, shoulder blades, and back of the head touching the wall. They were asked to take a deep breath in and hold it, and the height slide was moved as the subject inhaled. Height was recorded to the nearest 0.1 cm, both measurements were within 0.2 cm of each other, and the average of both measurements was recorded. Waist circumference was measured using a Gulick tape (North Coast Medical, Bolingbrook, IL) measure at the iliac crest, in centimeters to the nearest 0.1 cm, and both measurements were within 0.5 cm from each other. Participants' BMI was computed using height and weight as kg/m^2.

Analyses

All analyses were performed using SPSS (version 20.0; SPSS Inc, Chicago, IL). Descriptive analyses including mean values and standard deviations were calculated. Variables were examined for normality. For analyses, a square root transformation was applied to normalize cups of fruit and vegetable intake, as is standard procedure when using the NCI fruit and vegetable screener[23]. Correlation coefficients were used to examine bivariate associations between the primary variables of interest. For comparisons of normally-distributed variables, Pearson's correlation coefficients were calculated. For comparisons involving non-normally distributed variables, Spearman's rho were calculated. Between-gender differences in demographic and study variables were analyzed using Student's t-tests for continuous variables, and Chi-square tests for categorical variables. Variables were compared across tertiles of stress scores and by gender using a two-way analysis of variance (ANOVA). Post-hoc Tukey tests were used to determine which stress groups differed.

In cases where significant stress and gender interactions were found, gender-separate one-way ANOVA with Tukey tests were used to determine which stress groups differed for each gender.

RESULTS

A total of 1,645 participants were recruited for the YEAH study at baseline. Of these, 529 participants were excluded from the analyses due to missing data or outliers in the primary variables of interest, resulting in a final sample size of 1,116 subjects. The final sample was 30% male (n=339) and 70% female (n=777).

Characteristics of the study sample are provided in Table 1. Demographically, the majority of the population was age 18-19 (59.2%) in their freshman or sophomore year (73.3%) and white (75.1%). There were no significant differences in age or year in school between the male and female subjects, however there was a slightly significant difference in racial and ethnic composition between the males and females (p=.049). Males had significantly higher BMI (24.5±4.2 compared to 23.8±4.4, p=.022) and waist circumference (84.6±10.7 compared to 81.4±10.0, P<.001) than females, and a higher proportion of males had a BMI in the overweight range compared to females (27.1% compared to 19.9%, p=.015). Females had significantly higher perceived stress scores compared to males (23.1±6.9 compared to 21.0+7.1, p<.001), although there was no significant difference in stage of change for stress management between the sexes (p=.379). With regard to dietary intake and behaviors, males consumed more cups of fruits and vegetables per day (p=.002) and more kcals from sugar-sweetened beverages (p<.001), and females had higher scores on all four subscales of the WREQ (routine restraint: p<.001; compensatory restraint: p<.001; susceptibility to external cues: p=.001; emotional eating: p<.001). Males reported significantly higher vigorous (p<.001) and total (p<.001) MET-minutes per week of physical activity compared to females.

Correlations between stress and other variables are provided in Table 2 for the entire sample, the males only, and the females only. Spearman's rho are reported for comparisons where one or both variables are non-normally distributed, otherwise Pearson's correlation coefficients are reported. Stress was weakly positively correlated with BMI ($r = .081$, $p < .01$) and waist circumference ($r = .094$, $p < .01$), and negatively with both vigorous and total physical activity ($r = -.095$, $p < .01$ and $r = -.099$, $p < .01$, respectively) in the total study sample. When the sexes were viewed individually, the correlations between stress and BMI and waist circumference were larger in females than in the total study sample (BMI: $r = .112$, $p < .01$; waist circumference: $r = .134$, $p < .01$), while in males there were no significant correlations between stress and BMI or waist circumference.

A weak negative correlation between stress and fruit and vegetable intake was seen in total population ($r = -.082$, $p < .01$). When viewed separately, this relationship was stronger in the males ($r = -.123$, $p < .05$) but weaker and non-significant in the females ($r = .043$, $p > .05$). Daily Calories from SSB's and percentage of Calories from fat were positively correlated with stress in both genders, with a stronger correlation in SSB intake in males than in females ($r = 0.205$ for males, and $r = 0.119$ for females, $p < .01$ for both). The susceptibility to external cues and emotional eating scores of the WREQ increased with stress for both genders, but the routine and compensatory restraint subscales had significant positive correlations with stress only for males ($r = .143$, $p < .01$ and $r = .202$, $p < .01$, respectively). Fruit and vegetable intake was negatively correlated with percent of Calories from fat ($r = -.186$, $p < .01$)

and positively correlated with physical activity (vigorous $r = .195$, $p < .01$; total $r = .240$, $p < .01$).

The sample was divided into tertiles of perceived stress scores, creating lowest stress (LS, n=328), intermediate stress (IS, n=429), and highest stress (HS, n=359) groups. The 33rd percentile for stress score was 19, and the 67th percentile score was 25; thus, LS included stress scores of 18 or less, IS included scores of 19-25, and HS included stress scores of 26 and higher. Table 3 provides a summary of the two-way between-groups ANOVAs comparing the outcome variables by stress group and gender.

For BMI, there were significant main effects for stress, $F(2, 1110) = 3.432$, $p = .033$, partial $\eta^2 = .006$, and gender, $F(1, 1110) = 7.157$, $p = .008$, partial $\eta^2 = .006$, however the stress and gender interaction effect was not significant, $F(2, 1110) = 0.172$, $p = .881$. BMI was higher in males than in females. The overall trend showed an increase in BMI as stress increases, though post-hoc tests showed that only the HS and LS groups differed. There was no significant stress and gender interaction effect for waist circumference, $F(2, 1110) = 0.335$, $p = .716$, but there were significant main effects for stress, $F(2, 1110) = 5.672$, $p = .004$, partial $\eta^2 = .010$ and for gender, $F(1, 1110) = 24.381$, $p = .033$, partial $\eta^2 = .021$. Identical to the trends seen for BMI, waist circumference was higher in males than females and was significantly higher in the HS group compared to the LS group.

Cups of fruit and vegetable intake differed modestly but significantly between stress groups, $F(2, 1110) = 7.984$, $p < .001$, partial $\eta^2 = .014$, and by gender, $F(1, 1110) = 6.571$, $p = .010$, partial $\eta^2 = .006$, but there was no significant stress and gender interaction effect, $F(2, 1110) = 2.352$, $p = .096$, partial $\eta^2 = .004$. Males generally consumed more fruits and vegetables than females. The HS group consumed fewer cups of fruits and vegetables than the IS group, however there was no significant differences between the LS group and the other groups. The estimated percent of daily Calories from fat did not differ by gender, $F(1, 1110) = 3.174$, $p = .075$, but there was a relationship with stress, $F(2, 1110) = 5.868$, $p = .003$, partial $\eta^2 = .010$, with the HS group having a greater percentage of energy from fat compared to the other groups.

Calories from sugar-sweetened beverages differed between stress groups, $F(2, 1110) = 16.175$, $p < .001$, partial $\eta^2 = .028$, and by gender, $F(2, 1110) = 16.175$, $p < .001$, partial $\eta^2 = .028$. Males consumed more Calories per day from these beverages, and intake was higher in the HS group compared to the other groups. A significant stress and gender interaction was found in the overall model, $F(2, 1110) = 3.287$, $p = .038$, partial $\eta^2 = .006$. However, post-hoc gender-separate ANOVA's confirmed the stress and gender trends reported by the overall model.

Stress and gender interaction effects were observed for both routine restraint, $F(2, 1110) = 4.037$, $p = .018$, partial $\eta^2 = .007$, and for compensatory restraint, $F(2, 1110) = 6.620$, $p = .001$, partial $\eta^2 = .012$. Post-hoc analyses indicated that in males, routine and compensatory restraint were both significantly higher in the HS group compared to the other groups. The females, the routine relationship was less clear, with the IS group scoring higher than the HS group, and no significant differences between the LS group and the IS and HS groups. Compensatory restraint did not significantly differ between stress groups in females, although the trend was identical to that seen in routine restraint. Overall, scores on both restraint subscales were higher in females than in males.

There was no stress and gender interaction for susceptibility to external cues score, $F(2, 1110) = 0.127$, $p = .881$, partial $\eta^2 < .001$, however there were significant main effects for stress, $F(2, 1110) = 24.290$, $p < .001$, partial $\eta^2 = .042$, and for gender, $F(1, 1110) = 4.492$, $p = .034$, partial $\eta^2 = .004$. Similarly, for emotional eating score, there were significant main effects both for stress, $F(2, 1110) = 42.138$, $p < .001$, partial $\eta^2 = .071$, and for gender, $F(1, 1110) = 72.850$, $p < .001$, partial $\eta^2 = .062$, but the interaction effect was not significant, $F(2, 1110) = 0.284$ $p = .753$. The effect sizes for external cues (partial $\eta^2 = .042$) and emotional eating (partial $\eta^2 = .071$) were relatively high compared to other study variables, though still not large. Scores on both subscales were higher in females than in males and increased significantly with stress, with significant differences between all three stress groups.

While there were significant main effects for gender for both vigorous physical activity, $F(1, 1110) = 45.805$, $p < .001$, partial $\eta^2 = .040$, and total physical activity, $F(1, 1110) = 49.336$, $p < .001$, partial $\eta^2 = .043$, the main effects for stress were not significant for either variable ($p = .143$ and $p = .117$, respectively). Though non-significant, there was a clear downward trend in MET-minutes/week of physical activity as stress increased. The post-hoc Tukey-tests suggested significant differences between the HS and LS groups, which is noted in Table 3. However, the lack of significance in the overall model suggest that the post-hoc analyses should not be considered.

COMMENT

Conclusions

In this sample of college students from across the U.S., increased levels of perceived stress were associated with greater BMI, waist circumference, dietary fat intake, weight-related eating behaviors, and with lower fruit and vegetable intake and possibly physical activity. However, the main effect sizes of stress on these variables were al fairly small. Mean stress scores in this sample were close to those seen in similar populations[13], perhaps slightly lower[20]. Subject data were collected at the beginning of the semester, which may be a lower-stress time for students and thus may have resulted in relatively low levels of perceived stress. Analysis of the same sample at a more stressful period in time may produce larger effect sizes for stress.

Stress and body weight relationships are difficult to measure due to the potential for stress to induce weight gain and weight loss in different individuals[21, 30]. The trend towards increased BMI and waist circumference in the higher stress groups may indicate that the weight-gain stress pattern may be the more “typical” than the weight-loss pattern. However, some individuals’ primary source of stress may be their weight and/or body image[8], meaning stress could be the result of a higher body weight, not the cause. While the nature of this study cannot establish any form of causality, future studies may focus on the differences between individuals who gain weight in response to stress and individuals who lose weight in response to stress, while also taking care to determine how much of their stress is related to body image perception.

On average, males consumed about half a cup more of fruits and vegetables per day compared to females (2.9 cups/day vs. 2.5 cups/day), which is most likely representative of greater overall food intake in males and not necessarily indicative of any healthier eating pattern[21]. Overall mean intake for both males and females met the 2.5 cups/day minimum recommended by the 2010 Dietary Guidelines for Americans to reduce disease risk[31], however students in the HS group did not meet this goal for either gender. Both males and females in the HS group consumed fewer cups per day of fruits and vegetables, not just females as in previous studies[13, 21].

