University of Nevada, Reno

The Association of Self-Esteem and Energy Balance and Risk for Disordered Eating and Energy Balance in College Freshmen

A thesis submitted in partial fulfillment of the
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by

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Abstract

Objective: Assess the association between self-esteem (SE) and energy balance (EB) and risk for disordered eating (DE) and EB in college freshmen. In addition, evaluating if a combined low SE and risk for DE are predictive of a negative EB.

Method: Fifteen female and five male freshmen students from the University of Nevada, Reno volunteered for the five-day study. On the first appointment day, subjects completed a questionnaire regarding demographics, a 24-hour recall, and body composition analysis and were provided with an accelerometer and physical activity log. Subjects wore the accelerometer and completed the physical activity log over the duration of the study. On the fifth day of the study period, subjects revisited the nutrition laboratory and returned their accelerometer and physical activity log and completed the Rosenberg Self-Esteem Scale (RSES) questionnaire and the Eating Attitudes Test (EAT) questionnaire. Analysis of Variance (ANOVA), t-tests, logistic regression and linear regression were conducted.

Results: The study found non-significant differences of means for energy intake (EI), total energy expenditure (TEE) and energy balance (EB) between individuals who were at risk for DE and not at risk for DE (p=0.458; p=0.931; p=0.499, respectively). There were non-significant differences of means for EI, TEE, and EB between individuals with normal self-esteem (SE) and high SE (p=0.198; p=0.181; p=0.091, respectively). For the body mass index (BMI) categories of underweight, normal weight, overweight, and obese, there were no significant differences of means for EI, TEE, and EB (p=0.447; p=0.213; p=0.212, respectively). SE and risk for DE did not predict EB when it was expressed as two categories. In the final linear regression model, no significant association was found between low SE and EB. However, those subjects at risk for DE had a significant 1,630 kcalorie greater EB deficit compared to individuals not at risk for DE when holding age, sex, race, and BMI (kg/m^2) constant (p=0.080 and p=0.053, respectively). Race also significantly predicted EB in the final linear regression model. Whites were more likely to be in a positive EB than Hispanics (p=0.039).

Discussion: Long periods of being in a state of energy imbalance can result in weight gain or weight loss. These findings offer a potential explanation for the average 2 to 7 pound weight gain observed during the freshmen year in college and the role of risk for DE on EB. These results suggest that evaluating psychological factors such as risk for DE may help differentiate who will gain, maintain, or lose weight as a college freshman.

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List of Definitions

Body Mass Index (BMI) kg/m^2: A number calculated from a person's weight in kilograms divided by their height in meters squared (kg/m^2).

Disordered Eating (DE): A wide range of irregular eating behaviors not severe enough to be diagnosed as a specific eating disorder.

Energy Balance (EB): The homeostasis of energy, or the relationship between total energy intake and total energy expenditure in living systems.

Energy Intake (EI): The total number of calories consumed per day.

Self-Esteem (SE): A favorable or unfavorable attitude towards the self and a feeling of pride in the self.

Total Energy Expenditure (TEE): The total number of calories expended per day taking into account both resting metabolic rate and physical activity.

Appendices

Introduction

Data from the Behavioral Risk Factor Surveillance System shows that the greatest increase in obesity rates from 1991 to 1998 were among 18 to 29 year olds [1, 2]. This corresponds to the mean age of an incoming freshman student (18.2 to 19.01 years of age) [3, 4]. This may propitiate the popular belief of the "freshman 15". The term "freshman 15" refers to an unintentional weight gain that is thought to occur during the freshman year of college [2, 5-7]. However, not all college freshmen gain the predicted 15 pounds. According to a study by Gropper et al. only about 5% of college freshmen actually gain 15 pounds during their freshman year [6]. The results found in a study by Wengreen et al. showed that 23% of their subjects (n = 159) gained weight during their first semester of freshman year (defined as ≥5% of their baseline body weight) [2]. Of those who gained weight, males gained an average of 11.6 lbs. (±4.2 lbs.) and females gained an average of 9.2 lbs. (±3 lbs.) [2]. Statistically significant weight gain was also found in a study by Morrow et al. where subjects gained an average of 2.4 lbs. (± 5.7) throughout freshman year ($p \leq 0.0001$) [1].

Some freshman do not gain any weight, maintaining energy balance (EB) (total energy intake = total energy expenditure) [2]. Other studies have observed the opposite, a negative EB (total energy intake < total energy expenditure), resulting in weight loss [6, 7].