The estimated percentage of energy intake from fat and daily Calories from sugar-sweetened beverages were highest in the HS group for both genders. This would seem to agree with previous research suggesting that stress increases consumption high-energy comfort foods[13, 19, 32] and sugary beverages such as energy drinks[20] in college students. However, even in the HS group, the estimated proportion of energy coming from fat did not exceed 35%, which is the upper limit of fat intake recommended by the Dietary Guidelines for Americans[31]. Fat intake was estimated, not measured, and total energy intake was not assessed as part of the YEAH study. As such, it cannot be determined from these data whether the increased proportion of energy from fat observed in the HS group was the result of greater fat intake or some other shift in diet composition.

Females scored higher than males on the perceived stress scale and on all four subscales of the WREQ. Previous studies in college populations did not note significant differences in Cohen stress scores between males and females[13,20], however higher depressive symptoms have been noted in females[18], and are associated with stress[13]. Emotional eating habits are usually greater in females than males[7, 18, 22], however externally-motivated eating has not consistently shown such a difference[22]. With respect to stress, trends for emotional eating and susceptibility to external cues in this sample were very similar for males and females.

The relationships between stress and routine and compensatory restraint were far more consistent in males than in females. Correlations between the restraint subscales and stress were only significant in males, and there were no significant differences in compensatory restraint between stress groups in females. This is contrary to past studies which found greater restrained eating behaviors in females[22]. While there were between-stress group differences for routine restraint in females, the nature of the differences was rather unusual. Females reporting intermediate levels stress had the highest routine restraint scores, which were significantly greater than females reporting the least stress. However, neither the intermediate nor lowest stress groups significantly differed in routine restraint score from the highest-stress group of females. Though not significant, the trend for compensatory restraint was identical. This up-then-down trend in restraint scores as stress increases could be related to stress management and behavioral regulation. The lowest stress females may have less stress in part because they are not burdening themselves with restraint behavior[30]. Meanwhile, the highest stress females may have given up on restraint behavior under the weight of their stress.

The stress and restraint score trends were clearer in males, with the highest stress group reporting significantly higher restraint scores than the other stress groups. Increases in restrained eating behaviors with stress in males have been seen before[22].

It is possible that the nature of this relationship is restraint leading to stress[30]. Due to greater body image concerns, females may be more apt to practice restraint behaviors as second nature. In contrast, males may need to exert more mental effort to practice restrained eating behaviors, which could contribute to their stress burden. Restrained eaters are especially prone to overeating when stressed[32], however this may only be the case for the more rigid routine restraint behavior and not the more flexible compensatory restraint pattern[27]. Longitudinal studies are needed to better establish a typical causal pattern. In addition, qualitative studies may be useful in exploring how restrained eaters perceive and manage their behaviors and stress, and how they may influence one another.

The results of this study do not paint a very clear picture of the relationship between stress and exercise, however the relationship does not appear to be significant. Despite some weak correlation coefficients seen in the total and the female population, the exercise by stress and gender analyses did not find any significant main effect for stress, only for gender. Though non-significant, there is a slight downward trend in physical activity noticeable across the stress groups, with the exception of total physical activity in males. Inverse relationships between stress level and physical activity have been previously noted[11, 15]. The post-hoc between-stress group tests run with the overall model also hint at this trend, suggesting that the highest stress groups were not as physically active compared to the lower stress groups. However, because the overall model for stress was not significant, these post-hoc tests should not be seriously considered.

Strengths

Strengths of this study include a large sample size, offering significant statistical power. The BMI and waist circumference data collected in the YEAH study were measured in a laboratory setting using standardized equipment and methods, meaning that the anthropometric data used for these analyses were more accurate than those that may be found in studies using self-reported values. This accuracy, combined with the sample size of the study, gives significant strength to the findings pertaining to BMI and waist circumference. This study examined several different variables related to health and well-being, including diet, physical activity, and behavior. The fourteen universities which participated in the YEAH study occupy various geographical regions in the United States, which gives a degree of generalizability to these findings.

Limitations

The major limitation of this study is that, as a cross-sectional study, no causal effects can be established. The relationships between stress, weight, body fat, dietary behaviors, and physical activity are very complicated, with each variable potentially capable of affecting another or being affected by other variables that were not measured, including important hormonal mediators of stress such as cortisol.

No data were collected regarding total energy intake, making it difficult to tell if some of the dietary measures used for this study differed simply because total energy intake differed. The greater intake of fruits and vegetables and kcals from SSB’s in males compared to females may simply be the result of greater energy intake in the males compared to the females and not a result of a gender difference in stress response.

While this study can count regional generalizability as a strength, the sample was mostly female, white, and educated, which may limit generalizability. There are similar stressors and behaviors among young adults both in-school and not, however there are also key differences[14], and thus the results of this study may not translate to more diverse young adult populations or young adults who are not attending college. Furthermore, subjects were recruited as a convenience sample, which may have introduced selection bias favoring individuals who wanted to partake in a health-themed intervention.

The results of this study add to the growing body of literature describing associations between psychological stress and health behaviors which play important roles in mediating chronic disease risk. Positive associations between stress and BMI and waist circumference add to evidence that increased stress may promote weight gain and central adiposity[34,35]. Fruit and vegetable intake decreased in males and females, not just females as previously observed[13, 21]. The gender differences in the relationship between stress and restraint behaviors in this sample also differ from previous findings[22]. Further study using longitudinal design to examine causal relationships is needed to determine the most stress-vulnerable health behaviors to target in interventions to most effectively reduce risk of chronic disease.

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Table 1: Characteristics of the study sample at baseline

	Total (n=1116)	Male (n=339)	Female (n=777)	p*
Demographics				
Age (%)				.470
18-19 years	59.2	56.3	60.5	
20-21 years	37.9	40.7	36.7	
$\geq$22 years	2.9	3.0	2.9	
Year in School (%)				.501
Freshman + Sophomore	73.3	75.8	72.6	
Junior + Senior	26.2	24.0	27.1	
Graduate	0.3	0.0	0.4	
Race/Ethnicity (%)				.049
White	75.1	74.1	75.6	
Black	11.2	9.6	11.8	
Hispanic/Latino	6.2	6.8	5.9	
Asian	8.8	10.2	8.2	
Other/Not Reported	5.0	6.2	4.5	
Anthropometrics				
Body Mass Index (kg/m^2) (mean$\pm$SD)	24.0$\pm$4.3	24.5$\pm$4.2	23.8$\pm$4.4	.022
Body Mass Index Categories (%)				.015
normal	69.6	63.7	72.2	
overweight	22.1	27.1	19.9	
obese	8.2	9.1	7.9	
Waist Circumference (cm)(mean$\pm$SD)	82.4$\pm$10.9	84.6$\pm$10.7	81.4$\pm$10.9	<.001
Stress				
Perceived Stress Score (mean$\pm$SD)	22.5$\pm$7.1	21.0$\pm$7.1	23.1$\pm$6.9	<.001
Behavioral Stage of Change for Stress Management (%)				.379
Pre-action	14.5	13.9	14.8	
Post-action	85.5	86.1	85.2	
Dietary Intake and Behaviors				
Fruit and Vegetable Consumption (cups/day)(mean$\pm$SD)	2.6$\pm$1.9	2.9$\pm$2.1	2.5$\pm$1.8	.001
Percent of Daily Calories from Fat (%)(mean$\pm$SD)	31.0$\pm$4.9	31.3$\pm$4.6	30.9$\pm$5.0	.224
Daily Calories from Sugar-Sweetened Beverages (kcal)(mean$\pm$SD)	147$\pm$200	196$\pm$246	126$\pm$172	<.001
Routine Restraint Score (mean$\pm$SD)	1.8$\pm$0.8	1.6$\pm$0.7	1.9$\pm$0.8	<.001
Compensatory Restraint Score (mean$\pm$SD)	2.4$\pm$1.0	2.1$\pm$0.9	2.6$\pm$1.0	<.001
Susceptibility to External Cues Score (mean$\pm$SD)	2.8$\pm$0.9	2.7$\pm$0.9	2.9$\pm$0.9	.001
Emotional Eating Score (mean$\pm$SD)	2.1$\pm$1.0	1.7$\pm$0.7	2.3$\pm$1.0	<.001
Physical Activity				
Vigorous MET-minutes/week (mean$\pm$SD)	1108$\pm$1203	1501$\pm$1432	937$\pm$1044	<.001
Total MET-minutes/week (mean$\pm$SD)	2232$\pm$1659	2792$\pm$1900	1987$\pm$1478	<.001

*For between-gender differences, p-value significance set at <.05; reported p-values correspond to Pearson Chi square for categorical variables, Student's t-test for continuous variables; significance of between-gender differences for non-normally distributed continuous variables confirmed by Mann-Whitney U tests (not shown).

Table 2: Correlation coefficients of perceived stress score and primary study variables.

	Total (n=1116)	Male (n=339)	Female (n=777)
Body Mass Index	.081**	.044	.112**
Waist Circumference	.094**	.073	.134**
Fruit and Vegetable Consumption	-.082**	-.123*	-.043
Percent of Daily Calories from Fat	.118**	.117*	.128**
Daily Calories from Sugar-Sweetened Beverages[s]	.119**	.205**	.119**
Routine Restraint Score	.088**	.143**	.030
Compensatory Restraint Score	.096**	.202**	.008
Susceptibility to External Cues Score	.252**	.237**	.244**
Emotional Eating Score	.346**	.362**	.315**
Vigorous Physical Activity[s]	-.095**	-.039	-.083*
Total Physical Activity[s]	-.099**	-.050	-.076*

[s]: Spearman's rho reported due to variable having non-normal distribution; all other reported coefficients are Pearson's r.
*p<.05
**p<.001

Table 3: Means and standard deviations of primary study variables by stress category and gender.