It is unclear if there is an underlying difference, especially between the psychological factors self-esteem (SE) and risk for disordered eating (DE) that differentiate from who will gain, maintain, or lose weight as a freshman.

Factors that have been identified as promoting weight gain during freshman year include: excess intake by buffet style dining [8, 9], poor food choices [5, 8-12], increased alcohol consumption [3, 5, 8, 10], late night snacking [3, 5, 10], and/or a decrease in overall physical activity [2, 5, 7-10].

The weight gained may result in becoming overweight or obese [9, 13]. Those who are overweight or obese as a child, adolescent, or young adult are more likely to become or remain obese throughout their life [9, 13]. Individuals who are obese are at much higher risks for developing chronic diseases associated with obesity such as cardiovascular disease, type II diabetes mellitus, dyslipidemia, metabolic syndrome, certain cancers and osteoporosis when compared to individuals within a healthy weight range [12].

They may also be confronted with stereotyping, prejudice, and discrimination due to their weight [14, 15]. According to Andreyeva et al. weight discrimination in the U.S. has increased 66% in the last decade [16]. Heuer et al. evaluated the portrayal of obese individuals in internet and newspaper articles[15]. They found that 72% of images portrayed individuals who were obese in a negative, stigmatizing way and were more likely to have their heads cropped out with only their abdominal section or lower body showing, and were also more likely to be shown eating or drinking than individuals who were not obese [15]. Discrimination and social injustice is also present in the workforce, healthcare settings, and educational institutions, resulting in a common decrease in quality of life [14].

Existing low SE or a new onset of low SE are common among adolescents and young adults who are transitioning from high school to college or who are already in college [17]. Many people have difficulties with SE and self-perceived body image, which is defined as either a favorable or unfavorable attitude toward the self, and a feeling of pride in the self [18]. Harring et al. found that in their large sample (n = 90,484), 28% of their respondents suffered from an inaccurate perception of their body weight [17]. Of those 28%, 46.2% believed they were in a higher BMI category than in reality [17]. The other 53.8% of those suffering from an inaccurate body weight perception believed they were in a lower BMI category than they really were [17]. Also, of the 90,484 participants, 51.3% stated that they were currently trying to lose weight, but only 45.5% of those individuals were actually overweight or obese [17]. Not having the "ideal" physique that society promotes as perfect, can lead to significant changes or issues in regards to SE [18, 19], which is driven further by the additional stressors of dealing with the transition from high school to college [17].

A possible result in changes in SE and self-perceived body image is an accompanying change in eating attitudes, such as disordered eating (DE) [17, 20-22]. A study by Gargari et al., found that women (n = 250) ranging from 14 to 51 years old with a lower sense of SE, determined by the Rosenberg's Self-Esteem Scale (RSES), had higher senses of social physique anxiety ($p < 0.02$) and higher risk for developing DE ($p < 0.05$), as determined by the Eating Attitudes Test (EAT), than those who had a higher sense of SE [21].

DE has become increasingly prevalent in levels significant enough to warrant attention from researchers. Studies have shown the prevalence of DE in various samples of college females to range from 1.3% to 28.5%, although it is speculated that the prevalence is much higher [23-25]. The Diagnostic and Statistical Manual of Mental

Disorders defines DE as a wide range of irregular eating behaviors that are not severe enough to be diagnosed as a specific eating disorder such as anorexia nervosa or bulimia nervosa [26]. DE has been associated with an altered view of body shape and perceived body weight, reflecting negative beliefs about the self (e.g., low SE) [27].

Previously, DE was mainly observed amongst females, but lately DE patterns and weight cycling have been a growing issue for young males as well [28]. Similar to females, males have reported the use of drastic measures such as induced vomiting and/or using laxatives or medications in order to maintain or lose weight [17, 20]. A study looking at weight satisfaction and dieting practices in Taiwan male college students (n = 930) found that a large number of the subjects were dissatisfied with their current body weight (the specific number of subjects dissatisfied with their weight was not stated in the study) [20]. They also found that despite not being overweight, 34% of their subjects were still attempting to lose weight, with their methods becoming more drastic as BMI increased [20].