		Stress Category			*Main Effect**		
		Lowest Stress (n=328)	Intermediate Stress (n=429)	Highest Stress (n=359)	F	p-value	partial η^2
Body Mass Index (kg/m^2)	Male	24.2 ± 4.4^{a}	24.5 ± 4.0^{ab}	25.0 ± 4.1^{b}	3.432	.033	.006
	Female	23.2 ± 3.9^{a}	23.8 ± 4.1^{ab}	24.3 ± 5.0^{b}			
Waist Circumference (cm)	Male	83.8 ± 11.2^{a}	84.2 ± 9.9^{ab}	86.4 ± 10.9^{b}	5.672	.004	.010
	Female	79.5 ± 10.0^{a}	81.3 ± 10.1^{ab}	83.0 ± 12.0^{b}			
Fruit and Vegetable Consumption (cups/day)	Male	2.9 ± 2.0^{ab}	3.2 ± 2.0^{a}	2.3 ± 2.1^{b}	7.984	<.001	.014
	Female	2.5 ± 1.9^{ab}	2.6 ± 1.9^{a}	2.3 ± 1.8^{b}			
Percent of Daily Calories from Fat (%)	Male	31.1 ± 4.5^{a}	31.0 ± 5.1^{a}	32.2 ± 3.9^{b}	5.868	.003	.010
	Female	30.2 ± 5.0^{a}	30.7 ± 4.8^{a}	31.7 ± 5.2^{b}			
Daily Calories from Sugar-Sweetened Beverages (kcal)	Male	148 ± 183^{a}	190 ± 238^{a}	284 ± 319^{b}	16.175	<.001	.028
	Female	103 ± 137^{a}	115 ± 149^{a}	154 ± 210^{b}			
Routine Restraint Score	Male	1.5 ± 0.7^{a}	1.6 ± 0.6^{a}	1.8 ± 0.9^{b}	4.792	.008	.009
	Female	1.8 ± 0.9^{a}	2.7 ± 1.0^{b}	2.5 ± 1.0^{ab}			
Compensatory Restraint Score	Male	1.9 ± 0.8^{a}	2.0 ± 0.9^{a}	2.4 ± 11^{b}	6.010	.003	.011
	Female	2.5 ± 1.1^{a}	2.7 ± 1.0^{a}	2.5 ± 1.0^{a}			
Susceptibility to External Cues Score	Male	2.5 ± 0.9^{a}	2.7 ± 0.8^{b}	3.1 ± 0.9^{c}	24.290	<.001	.042
	Female	2.6 ± 0.9^{a}	2.8 ± 0.9^{b}	3.1 ± 0.9^{c}			
Emotional Eating Score	Male	1.4 ± 0.6^{a}	1.7 ± 0.7^{b}	2.2 ± 0.9^{c}	42.138	<.001	.071
	Female	1.9 ± 0.8^{a}	2.2 ± 0.9^{b}	2.6 ± 1.1^{c}			
Vigorous Physical Activity (MET-minutes/week)	Male	1545 ± 1406^{a}	1572 ± 1487^{ab}	1306 ± 1379^{b}	1.945	.143	.003
	Female	1001 ± 1079^{a}	948 ± 993^{ab}	881 ± 1072^{b}			
Total Physical Activity (MET-minutes/week)	Male	2780 ± 1914^{a}	2971 ± 1870^{ab}	2508 ± 1914^{b}	2.154	.117	.004
	Female	2069 ± 1436^{a}	1998 ± 1433^{ab}	1918 ± 1554^{b}			

*: Main effects for stress reported. Main effects for gender were significant for all variables except Percent of Daily Calories from Fat.

^{abc}: indicate significant or non-significant differences of means between groups. Groups sharing the same superscript letter(s) do not have significantly different mean values.

APPENDIX A: Review of Literature

The following review of literature will first discuss the prevalence and significance of chronic disease and introduce the modifiable behaviors – namely, eating and physical activity habits – which can reduce the risk of developing chronic diseases. The nature and importance of these behaviors in young adults will then be explored, particularly in college students. The effects of stress on health and health behaviors will then be discussed, both overall and (primarily) in the context of college. Throughout, attention will be drawn to curiosities and contradictions in the literature regarding the influence of stress on health and health behaviors. Towards the end of the review, special attention being drawn to the apparent gender differences in stress responses. The review will conclude with a brief summary, including the importance of existing and future research on these topics.

Chronic Disease

Chronic diseases, including cardiovascular disease (CVD), diabetes, and cancer, are some of the most common causes of morbidity and mortality in the United States. The Centers for Disease Control and Prevention (CDC) reports that 7 out of 10 deaths in the U.S. are the result of chronic illnesses, and that almost half of all adults in the country have at least one chronic disease(CDC 2012). About 37% of the U.S. population has cardiovascular disease, and 11% have diabetes, and it is estimated that about 41% of Americans will develop cancer at some point in their life(USDA 2010). Furthermore, obesity – a major risk factor for many chronic diseases – now affects over a third of adults and one in five children(CDC 2012).

Though chronic diseases are some of the most costly health problems(Agarwal, 2012;CDC 2012), modifiable behaviors such as diet(Agarwal, 2012; Amaral P, 2010; Hung et al., 2004; CDC 2012; Staser, 2011; Van Duyn & Pivonka, 2000) and physical activity habits(Agarwal, 2012; Annesi & Vaughn, 2011; Goncalves & Gomes, 2012;CDC 2012) can prevent, delay, or lessen the severity of many chronic diseases, either directly or indirectly through weight management. Current U.S. dietary guidelines recommend consuming a variety of plant-based foods for their protective effects, and balancing energy intake and physical activity in order to maintain neutral energy balance and prevent weight gain (DGA 2010). American Heart Association recommends at least 30 minutes of moderate-intensity physical activity most days of the week, and the U.S. Department of Health and Human Services recommends that school students get 60 minutes per day of exercise(Agarwal, 2012). However, the majority of Americans do not meet these guidelines (DGA 2010)

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In addition to encouraging energy balance, current dietary guidelines recommend eating a diet high in fruits and vegetables, selecting lean and lower-fat foods over higher-fat options, and limiting intake of added fat and sugars (DGA 2010). Fruits and vegetables in particular receive a great deal of attention as a dietary means of reducing disease risk, and intake of fruits and vegetables is a frequent target for intervention(Greaney et al., 2009).

Evidence that fruits and vegetables reduce CVD risk has generally been stronger and more consistent than the evidence for reduced cancer risk(Van Duyn & Pivonka, 2000). Hung, et al. analyzed subjects from the Nurses' Health Study (female) and the Health Professionals Follow-up Study (male) for the effect of fruit and vegetable intake (excluding potatoes) on the incidence of CVD and cancer. A significant reduction in CVD cases was seen with higher fruit and vegetable intake, with green leafy vegetables having the strongest effect, however no significant effect was seen for cancer(Hung et al., 2004). However, it was noted that the study sample's fruit and vegetable intake was relatively high. The median intakes were 5.3 servings/day for women and 5.2 servings/day for men, and the lowest quintile had intakes on par with the average for Americans (0.7 servings/day each of fruit and vegetables excluding salad and potatoes). Amaral, et al. found that the most aggressive histologies of breast cancer in Portuguese women were in those with the lowest intake of leafy greens(Amaral P, 2010).

Beyond the protective effects fruits and vegetables provide themselves, a higher fruit and vegetable intake may correspond to an overall healthier dietary pattern which lowers disease risk. In a sample of 4,784 adults in Indiana, those who consumed "adequate" fruits and vegetables, defined as the maximum score for fruits and vegetables on the Healthy Eating Index 2005 (HEI-2005), were compared to those who consumed "inadequate" amounts. The adequate consumers were more than twice as likely to snack on healthy foods (OR=2.54) and 52% more likely to use food labels to help make decisions when food shopping (OR=1.52) compared to those who ate "inadequate amounts." (Staser, 2011). Though fruit and vegetable intake is just one part of an individual's diet, it may also be indicative of a larger grouping of dietary patterns, quality, or behavior.

Despite years of study and public attention, there is still some ambiguity in the relationship between total fat intake and heart disease. Dietary guidelines recommend consuming 20-35% of total Calories from fat. This recommendation is meant to ensure adequate intake of essential fatty acids and fat-soluble vitamins while minimizing intake of saturated and *trans* fats, have most consistently been linked to lipid profiles associated with heart disease (DGA 2010). However, certain fats such as mono- and poly-unsaturated fats may have protective effects (Hu et al., 1997). A recent meta-analysis of low-fat diet interventions suggests they are effective in improving blood lipid profiles and in promoting weight loss, thus reducing the risk of CVD (Hooper et al., 2012). Overall, evidence supports interventions reducing dietary fat intake as a viable strategy to reduce disease risk.

Sugar-sweetened beverages, such as sodas and energy drinks, have been associated with obesity, type 2 diabetes, and heart disease (Hu & Malik, 2010; Te Morenga, Mallard, & Mann, 2013), (Malik, Popkin, Bray, Despres, & Hu, 2010). The average American consumed 293kcal per day from sugar-sweetened beverages between 1999 and 2004(Bleich, Wang, Wang, & Gortmaker, 2009). Though high in Calories, sugar-sweetened beverages provide little or no nutritional value and my replace more nutritious drinks such as milk and pure fruit juice. By adding Calories and replacing sources of nutrients, sugar-sweetened beverages have a diluting effect on diet quality(Libuda et al., 2009).

Based on dietary data collected from adults from the Mississippi Delta region, replacement of sugar-sweetened beverages with tap water would decrease total energy intake by 215kcal, roughly 11% of total energy intake, as well as significantly improve diet quality score(Thomson et al., 2011). A more nationally-representative sample of children estimated a 235kcal reduction of energy intake with a similar replacement(Wang, Ludwig, Sonneville, & Gortmaker, 2009). Because these reductions are so drastic, and because tap water is readily available to most Americans, the reduction of sugar-sweetened beverage intake is an attractive target for health interventions(Thomson et al., 2011).

Twenty years of follow-up with subjects in the Coronary Artery Risk Development in Young Adults (CARDIA) study showed a secular negative trend in diet quality(Sijtsma et al., 2012). Designing interventions to change intakes of one or more improve diet quality is one way to reduce risk of chronic disease, however diet quality alone is not the only metric by which healthy eating patterns can be established. Eating behaviors, such as emotional eating and restraint, also play important roles in food choices, weight management, and disease risk(S. Schembre, Greene, & Melanson, 2009).

Emotional eating refers to eating in response to negative feelings. It has been associated with higher weight, depressive symptoms, and consumption of energy-dense foods(Konttinen, Silventoinen, Sarlio-Lahteenkorva, Mannisto, & Haukkala, 2010). Emotional eating is generally more prevalent in females than in males (Annesi & Vaughn, 2011), however this is not always the case(Burton, Smit, & Lightowler, 2007).

External eating, or eating in response to external cues, refers to consumption of foods in response to sensory stimuli, availability, or social reasons. Consumption of food in response to external cues can occur in spite of feelings of hunger or satiety (Schachter, Goldman, & Gordon, 1968). Variability in how individuals respond to external food stimuli may explain differences in susceptibility to weight gain (Burton et al., 2007).

Restrained dietary behavior is the willful self-imposed limitation of intake. The limitations may be imposed on types of food, such as sweets, as well as on amounts of food consumed. The effect of restrained behavior on weight and weight management has been difficult to assess due to conflicting results (Lai, Why, Koh, Ng, & Lim, 2012). Dietary restraint has been linked to food cravings, which can result in overconsumption and binging episodes. Food cravings have been associated with higher BMI, and in one study accounted for 8-20% of the variance in BMI among subjects(Burton et al., 2007). However, the causal pathway could be that individuals who have more food cravings subsequently practice greater restraint to resist those cravings. Susceptibility to external eating cues also tends to be higher in restrained eaters(Burton et al., 2007).

Further study of dietary restraint has revealed two different subscales of restrained eating(Westenhoefer, 1991), which may explain some of the conflicting results found using older restraint score instruments(S. Schembre et al., 2009). Rigid restrained eating refers to very strict controlled approaches to limiting intake and weight changes. The flexible restrained eating pattern allows for more deviation from routine intake by compensating for episodes of increased intake. The recently developed weight-related eating questionnaire (WREQ) measures rigid restrained eating and flexible restrained eating in its routine restraint and compensatory restraint subscores, respectively(S. Schembre et al., 2009; S. M. Schembre & Geller, 2011).

Physical activity is important for weight management, as energy expenditure is the most variable component of energy balance. However, physical activity is protective against chronic disease and death regardless of body weight(Kokkinos, 2012). Regular exercise decreases the risk of type 2 diabetes, some cancers, osteoporosis, and depression(Agarwal, 2012). Hypertension, the most important risk factor for CVD, can be managed through exercise both through improved weight management and cardiovascular benefits from the exercise itself(Kokkinos, 2012).

While physical activity is the best predictor of weight loss, the energy expended during activity may only account for some the weight loss(Annesi &

Vaughn, 2011). It is common for health behaviors to cluster in such a way that those who eat well exercise regularly, and vice versa (Zenong, Davis, Moore, & Treiber, 2005). Self-efficacy to perform physical activity has shown a negative association with emotional eating and depressive symptoms in women(Annesi & Vaughn, 2011). Thus, exercise may help individuals maintain a healthy weight not only through energy expenditure, but by improving dietary quality and behavior.

Health Behaviors in Young Adults

Emerging adulthood is a developmental period in life occurring roughly between the ages of 18 and 25(Arnett, 2000). It is distinct from adolescence in its relative independence, yet the responsibilities typical of true adulthood may not yet weigh on this age group. These social and developmental freedoms allow emerging adults to explore life possibilities, professional desires, and worldviews. Emerging adulthood is also a time during which many health-related behaviors begin to take form (Betts, Amos, Keim, Peters, & Stewart, 1997; Larson, Perry, Story, & Neumark-Sztainer, 2006).

Unfortunately, many of these new behaviors are associated with weight gain, especially among college students(Greaney et al., 2009). Ease and convenience are important factors in food choices among young adults (Larson et al., 2006). Compared to non-students, college students are more likely to view foods in terms of convenience and place less importance on nutrition(Betts et al., 1997).

Focus groups of college students at the University of Minnesota have provided insight into the factors and barriers affecting influencing weight, diet, and physical activity. Students commented on the abundance of food on campus and the buffet-style dining halls as triggers for excessive consumption. Students also reported a great number of food choices, including many unhealthy choices, and a lack of available nutrition information. Snacking and late-night eating out of hunger, for stimulation, out of boredom, or because of stress were reported, as well as eating for social reasons. Alcohol promoted extra intake after consumption, and students also reported eating more before going out so they could consume more alcohol than they could otherwise(Nelson, Kocos, Lytle, & Perry, 2009). Other studies have similarly noted that buffet-style dining, junk food availability, and alcohol intake contribute to weight gain in college students(Economos CD, 2008).

Sedentary behaviors are also typical of college youth. A sharp decline in physical activity occurs during the transition from high school to college, and again upon entering the work force(Agarwal, 2012). Several students in the previously described focus groups reported spending large amounts of time sitting for class or working on homework, leaving little time for physical activity. Negative experiences using campus recreational resources were also noted. These experiences include overcrowding of the recreational facilities and lines to use the machines, as well as intimidation at the prospect of joining intramural sports teams (Nelson et al., 2009)

Given the food environment and sedentary habits many students fall into, it is not surprising that weight gain in first-year college students is fairly typical. However, the so-called “Freshman Fifteen” is an exaggeration of this trend. In reality, freshman students tend to gain around five pounds during the course of their first academic year(Economos CD, 2008; Grinnell, Greene, Melanson, Blissmer, & Lofgren, 2011). In addition to the college environment itself, the college experience carries with it new stressors which may negatively affect students’ health.

Stress and Health

Stress is a coping response to events or environmental circumstances, referred to as stressors. The immediate responses to these stressors, for example increase in heart rate and blood pressure, can be beneficial to handling the stressful situation at hand. However, chronic stimulation of stress responses can cause complications. These complications may include failure to turn off the stress response when it’s no longer required, or a dampening of the response to the same stressor(McEwen, 2008).

Hormonal responses to stress are mediated by the autonomic nervous system (ANS) and the hypothalamic-pituitary-adrenal (HPA) axis(Bose, 2009; Kuo et al., 2008; McEwen, 2008). For example, the classic “fight or flight” response is mediated by hormones released by the HPA. Cortisol and pro-inflammatory cytokines released by these systems are important for short-term stress responses, but may cause damage in the long term(McEwen, 2008).

Hormonal dysregulation due to stress is one of the underlying mechanisms which may be responsible for increased health risk (Bose, 2009; Kuo et al., 2008; Tomiyama, Dallman, & Epel, 2011). The hormonal profile associated with stress favors abdominal fat deposition(Bose, 2009; Tomiyama et al., 2011). More so than other body fat and total weight, abdominal fat is associated with increased disease risk (Bose, 2009). Stress can also disrupt sleeping patterns, which may in turn cause further metabolic changes favoring weight gain (Bidulescu et al., 2010; Bose, 2009).

Stress and Health Behaviors

Voluntary behavior related to food cravings and reward systems can overrule the homeostasis-driven hormonal controls of food intake(Dallman, 2010). Numerous studies have examined the relationship between stress and emotional eating. Tomiyama, et al. found that women in the highest quartile for perceived stress reported higher levels of emotional eating(Tomiyama et al., 2011). In adolescents, reporting stress or depressive symptoms 10 or more days in the past month was associated with an unhealthy diet, and in some individuals with an increase in consumption and a shift toward foods higher in fat(Mikolajczyk, El Ansari, & Maxwell, 2009; Zenong et al., 2005). Individuals of a higher weight are more likely to favor comfort foods in response to stress than those of more normal weight(Lemmens, Rutters, Born, & Westerterp-Plantenga, 2011), suggesting that the relationship between stress and weight is more complicated than it appears.

Stress is associated with overeating, and individuals who practice restrained eating are especially prone to overeating when stressed(Zenong et al., 2005). However, some other studies have found no significant increase effect of stress on intake in restrained eaters(Lai et al., 2012). This may in part be due to inconsistencies in measuring restraint due to the different forms of restraint previously described(S. Schembre et al., 2009). The mental effort of practicing dietary restraint may itself be stressful(Dallman, 2010), which may lead to a cycle where stress and restraint beget one another until the individual is unable to maintain dietary their restraint.

While there is evidence to suggest that stress results in increased intake, stress can also cause individuals to decrease food intake. Some studies have found decreased intake to be the more likely response, and others still have shown that roughly equal proportions of individuals decrease and increase their intake(Dallman, 2010; Torres & Nowson, 2007). Overall, youghly 40% of individuals increase energy intake when stress, while another 40% decrease energy intake and 20% do not change intake when stressed(Dallman, 2010). Regardless of whether or not one's energy intake changes in response to stress, shifts towards these pleasurable high-Calorie foods may be observed(Dallman, 2010).

While exercise can improve some individual's behavioral self-regulation(Annesi & Vaughn, 2011), maintaining exercise habits may tax another individual's ability to self-regulate. Just as stress may cause restrained eaters to lose their ability to regulate intake, stress may cause some individuals to fall out of their exercise habits(Lai et al., 2012).

For individuals who can maintain their exercise habits, their physical activity may act the buffer the effects of stress on weight(Zenong et al., 2005). Leisure physical activity has been shown to blunt the effects of minor stressors, such as anxiety, in a sample of college students. One hypothesis is that exercise provides a distraction from stressors, providing a reprieve from the effects of the stress(Carmack, Boudreaux, Amaral-Melendez, Brantley, & de Moor, 1999).

In the college population, stress is one of the top threats to academic performance(Pettit & DeBarr, 2011). Focus groups of college students have reported stress as one of the factors influencing extra food intake and decreased exercise(Nelson et al., 2009). The consumption of energy drinks, which are typically sugar-sweetened beverages high in caffeine and other stimulants, increases in volume frequency in college students with higher perceived stress(Pettit & DeBarr, 2011) (Pettit). Disrupted sleep patterns common to college students(Economos CD, 2008) may cause some of the previously described hormonal dysregulation that can lead to weight gain, especially in the abdomen(Bidulescu et al., 2010; McEwen, 2008).

In a large-scale cross-sectional study of college students from eight universities across the US, Greene, et al.(Greene et al., 2011) investigated the relationships between overweight and obesity and eating behaviors, physical activity, and psychological stress(Greene et al., 2011). Cluster analyses divided 1,435 subjects into three relatively homogenous subgroups based on weight-related dietary and physical activity behaviors and psychological variables. The “Psychologically Secure” cluster had the lowest uncontrolled and emotional eating scores, and the “Behaviorally Competent” cluster had the highest intake of fruits and vegetables and highest physical activity scores. The “High Risk” cluster, determined by higher BMI and waist circumference, had the highest emotional eating scores, lowest levels of physical activity, and the highest desire to lose weight. The findings of this study support the notion that those who are most susceptible to stress are more likely to be overweight or obese. Conversely, those who are least susceptible to these psychological stresses appear to eat healthier and get more physical activity.

Gender differences in response to stress complicate the relationships between stress and health behaviors. A study completed as part of the multinational Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study found significant negative associations between stress and diet quality scores in both sexes. Diet quality was assessed in terms of 1) variety of foods chosen, 2) healthfulness of foods chosen, and 3) how well portions consumed matched dietary recommendations. In girls, stress was inversely related to all three measures of diet quality. However, in boys only healthfulness of food choices was significantly related to stress, suggesting that while both boys and girls were choosing unhealthy foods when stressed, boys consumed a greater variety of foods and came closer to meeting dietary guidelines compared to girls(De Vriendt et al., 2011).

In a study of Latino adolescents in Los Angeles, subjects of both sexes with higher emotional eating scores consumed more energy-dense salty foods compared to non-emotional eaters. However, boys classified as emotional eaters also consumed more fruits and vegetables when compared to non-emotional eaters, an association which was not seen in girls(Nguyen-Michel, Unger, & Spruijt-Metz, 2007).

Gender differences in stress responses continue into adulthood. In a cross sectional analysis of college students from Germany, Poland, and Bulgaria, none of the food consumption subscales of the food frequency questionnaire were associated with perceived stress or depressive symptoms in the male students. In the female students, higher consumption of carbohydrate-dense sweets and snacks was associated with higher stress, and lower consumption of fruits and vegetables was associated with both higher stress and greater depressive symptoms(Mikolajczyk et al., 2009). Economos, et al. found similar trends between stress and fruit and vegetable intake, with males showing no relationship and females decreasing intake as stress increased(Economos CD, 2008).

In the study of behavior clusters of college students, Greene, et al. also found significant differences between male and female college students' behaviors. For male subjects, cognitive restraint and eating competence (including attitudes, regulation and meal planning) showed the largest effect size for differences between the clusters, with the High Risk cluster having the lowest scores. Among the female subjects, emotional eating and uncontrolled eating contributed most to between-cluster differences, with the High Risk cluster having the highest scores(Greene et al., 2011). These results may indicate that females under stress are more prone to overeat while males are more likely to practice less restraint and control.