There is a lack of knowledge pertaining to both the associations of SE and DE in relation to EB (combined energy intake and total energy expenditure) amongst college freshmen. Many studies have been conducted that focus on weight changes, mainly weight gain, during the freshman year of college [1, 2, 4-6, 11-13, 29, 30]. Previous studies have focused on energy intake; examining the association of different levels of SE with eating behaviors, either in terms of eating attitudes, DE, or eating disorders [21, 22, 31-34]. A few studies evaluated total energy expenditure (i.e. the associations between SE and physical activity) [17, 35]. No studies included both aspects of the energy balance equation (energy intake and total energy expenditure) while evaluating SE and

DE in relationship to weight change. This study is unique due to the analysis of both energy intake, by 24-hour recall, and total energy expenditure, by accelerometer, in order to calculate an individual's level or energy balance.

In this study, participants completed an Eating Attitudes Test (EAT) to assess risk for DE [21]. This test has been shown to be valid and reliable predictors of DE patterns and the potential risk for having or later developing an eating disorder [36, 37]. The study also used the Rosenberg's Self-Esteem Scale (RSES) to assess an individual's level of SE. RSES is a valid and reliable method for assessing different aspects of SE, including topics such as body image perception, body image satisfaction, and self worth [38]. It is the most widely used assessment tool for measuring individual SE [38]. The aim of this study is to examine if low SE and/or risk for DE increase the odds of a negative EB or predict a negative EB amongst college freshmen.

The study hypotheses:

1. College freshmen with low self-esteem attending the University of Nevada, Reno will be associated with being in a negative energy balance (total energy intake < total energy expenditure).
2. College freshmen with a risk for disordered eating attending the University of Nevada, Reno will be associated with being in a negative energy balance.
3. Lower self-esteem and/or being at risk for disordered eating will be predictive factors of a negative energy balance in college freshmen attending the University of Nevada, Reno.

Literature Review

Obesity

The Centers for Disease Control and Prevention (CDC) has established classifications for individuals who are underweight, healthy weight, overweight, and obese based on body mass index (BMI) (Table 1) [39].

Table 1: Centers for Disease Control weight classifications according to BMI Category

Underweight	BMI < 18.5 kg/m2
Healthy Weight	BMI 18.5 – 24.9 kg/m2
Overweight	BMI 25 – 29.9 kg/m2
Obese	BMI > 30 kg/m2

Using these definitions, the Healthy People 2010 set forth to reduce the proportion of adults in the United States who are obese from a baseline prevalence of 23%, measured from 1988 to 1994, down to 15% [40]. Rather than the national prevalence of obesity decreasing, the percentage of adults who are obese increased to 33.8% [39]. The new goal set forth by Healthy People 2020 is to reduce the proportion of adults in the United States who are obese from a baseline prevalence of 34.0% to 30.6% [40, 41], which is more than double the previous target goal of Healthy People 2010.

<u>Obesity and Education Levels</u>

Data from the Behavioral Risk Factor Surveillance System (BRFSS) showed that the greatest increase in obesity rates from 1991 to 1998 were among 18 to 29 year olds, the general age of college undergraduates, which increased from 7.1% to 12.1% [1, 2]. Additionally, over the same time period the BRFSS found that those with 'some college education' displayed a more dramatic rise in obesity rates than those with no college education, increasing from 10.6% to 17.8% between 1991 and 1998 [1].

However, others have observed the opposite relationship between BMI categories and education levels [42]. Data from the National Health and Nutrition Examination Survey (NHANES) of 2005-2008 found a higher prevalence of obesity among lower educated individuals compared to individuals with higher education [43]. Among men who completed college, 27.4% were obese compared to 34.8% of men with a high school degree and 32.1% of men with less than a high school degree [43]. A significant difference was only present between the 36.2% obesity rate among men with some college education and 27.4% for males male college graduates (no p-value given) [43]. NHANES data for women showed a significant trend with lower obesity prevalence with increasing education, with 23.4% of women with a college degree classified as obese, 38.4% of women with some college education, 39.8% of women with a high school degree, and 42.1% of women with less than a high school degree (no p-value given) [43]. In summary, data regarding obesity prevalence reported in NHANES for both male and female education levels indicate that those with a college degree are less likely to be obese [43]. Unfortunately however, the prevalence of obesity across all education levels increased, on average, 12% from the data collected between 1988 to 1994 and data collected between 2005 to 2008 [43].