While overall weight changes upon entering college is similar for males and females, as much as a third of males actively trying to gain weight(Economos CD, 2008). Males may decrease intake and lose weight when stressed for academic or social reasons(Economos CD, 2008; Torres & Nowson, 2007). Since such a large proportion of males may desire weight gain and experience weight loss when stressed, opposite to the trends seen elsewhere, stress and weight relationships may be difficult to tease out statistically.

Summary

Chronic diseases are major causes of morbidity and mortality which can be prevented, delayed, and lessened in severity with modifiable health behaviors. These health behaviors may develop in young adults and persist throughout the lifespan. However, the behaviors which develop during this period are often not ideal for decreasing chronic disease risk. The college population faces a unique set of stressors during a developmental period when lifelong health behaviors usually develop. These stressors may negatively influence health behaviors. However, these relationships are not always clear and are confounded by gender differences in stress response, particularly with respect to weight and restraint behaviors. To design more effective disease prevention interventions for young adults, a better picture of stress, gender, and health behavior relationships is needed.

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APPENDIX B: Perceived Stress Scale

*****Not enough time to finish this survey now? You can come back later and finish, just remember to finish this page and click next at the bottom to save this page. When you return, you will start with the next survey.***

The next set of questions are about how you perceive stress.

In the last month, how often have you…

1)…been upset because of something that happened unexpectedly?
(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

2)…felt that you were unable to control the important things in your life?
(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

3)…felt nervous and stressed?
(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

4)…dealt successfully with irritating life hassles?
(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

5)…felt that you were effectively coping with important changes that were occurring in your life?
(1) Never
(2) Almost never

(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

6)…felt confident about your ability to handle your personal problems?
(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

7)…felt that things were going your way?
(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

8)…found that you could not cope with all the things that you had to do?
(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

9)…been able to control irritations in your life?
(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

10)…felt that you were on top of things?
(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

11)…been angered because of things that happen that were outside of your control?

(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

12)…found yourself thinking about things that you have to accomplish?
(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

13)…been able to control the way you spend your time?
(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

14)…felt difficulties were piling up so high that you could not overcome them?
(1) Never
(2) Almost never
(3) Sometimes
(4) Fairly often
(5) Very often
(6) Choose not to answer

APPENDIX C: Fruit and Vegetable Screener

*****Not enough time to finish this survey now? You can come back later and finish, just remember to finish this page and click next at the bottom to save this page. When you return, you will start with the next survey.***

Think about what you usually ate last month. Please think about <u>all</u> the fruits and vegetables that you ate <u>last month.</u> Include those that were:

- ***Raw and cooked,***
- ***Eaten as snacks and at meals***
- ***Eaten at home and away from home (restaurants, friends, take-out), and***
- ***Eaten alone and mixed with other foods.***

Report how many times per month, week, or day you ate each food, and if you ate it, how much you usually had.
If you mark "never" for a question, follow the "Go to" instruction.
Choose the best answer for each question. Mark only one response for each question.

1) Over the last month, how many times per month, week, or day did you drink **100% juice** such as orange, apple, grape, or grapefruit juice? **Do not count** fruit drinks like Kool-Aid, lemonade, Hi-C, cranberry juice drink, Tang, and Twister. Include juice you drank at all mealtimes and between meals.
(1) never (go to question 3)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

2) Each time you drank **100% juice**, how much did you usually drink?
(1)Did not drink 100% juice
(2) Less than ¾ cup (less than 6 ounces)
(3) ¾ to 1¼ cup (6 to 10 ounces)
(4) 1¼ to 2 cups (10 to 16 ounces)
(5) More than 2 cups (more than 16 ounces)
(6) Choose not to answer

3) Over the last month, how many times per month, week, or day did you eat **fruit?** Count any kind of fruit—fresh, canned, and frozen. **Do not count** juices. Include fruit you ate at all mealtimes and for snacks.
(1) never (go to question 5)

(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

4) Each time you ate **fruit,** how much did you usually eat?
(1) Did not eat fruit
(2) Less than 1 medium fruit (less than ½ cup)
(3) 1 medium fruit (about ½ cup)
(4) 2 medium fruits (about 1 cup)
(5) More than 2 medium fruits (more than 1 cup)
(6) Choose not to answer

5) Over the last month, how often did you eat **lettuce salad (with or without other vegetables)?**
(1) never (go to question 7)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

6) Each time you ate **lettuce salad**, how much did you usually eat?
(1) Did not eat lettuce salad
(2)About ½ cup
(3) About 1 cup
(4) About 2 cups
(5) More than 2 cups
(6) Choose not to answer

7) Over the last month, how often did you eat **French fries** or **fried potatoes?**
(1) never (go to question 9)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**

(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

8) Each time you ate **French fries** or **fried potatoes,** how much did you usually eat?
(1) Did not eat French fries or fried potatoes
(2)Small order or less (About 1 cup or less)
(3) Medium order (About1½ cups)
(4) Large order (About 2 cups)
(5) Super-Size order or more (About 3 cups or more)
(6) Choose not to answer

9) Over the last month, how often did you eat **other white potatoes?** Count **baked, boiled,** and **mashed potatoes, potato salad,** and **white potatoes that were not fried.**
(1) never (go to question 11)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

10) Each time you ate **these potatoes,** how much did you usually eat?
(1) Did not eat these types of potatoes
(2)1 small potato or less (1/2 cup or less)
(3) 1 medium potato (1/2 to 1 cup)
(4) 1 large potato (1 to 1½ cups)
(5) 2 medium potatoes or more (1½ cups or more)
(6) Choose not to answer

11) Over the last month, how often did you eat **cooked dried beans?** Count **baked beans, bean soup, refried beans, pork and beans** and **other bean dishes.**

(1) never (go to question 13)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**

(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

12) Each time you ate **these beans,** how much did you usually eat?
(1) Did not eat cooked dried beans
(2)Less than ½ cup
(3) ½ to 1 cup
(4) 1 to 1½ cups
(5) More than 1½ cups
(6) Choose not to answer

13) Over the last month, how often did you eat **other vegetables?**

DO NOT COUNT:

- Lettuce salads
- White potatoes
- Cooked dried beans
- Vegetables in mixtures, such as in sandwiches, omelets, casseroles, Mexican dishes, stews, stir-fry, soups, etc.
- Rice

COUNT: All other vegetables—raw, cooked, canned, and frozen

(1) never (go to question 15)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

14) Each of these times that you ate **other vegetables,** how much did you usually eat?

(1) Did not eat these vegetables
(2)Less than ½ cup
(3) ½ to 1 cup
(4) 1 to 2 cups
(5) More than 2 cups
(6) Choose not to answer

15) Over the last month, how often did you eat **tomato sauce**? Include tomato sauce on pasta or macaroni, rice, pizza and other dishes.
(1) never (go to question 17)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

16) Each time you ate **tomato sauce,** how much did you usually eat?
(1) Did not eat tomato sauce
(2)About ¼ cup
(3) About ½ cup
(4) About 1 cup
(5) More than 1 cup
(6) Choose not to answer

17) Over the last month, how often did you eat **vegetable soups?** Include tomato soup, gazpacho, beef with vegetable soup, minestrone soup, and other soups made with vegetables.
(1) never (go to question 19)
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

18) Each time you ate **vegetable soup,** how much did you usually eat?
(1) Did not eat vegetable soup
(2)Less than 1 cup
(3) 1 to 2 cups
(4) 2 to 3 cups
(5) More than 3 cups
(6) Choose not to answer

19) Over the last month, how often did you eat **mixtures that included vegetables?** Count such foods as sandwiches, casseroles, stews, stir-fry, omelets, and tacos.
(1) never
(2) 1-3 times last **month**
(3) 1-2 times per **week**
(4) 3-4 times per **week**
(5) 5-6 times per **week**
(6) 1 time per **day**
(7) 2 times per **day**
(8) 3 times per **day**
(9) 4 times per **day**
(10) 5 or more times per **day**
(11) Choose not to answer

20) Including snacks, how many cups of fruit and 100% fruit juice do you usually eat each day?
(1) Less than ½ cup
(2) ½ cup
(3) 1 cup
(4) 1 ½ cups
(5) 2 cups
(6) 2 ½ cups
(7) 3 cups
(8) 3 ½ cups
(9) 4 cups
(10) 4 ½ cups
(11) 5 cups
(12) 5 ½ cups
(13) 6 cups or more
(14) Choose not to answer

21) Including snacks, how many cups of vegetables do you usually eat each day?
(1) Less than ½ cup
(2) ½ cup
(3) 1 cup
(4) 1 ½ cups
(5) 2 cups
(6) 2 ½ cups
(7) 3 cups
(8) 3 ½ cups
(9) 4 cups
(10) 4 ½ cups
(11) 5 cups
(12) 5 ½ cups
(13) 6 cups or more

(14) Choose not to answer

The next 2 questions are about grains.

22) How many servings of <u>grains</u> do you eat on average per day?
From Healthy Eating Index
NOTE: Any food made from wheat, rice, oats, cornmeal, barley or another cereal grain is a grain product. Bread, pasta, oatmeal, breakfast cerals, tortillas and grits are examples of grain products.
Examples: 1 serving = 1 slice of bread; 1 cup of ready-to-eat cereal; ½ cup cooked rice or pasta
1) Less than one
2) 1
3) 2
4) 3
5) 4
6) 5
7) 6 or more
8) Choose not to answer

23) How many servings of <u>whole grains</u> do you eat on average per day?
NOTE: All grains begin as whole grains; however, if after milling they keep all the parts of the original grain in their original proportions they are still considered a whole grain. Whole grains should be the first ingredient listed on the label.
Examples: 1 serving = 1 slice whole wheat bread; 5-6 whole grain crackers; ½ cup cooked brown rice; ½ cup oatmeal
1) Less than one
2) 1
3) 2
4) 3
5) 4
6) 5
7) 6 or more
8) Choose not to answer

APPENDIX D: Fat Screener

*****Not enough time to finish this survey now? You can come back later and finish, just remember to finish this page and click next at the bottom to save this page. When you return, you will start with the next survey.***

Thinking about your eating habits over the past 12 months. About how often did you eat or drink each of the following foods? Remember breakfast, lunch, dinner, snacks, and eating out. Click on only one bubble for each food.

1) Cold cereal
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

2) Skim milk, on cereal or to drink
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

3) Eggs, fried or scrambled in margarine, butter, or oil
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

4) Sausage or bacon, regular-fat
(1) never

(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

5) Margarine or butter on bread, rolls, pancakes
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

6) Orange juice or grapefruit juice
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

7) Fruit (not juices)
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

8) Beef or pork hot dogs, regular-fat
(1) never
(2) Less than once per month
(3) 1-3 times per month

(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

9) Cheese or cheese spread, regular-fat
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

10) French fries, home fries, or hash brown potatoes
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

11) Margarine or butter on vegetables, including potatoes
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

12) Mayonnaise, regular-fat
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week

(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

13) Salad dressings, regular-fat
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

14) Rice
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

15) Margarine, butter, or oil on rice or pasta
(1) never
(2) Less than once per month
(3) 1-3 times per month
(4) 1-2 times per week
(5) 3-4 times per week
(6) 5-6 times per week
(7) 1 time per day
(8) 2 or more times per day
(9) Choose not to answer

16) Over the past 12 months, when you prepared foods with margarine or ate margarine, how often did you use a reduced-fat margarine?
(1) Didn't Use Margarine
(2) Almost Never
(3) About ¼ of the time
(4) About ½ of the time
(5) About ¾ of the time
(6) Almost always or always

(7) Choose not to answer

17) Overall, when you think about the foods you ate over the past 12 months, would you say your diet was high, medium, or low in fat?
(1) High
(2) Medium
(3) Low
(4) Choose not to answer

APPENDIX E: Sugar-Sweetened Beverage Screener

*****Not enough time to finish this survey now? You can come back later and finish, just remember to finish this page and click next at the bottom to save this page. When you return, you will start with the next survey.***

1) On average, how often in the past month did you consume a non-diet, sugar-sweetened soft drink (pop)? (For example, Coke, Sprite, Dr. Pepper, Pepsi, Mountain Dew, Orange Crush, Mr. Pibb, 7-Up, Fanta, root beer)
(1) Never or less than one per month
(2) One to four per month
(3) Two to six per week
(4) One per day
(5) Two per day
(6) Three per day
(7) Four per day or more
(8) Choose not to answer

2) If you consumed any non-diet, sugar-sweetened soft drinks last month, what was the typical serving size you consumed?
(1) I have not had a non-diet sugared soft drink in the last month
(2) 12-ounce can
(3) Restaurant glass or cup
(4) 20-ounce bottle
(5) 2-liter bottle
(6) Choose not to answer

3) On average, how often in the past month did you consume fruit drinks or other sugar sweetened beverages? (For example, Hawaiian Punch, Hi-C, Kool-Aid, Ocean Spray cranberry juice cocktail, Snapple, Sunny Delight, Country Time Lemonade, Sobe, Arizon Ice Tea, sugar sweetened tea, etc.)
(1) Never or less than one per month
(2) One to four per month
(3) Two to six per week
(4) One per day
(5) Two per day
(6) Three per day
(7) Four per day or more
(8) Choose not to answer

4) If you consumed any fruit drinks last month, what was the typical serving size you consumed?
(1) I have not had a fruit drink in the last month
(2) 11.5-ounce can or less
(3) 20-ounce bottle

(4) 64-ounce bottle
(5) Choose not to answer

Note: The following energy drink and coffee drink items were designed by Mallory Koenings, Susan Nitzke, Beatrice Phillips.

5) On average, how often in the past month did you consume non-diet (**NOT** sugar-free) energy drinks (For example, RockStar, Red Bull, Monster, Full Throttle)?

(1) Never or less than one per month
(2) One to four per month
(3) Two to six per week
(4) One per day
(5) Two per day
(6) Three per day
(7) Four per day or more
(8) Choose not to answer

6) If you consumed any non-diet energy drinks last month, what was the typical serving size you consumed?
(1) I have not had a non-diet energy drink in the last month
(2) 2-6 oz. (energy shot)
(3) between 6 and 16 oz.
(4) more than 16 oz.
(5) Choose not to answer

7) On average, how often in the past month did you consume sugar-sweetened specialty coffee drinks (For example, Frappuccino, flavored latté/cappuccino)?
(1) Never or less than one per month
(2) One to four per month
(3) Two to six per week
(4) One per day
(5) Two per day
(6) Three per day
(7) Four per day or more
(8) Choose not to answer

8) If you consumed any sugar-sweetened specialty coffee drinks last month, what was the typical serving size you consumed?
(1)I have not had a sugar-sweetened specialty coffee last month
(2)12 oz. or less
(3) more than 12 oz.
(4) Choose not to answer

APPENDIX F: Weight-Related Eating Questionnaire

*****Not enough time to finish this survey now? You can come back later and finish, just remember to finish this page and click next at the bottom to save this page. When you return, you will start with the next survey.***

Note: WREQ scale scores are calculated as the average of the summed item raw scores by the following criteria: Not at all = 1; Slightly = 2; More or Less = 3; Pretty Well = 4; Completely = 5.
Routine Restraint = (Item 1 + Item 3 + Item 7)/3
Compensatory Restraint = (Item 10 + Item 12 + Item 16)/3
Susceptibility to External Cues = (Item 5 + Item 8 + Item 9 + Item 11 + Item 13)/5
Emotional Eating = (Item 2 + Item 4 + Item 6 + Item 14 + Item 15)/5

Please choose the response that best describes you.

1) I purposefully hold back at meals in order not to gain weight.
   (1) Not at all
   (2) Slightly
   (3) More or less
   (4) Pretty well
   (5) Completely
   (6) Choose not to answer

2) I tend to eat more when I am anxious, worried, or tense.
   (1) Not at all
   (2) Slightly
   (3) More or less
   (4) Pretty well
   (5) Completely
   (6) Choose not to answer

3) I count calories as a conscious means of controlling my weight.
   (1) Not at all
   (2) Slightly
   (3) More or less
   (4) Pretty well
   (5) Completely
   (6) Choose not to answer

4) When I feel lonely I console myself by eating.
   (1) Not at all
   (2) Slightly
   (3) More or less
   (4) Pretty well
   (5) Completely
   (6) Choose not to answer

5) I tend to eat more food than usual when I have more available places that serve or sell food.
   (1) Not at all
   (2) Slightly
   (3) More or less

(4) Pretty well
(5) Completely
(6) Choose not to answer

6) I tend to eat when I am disappointed or feel let down.
(1) Not at all
(2) Slightly
(3) More or less
(4) Pretty well
(5) Completely
(6) Choose not to answer

7) I often refuse foods or drinks offered because I am concerned about my weight.
(1) Not at all
(2) Slightly
(3) More or less
(4) Pretty well
(5) Completely
(6) Choose not to answer

8) If I see others eating, I have a strong desire to eat too.
(1) Not at all
(2) Slightly
(3) More or less
(4) Pretty well
(5) Completely
(6) Choose not to answer

9) Some foods taste so good I eat more even when I am no longer hungry.
(1) Not at all
(2) Slightly
(3) More or less
(4) Pretty well
(5) Completely
(6) Choose not to answer

10) When I have eaten too much during the day, I will often eat less than usual the following day.
(1) Not at all
(2) Slightly
(3) More or less
(4) Pretty well
(5) Completely
(6) Choose not to answer

11) I often eat so quickly I don't notice I'm full until I've eaten too much.
(1) Not at all
(2) Slightly
(3) More or less
(4) Pretty well
(5) Completely

(6) Choose not to answer

12) If I eat more than usual during a meal, I try to make up for it at another meal.
(1) Not at all
(2) Slightly
(3) More or less
(4) Pretty well
(5) Completely
(6) Choose not to answer

13) When I'm offered delicious food, it's hard to resist eating it even if I've just eaten.
(1) Not at all
(2) Slightly
(3) More or less
(4) Pretty well
(5) Completely
(6) Choose not to answer

14) I eat more when I'm having relationship problems.
(1) Not at all
(2) Slightly
(3) More or less
(4) Pretty well
(5) Completely
(6) Choose not to answer

15) When I'm under a lot of stress, I eat more than I usually do.
(1) Not at all
(2) Slightly
(3) More or less
(4) Pretty well
(5) Completely
(6) Choose not to answer

16) When I know I'll be eating a big meal during the day, I try to make up for it by eating less before or after that meal.
(1) Not at all
(2) Slightly
(3) More or less
(4) Pretty well
(5) Completely
(6) Choose not to answer

APPENDIX G: International Physical Activity Questionnaire

*****Not enough time to finish this survey now? You can come back later and finish, just remember to finish this page and click next at the bottom to save this page. When you return, you will start with the next survey.***

How Active Are You?
We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the <u>last 7 days</u>. 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.

Think about all the <u>vigorous</u> activities that you did in the last <u>7 days</u>. <u>Vigorous</u> physical activities refer to activities that take hard physical effort and make you breathe much harder than normal <u>or make your heart beat much harder than normal</u>. Think only about those <u>vigorous</u> physical activities that you did for at least 10 minutes at a time, <u>such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate</u>.

1) During the <u>last 7 days</u>, on how many days did you do <u>vigorous</u> physical activities like heavy lifting, digging, aerobics, or fast bicycling?
(1) 0 days (Skip to question 3)
(2) 1 day
(3) 2 days
(4) 3 days
(5) 4 days
(6) 5 days
(7) 6 days
(8) 7 days
(9) Choose not to answer

2) How much time did you usually spend doing <u>vigorous</u> physical activities on one of those days?
(1) Did not do vigorous physical activities
(2)10 minutes
(3) 20 minutes
(4) 30 minutes
(5) 40 minutes
(6) 50 minutes
(7) 60 minutes
(8) 70 minutes (1 hr 10 min)
(9) 80 minutes (1 hr 20 min)
(10) 90 minutes (1 hr 30 min)
(11) 100 minutes (1 hr 40 min)
(12) 110 minutes (1 hr 50 min)

(13) 120 minutes (2 hrs)
(14) 130 minutes (2 hrs 10 min)
(15) 140 minutes (2 hrs 20 min)
(16) 150 minutes (2 hrs 30 min)
(17) 160 minutes (2 hrs 40 min)
(18) 170 minutes (2 hrs 50 min)
(19) 180 + minutes (3 hrs or more)
(20) Don't know/not sure
(21) Choose not to answer

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal or make your heart beat somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time, such as brisk walking, bicycling, vacuuming, gardening, or anything else that causes some increase in breathing or heart rate.

3) 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.
(1) 0 days (Skip to question 5)
(2) 1 day
(3) 2 days
(4) 3 days
(5) 4 days
(6) 5 days
(7) 6 days
(8) 7 days
(9) Choose not to answer

4) How much time did you usually spend doing moderate physical activities on one of those days?

(1) Do not do moderate physical activities
(2)10 minutes
(3) 20 minutes
(4) 30 minutes
(5) 40 minutes
(6) 50 minutes
(7) 60 minutes
(8) 70 minutes (1 hr 10 min)
(9) 80 minutes (1 hr 20 min)
(10) 90 minutes (1 hr 30 min)
(11) 100 minutes (1 hr 40 min)
(12) 110 minutes (1 hr 50 min)
(13) 120 minutes (2 hrs)

(14) 130 minutes (2 hrs 10 min)
(15) 140 minutes (2 hrs 20 min)
(16) 150 minutes (2 hrs 30 min)
(17) 160 minutes (2 hrs 40 min)
(18) 170 minutes (2 hrs 50 min)
(19) 180 + minutes (3 hrs or more)
(20) Don't know/not sure
(21) Choose not to answer

Think about the time you spent <u>walking</u> in the <u>last 7 days</u>. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise or leisure.

5) During the <u>last 7 days</u>, on how many days did you <u>walk</u> for at least 10 minutes at a time?
(1) 0 days (Skip to question 7)
(2) 1 day
(3) 2 days
(4) 3 days
(5) 4 days
(6) 5 days
(7) 6 days
(8) 7 days
(9) Choose not to answer

6) How much time did you usually spend <u>walking</u> on one of those days?

(1) Did not walk
(2)10 minutes
(3) 20 minutes
(4) 30 minutes
(5) 40 minutes
(6) 50 minutes
(7) 60 minutes
(8) 70 minutes (1 hr 10 min)
(9) 80 minutes (1 hr 20 min)
(10) 90 minutes (1 hr 30 min)
(11) 100 minutes (1 hr 40 min)
(12) 110 minutes (1 hr 50 min)
(13) 120 minutes (2 hrs)
(14) 130 minutes (2 hrs 10 min)
(15) 140 minutes (2 hrs 20 min)
(16) 150 minutes (2 hrs 30 min)
(17) 160 minutes (2 hrs 40 min)
(18) 170 minutes (2 hrs 50 min)

(19) 180 + minutes (3 hrs or more)
(20) Don't know/not sure
(21) Choose not to answer

This question is about the time you spent <u>sitting</u> on weekdays during the <u>last 7 days</u>. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television.

7) During the <u>last 7 days</u>, how much time did you spend <u>sitting</u> on a week day?
(1) 10 minutes
(2) 20 minutes
(3) 30 minutes
(4) 40 minutes
(5) 50 minutes
(6) 60 minutes
(7) 70 minutes (1 hr 10 min)
(8) 80 minutes (1 hr 20 min)
(9) 90 minutes (1 hr 30 min)
(10) 100 minutes (1 hr 40 min)
(11) 110 minutes (1 hr 50 min)
(12) 120 minutes (2 hrs)
(13) 130 minutes (2 hrs 10 min)
(14) 140 minutes (2 hrs 20 min)
(15) 150 minutes (2 hrs 30 min)
(16) 160 minutes (2 hrs 40 min)
(17) 170 minutes (2 hrs 50 min)
(18) 180 + minutes (3 hrs or more)
(19) Don't know/not sure
(20) Choose not to answer

Think about the time you spent doing any physical activities specifically designed to <u>strengthen</u> your <u>muscles</u> such as lifting weights, push-ups or sit-ups. Include all such activities even if you have reported them before.

8) During the <u>last 7 days</u>, how many days did you do any physical activities designed to <u>strengthen</u> muscles such as lifting weights, push-ups or sit-ups?
(1) 0 days (Skip to question 68)
(2) 1 day
(3) 2 days
(4) 3 days
(5) 4 days
(6) 5 days
(7) 6 days
(8) 7 days
(9) Choose not to answer

9) How much time did you usually spend doing <u>strength training activities</u> on one of those days?
(1) Did not do strength activities
(2)10 minutes
(3) 20 minutes
(4) 30 minutes
(5) 40 minutes
(6) 50 minutes
(7) 60 minutes
(8) 70 minutes (1 hr 10 min)
(9) 80 minutes (1 hr 20 min)
(10) 90 minutes (1 hr 30 min)
(11) 100 minutes (1 hr 40 min)
(12) 110 minutes (1 hr 50 min)
(13) 120 minutes (2 hrs)
(14) 130 minutes (2 hrs 10 min)
(15) 140 minutes (2 hrs 20 min)
(16) 150 minutes (2 hrs 30 min)
(17) 160 minutes (2 hrs 40 min)
(18) 170 minutes (2 hrs 50 min)
(19) 180 + minutes (3 hrs or more)
(20) Don't know/not sure
(21) Choose not to answer

APPENDIX H: Unreported Data Tables

Table 4a: Correlations between primary study variables for complete study sample (n=1,116)

	Perceived Stress Score	Body Mass Index (kg/m^2)	Waist Circumference (cm)	Fruit and Vegetable Consumption (cups/day)s	Percent of Daily Calories from Fat	Daily Calories from Sugar-Sweetened Beverages (kcal)s	Routine Restraint Score	Compensatory Restraint Score	Susceptibility to External Cues Score	Emotional Eating Score	Vigorous Physical Activity (MET minutes/week)s	Total Physical Activity (MET minutes/week)s
Perceived Stress Score	-											
Body Mass Index (kg/m^2)	.081**	-										
Waist Circumference (cm)	.094**	.883**	-									
Fruit and Vegetable Consumption (cups/day)s	-.085**	-.043	-.055	-								
Percent of Daily Calories from Fat	.118**	.109**	.127**	-.186**	-							
Daily Calories from Sugar-Sweetened Beverages (kcal)s	.119**	-.089**	-.128**	-.017	.341**	-						
Routine Restraint Score	.088**	.047	.028	-.082	-.212**	-.218**	-					
Compensatory Restraint Score	.096**	.033	.011	-.035	-.128**	-.149**	.594**	-				
Susceptibility to External Cues Score	.252**	.110**	.137**	-.082**	-.114**	.002	.142**	.218**	-			
Emotional Eating Score	.346**	.207**	.204**	-.078**	.050	-.014	.187**	.235**	.475**	-		
Vigorous Physical Activity (MET minutes/week)s	-.095**	.022	-.023	.195**	-.129**	-.103**	.100**	.023	-.104**	-.084**	-	
Total Physical Activity (MET minutes/week)s	-.099**	-.019	-.042	.240**	-.113**	-.080**	.062*	.004	-.122**	-.095**	.810**	-

s: Spearman's rho, used for non-normally distributed variables. All reported correlation coefficients are Pearson's coefficients unless otherwise noted.
*p<.05
**p<.01

Table 4b: Correlations between primary study variables, males only (n=339)

	Perceived Stress Score	Body Mass Index (kg/m^2)	Waist Circumference (cm)	Fruit and Vegetable Consumption (cups/day)s	Percent of Daily Calories from Fat	Daily Calories from Sugar-Sweetened Beverages (kcal)s	Routine Restraint Score	Compensatory Restraint Score	Susceptibility to External Cues Score	Emotional Eating Score	Vigorous Physical Activity (MET minutes/week)s	Total Physical Activity (MET minutes/week)s
Perceived Stress Score	-											
Body Mass Index (kg/m^2)	.044	-										
Waist Circumference (cm)	.073	.907**	-									
Fruit and Vegetable Consumption (cups/day)s	.-.069	-.024	-.033	-								
Percent of Daily Calories from Fat	.117*	.074	.099	-.119*	-							
Daily Calories from Sugar-Sweetened Beverages (kcal)s	.205**	.068	.088	.030	.322**	-						
Routine Restraint Score	.143**	.204**	..170**	.110*	-.255**	-.156**	-					
Compensatory Restraint Score	.202**	.284**	.264**	.061	-.105	-.043	.569**	-				
Susceptibility to External Cues Score	.237**	.200**	.260**	.006	.171**	.093	.061	.208**	-			
Emotional Eating Score	.362**	.265**	.287**	-.025	.075	.120*	.184**	.264**	.430**	-		
Vigorous Physical Activity (MET minutes/week)s	-.039	-.002	-.106	.210**	-.068	-.114*	.079	-.007	-.078	-.052	-	
Total Physical Activity (MET minutes/week)s	-.050	-.050	-.121*	.225**	-.093	-.080	.096	-.038	-.122*	-.044	.853**	-

s: Spearman's rho, used for non-normally distributed variables. All reported correlation coefficients are Pearson's coefficients unless otherwise noted.
*p<.05
**p<.01

Table 4c: Correlations between primary study variables, females only (n=777)

	Perceived Stress Score	Body Mass Index (kg/m^2)	Waist Circumference (cm)	Fruit and Vegetable Consumption (cups/day)s	Percent of Daily Calories from Fat	Daily Calories from Sugar-Sweetened Beverages (kcal)s	Routine Restraint Score	Compensatory Restraint Score	Susceptibility to External Cues Score	Emotional Eating Score	Vigorous Physical Activity (MET minutes/week)s	Total Physical Activity (MET minutes/week)s
Perceived Stress Score	-											
Body Mass Index (kg/m^2)	.112**	-										
Waist Circumference (cm)	.134**	.875**	-									
Fruit and Vegetable Consumption (cups/day)s	-.049	-.068	-.088*	-								
Percent of Daily Calories from Fat	.128**	.119**	.133**	-.233**	-							
Daily Calories from Sugar-Sweetened Beverages (kcal)s	.119**	.081*	.117**	-.066	.337**	-						
Routine Restraint Score	.030	.009	.012	.026	-.192**	-.207**	-					
Compensatory Restraint Score	.008	-.038	-.044	.065	-.130**	-.164**	.577**	-				
Susceptibility to External Cues Score	.244**	.083*	.106**	-.105**	.097**	-.018	.151**	.199**	-			
Emotional Eating Score	.315**	.231**	.247**	.056	.060	.001	.125**	.156**	.486**	-		
Vigorous Physical Activity (MET minutes/week)s	-.083*	.011	-.033	.165**	-.183**	-.150**	.178**	.110**	-.092**	-.021	-	
Total Physical Activity (MET minutes/week)s	-.076*	-.034	-.062	.230**	-.156**	-.143**	.130**	.108**	-.095**	-.025	.778**	-

s: Spearman's rho, used for non-normally distributed variables. All reported correlation coefficients are Pearson's coefficients unless otherwise noted.
*p<.05
**p<.01

Table 5a: Means ± standard deviations by tertiles of perceived stress scores for complete study sample (n=1,116)

	Lowest Stress (n=328)	Intermediate Stress (n=429)	Highest Stress (n=359)	F	p-value	Eta^{2*}
Body Mass Index (kg/m^2)	23.6 ± 4.1^{a}	24.0 ± 4.1^{ab}	24.5 ± 4.8^{b}	3.632	.027	.006
Waist Circumference (cm)	81.2 ± 10.7^{a}	82.2 ± 10.1^{ab}	83.7 ± 11.8^{b}	4.891	.008	.009
Fruit and Vegetable Consumption (cups/day)	2.7 ± 2.0^{a}	2.8 ± 1.9^{a}	2.3 ± 1.9^{b}	5.355	.005	.006
Percent of Daily Calories from Fat (%)	30.5 ± 4.8^{a}	30.7 ± 4.9^{a}	31.8 ± 5.0^{b}	7.070	.001	.013
Daily Calories from Sugar-Sweetened Beverages (kcal)	121 ± 158^{a}	138 ± 184^{a}	182 ± 243^{b}	8.807	<.001	.016
Routine Restraint Score	1.7 ± 0.8^{a}	1.9 ± 0.8^{b}	1.9 ± 0.8^{b}	6.235	.002	.011
Compensatory Restraint Score	2.3 ± 1.0^{a}	2.5 ± 1.0^{b}	2.5 ± 1.0^{b}	6.316	.002	.015
Susceptibility to External Cues Score	2.6 ± 0.9^{a}	2.8 ± 0.8^{b}	3.1 ± 0.9^{c}	32.256	<.001	.055
Emotional Eating Score	1.7 ± 0.8^{a}	2.0 ± 0.9^{b}	2.5 ± 1.1^{c}	62.113	<.001	.100
Vigorous Physical Activity (MET minutes/week)	1215 ± 1245^{a}	1140 ± 1201^{ab}	974 ± 1157^{b}	3.705	.025	.007
Total Physical Activity (MET minutes/week)	2349 ± 1674^{a}	2297 ± 1641^{ab}	2046 ± 1654^{b}	3.414	.033	.006

^{a,b,c} indicate significant or non-significant differences of means between groups, as determined by post-hoc Tukey B tests. Groups sharing the same superscript letter(s) do not have significantly different mean values.

*Eta^2 calculated as sum of squares between groups/total sum of square

Table 5b: Means ± standard deviations by tertiles of perceived stress scores for males only (n=339)

	Lowest Stress (n=110)	Intermediate Stress (n=134)	Highest Stress (n=95)	F	p-value	Eta^{2*}
Body Mass Index (kg/m^2)	24.3 ± 4.6^{a}	24.2 ± 4.0^{a}	25.1 ± 3.9^{a}	1.624	.199	.010
Waist Circumference (cm)	84.3 ± 11.4^{a}	83.3 ± 10.0^{ab}	86.7 ± 10.4^{b}	2.862	.059	.018
Fruit and Vegetable Consumption (cups/day)	3.0 ± 2.0^{a}	3.1 ± 2.0^{a}	2.5 ± 2.1^{a}	2.461	.087	.014
Percent of Daily Calories from Fat (%)	31.1 ± 4.6^{a}	30.7 ± 5.0^{ab}	32.3 ± 4.0^{b}	3.579	.029	.021
Daily Calories from Sugar-Sweetened Beverages (kcal)	150 ± 193^{a}	182 ± 233^{a}	268 ± 299^{b}	6.382	.002	.037
Routine Restraint Score	1.5 ± 0.7^{a}	1.5 ± 0.6^{a}	1.8 ± 0.9^{b}	5.391	.005	.031
Compensatory Restraint Score	1.9 ± 0.9^{a}	2.0 ± 0.8^{a}	2.4 ± 1.1^{b}	7.166	.001	.041
Susceptibility to External Cues Score	2.5 ± 0.9^{a}	2.6 ± 0.8^{a}	3.0 ± 0.9^{b}	8.664	<.001	.049
Emotional Eating Score	1.4 ± 0.5^{a}	1.6 ± 0.7^{a}	2.1 ± 0.9^{b}	26.693	<.001	.137
Vigorous Physical Activity (MET minutes/week)	1535 ± 1419^{a}	1539 ± 1444^{a}	1407 ± 1439^{a}	.280	.756	.002
Total Physical Activity (MET minutes/week)	2768 ± 1923^{a}	2865 ± 1817^{a}	2716 ± 1999^{a}	.184	.832	.001

^{a,b,c} indicate significant or non-significant differences of means between groups, as determined by post-hoc Tukey B tests. Groups sharing the same superscript letter(s) do not have significantly different mean values.

*Eta^2 calculated as sum of squares between groups/total sum of square

Table 5c: Means ± standard deviations by tertiles of perceived stress scores for females only (n=777)

	Lowest Stress (n=243)	Intermediate Stress (n=296)	Highest Stress (n=238)	F	p-value	Eta^{2*}
Body Mass Index (kg/m^2)	23.5 ± 4.1[a]	23.6 ± 3.9[a]	24.5 ± 5.2[b]	4.285	.014	.011
Waist Circumference (cm)	80.1 ± 10.1[a]	81.1 ± 10.2[a]	83.3 ± 12.2[b]	5.333	.005	.014
Fruit and Vegetable Consumption (cups/day)	2.6 ± 2.0[a]	2.5 ± 1.8[a]	2.4 ± 1.8[a]	.878	.416	.002
Percent of Daily Calories from Fat (%)	30.2 ± 4.9[a]	30.8 ± 4.9[ab]	31.7 ± 5.2[b]	5.284	.005	.013
Daily Calories from Sugar-Sweetened Beverages (kcal)	110 ± 152[a]	114 ± 154[a]	157 ± 206[b]	5.871	.003	.015
Routine Restraint Score	1.9 ± 0.8[a]	2.0 ± 0.8[a]	1.9 ± 0.8[a]	2.073	.127	.005
Compensatory Restraint Score	2.5 ± 1.0[a]	2.7 ± 1.0[a]	2.6 ± 1.0[a]	1.465	.232	.004
Susceptibility to External Cues Score	2.6 ± 0.9[a]	2.9 ± 0.8[b]	3.2 ± 0.9[c]	23.635	<.001	.058
Emotional Eating Score	1.9 ± 0.8[a]	2.3 ± 1.0[b]	2.7 ± 1.1[c]	34.116	<.001	.081
Vigorous Physical Activity (MET minutes/week)	1039 ± 1137[a]	889 ± 920[a]	894 ± 1088[a]	1.665	.190	.004
Total Physical Activity (MET minutes/week)	2107 ± 1477[a]	1938 ± 1402[a]	1927 ± 1567[a]	1.169	.311	.003

[a,b,c] indicate significant or non-significant differences of means between groups, as determined by post-hoc Tukey B tests. Groups sharing the same superscript letter(s) do not have significantly different mean values.
*Eta^2 calculated as sum of squares between groups/total sum of squares

Table 6a: Kruskal-Wallis mean ranks (medians) between tertiles of perceived stress for complete study sample (n=1,116)

	Lowest Stress (n=328)	Intermediate Stress (n=429)	Highest Stress (n=359)	χ^2	p-value
Body Mass Index (kg/m^2)	516.54 (22.7)[a]	562.98 (23.1)[b]	591.48 (23.5)[b]	9.403	.009
Waist Circumference (cm)	514.58 (79.3)[a]	561.15 (80.5)[b]	595.46 (80.8)[b]	10.840	.004
Fruit and Vegetable Consumption (cups/day)	565.65 (2.2)[a]	597.04 (2.4)[a]	505.91 (1.8)[b]	15.854	<.001
Percent of Daily Calories from Fat (%)	531.70 (30.5)[a]	536.46 (30.4)[a]	609.32 (31.3)[b]	13.200	.001
Daily Calories from Sugar-Sweetened Beverages (kcal)	518.54 (54.6)[a]	553.68 (89.0)[a]	600.76 (102.2)[b]	11.326	.003
Routine Restraint Score	488.57 (1.33)[a]	582.85 (1.67)[b]	593.29 (1.67)[b]	22.753	<.001
Compensatory Restraint Score	500.96 (2.00)[a]	576.19 (2.33)[b]	589.93 (2.33)[b]	15.314	<.001
Susceptibility to External Cues Score	475.72 (2.60)[a]	537.76 (2.80)[b]	658.91 (3.20)[c]	58.488	<.001
Emotional Eating Score	431.87 (1.60)[a]	551.06 (1.80)[b]	683.08 (2.40)[c]	105.435	<.001
Vigorous Physical Activity (MET minutes/week)	587.09 (960)[a]	576.27 (720)[a]	511.15 (640)[b]	11.778	.003
Total Physical Activity (MET minutes/week)	589.44 (2084)[a]	577.59 (1902)[a]	507.43 (1552)[b]	13.541	.001

[a,b,c] indicate significant or non-significant differences in mean ranks between groups, as determined by post-hoc Mann-Whitney U tests. Groups sharing the same superscript letter(s) do not have significantly different mean rank values.

Table 6b: Kruskal-Wallis mean ranks (medians) between tertiles of perceived stress for males only (n=339)

	Lowest Stress (n=110)	Intermediate Stress (n=134)	Highest Stress (n=95)	χ^2	p-value
Body Mass Index (kg/m^2)	158.55 (23.2)[a]	163.40 (23.1)[a]	192.56(24.1)[b]	7.140	.028
Waist Circumference (cm)	162.33 (81.5)[a]	158.59 (81.8)[a]	194.84(84.6)[b]	8.560	.014
Fruit and Vegetable Consumption (cups/day)	178.06 (2.5)[a]	179.81 (2.7)[a]	146.83(2.0)[b]	7.395	.025
Percent of Daily Calories from Fat (%)	168.34 (31.1)[a]	156.15 (30.9)[a]	191.46 (32.3)[b]	7.264	.026
Daily Calories from Sugar-Sweetened Beverages (kcal)	150.67 (79.6)[a]	164.29 (118.3)[a]	200.43 (177.7)[b]	13.907	.001
Routine Restraint Score	157.70 (1.33)[a]	163.39 (1.33)[a]	193.56 (1.67)[b]	8.533	.014
Compensatory Restraint Score	150.57 (1.33)[a]	168.45 (1.83)[a]	194.68 (2.70)[b]	10.589	.005
Susceptibility to External Cues Score	151.22 (2.40)[a]	161.92 (2.70)[a]	203.14 (3.0)[b]	15.884	<.001
Emotional Eating Score	132.74 (1.2)[a]	162.15 (1.4)[b]	224.21 (1.8)[c]	47.339	<.001
Vigorous Physical Activity (MET minutes/week)	172.68 (1240)[a]	173.19 (1200)[a]	162.40 (960)[a]	0.801	.670
Total Physical Activity (MET minutes/week)	171.55 (2564)[a]	175.13 (2517)[a]	160.96 (2095)[a]	1.204	.548

[a,b,c] indicate significant or non-significant differences in mean ranks between groups, as determined by post-hoc Mann-Whitney U tests. Groups sharing the same superscript letter(s) do not have significantly different mean rank values.

Table 6c: Kruskal-Wallis mean ranks (medians) between tertiles of perceived stress for females only (n=777)

	Lowest Stress (n=243)	Intermediate Stress (n=296)	Highest Stress (n=238)	χ^2	p-value
Body Mass Index (kg/m^2)	367.41 (22.5)[a]	378.41 (22.7)[a]	424.31 (23.5)[b]	8.806	.012
Waist Circumference (cm)	359.52 (77.8)[a]	384.56 (80.0)[a]	424.62 (80.4)[b]	10.301	.006
Fruit and Vegetable Consumption (cups/day)	398.07 (2.1)[a]	396.90 (2.0)[a]	369.92 (1.9)[a]	2.483	.289
Percent of Daily Calories from Fat (%)	359.97 (30.0)[a]	384.02 (30.1)[a]	424.84 (31.0)[b]	10.279	.006
Daily Calories from Sugar-Sweetened Beverages (kcal)	362.89 (43)[a]	383.83 (67)[a]	422.09 (89)[b]	8.636	.013
Routine Restraint Score	359.23 (1.67)[a]	408.14 (2.00)[b]	395.60 (1.67)[b]	6.787	.034
Compensatory Restraint Score	372.50 (2.33)[a]	407.20 (2.67)[a]	383.21 (2.33)[b]	3.451	.178
Susceptibility to External Cues Score	325.91 (2.60)[a]	385.17 (2.80)[b]	458.19 (3.20)[c]	42.078	<.001
Emotional Eating Score	314.88 (1.80)[a]	388.81 (2.00)[b]	464.91 (2.60)[c]	54.005	<.001
Vigorous Physical Activity (MET minutes/week)	409.01 (720)[a]	391.35 (680)[ab]	365.64 (480)[b]	4.612	.100
Total Physical Activity (MET minutes/week)	410.51 (1784)[a]	390.01 (1666)[ab]	365.78 (1491)[b]	4.784	.091

[a,b,c] indicate significant or non-significant differences in mean ranks between groups, as determined by post-hoc Mann-Whitney U tests. Groups sharing the same superscript letter(s) do not have significantly different mean rank values.