A large international (n=477,867) cohort study by Hermann et al. supports the NHANES data; observing an inverse relationship between education level and BMI in subjects 35 to 70 years of age [42]. Subjects from ten countries (Denmark, France, Germany, Greece, Italy, the Netherlands, Norway, Spain, Sweden, and the United Kingdom) were categorized into four different education levels: (1) primary school or less; (2) vocational secondary education; (3) other secondary education; and (4) university degree [42]. Women with the lowest level of education had an average BMI of 26.3 kg/m2, which was 3.6 kg/m2 higher than the average 22.7 kg/m2 BMI for women with a University degree [42]. Men with the lowest level of education had an average BMI of 27.2 kg/m2, which was 1.8 kg/m2 higher than the average 25.4kg/m2 BMI for men with a University degree [42]. For both men and women, a trend was observed in which BMI decreased as education level increased (trend p-values not given) [42].

<u>Physical and Psychological Outcomes due to Obesity</u>

Individuals who are obese are at a higher risk for developing certain cancers, cardiovascular disease, stroke, type II diabetes, obstructive sleep apnea, and osteoporosis as a secondary disease [6, 12, 39, 42]. In 2009, the medical cost associated with obesity related conditions was estimated to be as high as 147 billion dollars [39].

Individuals who are obese have reported experiencing greater difficulty partaking in daily activities, such as getting dressed or walking up stairs, with reported difficulty increasing as individual body weight increased when compared to individuals at a healthy weight [44]. Being obese can also potentially cause interpersonal complications between the obese individual and their family members, friends, or romantic partners [14]. In a survey of overweight and obese women (n = 2,449), 72% of the participants identified their family members as the most common source of the weight stigmatization they experience, such as name calling and being teased about their weight [45]. Another study suggested that being obese negatively affects dating and relationships, especially for women [46]. Sheets and Ajmere surveyed undergraduate students (n = 554) with a mean age of 19.1 years and found that obese women were half as likely to be dating than their non-obese peers [46]. The study also revealed that non-daters had significantly higher BMIs (mean = 24.21 kg/m2) than women who were causal daters (mean = 22.54 kg/m2) or exclusive daters (mean = 22.48 kg/m2) ($p<0.01$) [46]. Although not statistically significant, the opposite was observed among male subjects, with non-dating men having a lower average BMI of 23.91 kg/m2 when compared to casual daters (mean = 25.12 kg/m2) and exclusive daters (mean = 25.22 kg/m2) [46]. The study results also found a negative correlation (r = -0.13) between a woman's BMI and relationship satisfaction, showing that women with higher BMIs found their relationship less satisfying ($p<0.10$) [46]. The opposite was observed for men, with a significant positive correlation (r = 0.22) found between a man's BMI and relationship satisfaction, indicating that men with higher BMIs found their relationship more satisfying ($p<0.05$) [46].

A study by Ball et al. surveyed women (n = 7,856) between the ages of 18 and 23 years old and categorized them as underweight (BMI$<$20 kg/m2), healthy weight (BMI 20-25 kg/m2), overweight (BMI 25-30 kg/m2), or obese (BMI$>$30 kg/m2) [47]. They found that fewer obese women reported being 'very satisfied' with their career, social activities, and family and romantic relationships when compared to women in the lower BMI categories ($p<0.01$) [47]. Also, a greater number of obese women reported being 'very dissatisfied' with their careers, social activities, and family and romantic relationships when compared to women in the three lower BMI categories ($p<0.01$) [47].

While there were significant differences across BMI categories when looking at relationship satisfaction, there were no significant differences in regards to marital status (married, stable relationship, or single) ($p = 0.52$) [47].

In addition to facing interpersonal difficulties, studies have shown that obese individuals experience stereotyping, prejudice, and/or discrimination in the workforce, in healthcare settings, and in educational institutions [14-16, 45, 48, 49].

Freshman Weight Gain

The term ‘Freshman 15’ has been adopted by the general public to represent an unintentional weight gain thought to occur in young adults (18 to 25 years old) during their first year of college [1, 2, 4, 6, 11-13, 29, 30]. While many studies have observed weight gain during the first year of college to be >5% of body weight, the average weight gained typically does not reach 15 lbs. [1, 2, 6, 29]. According to Gropper et al., only about 5% of college freshmen actually gain 15 lbs. during their freshman year of college [6].

Studies Regarding Freshman Weight Gain

Research has identified the lifestyle transition from high school to college as a critical period (for becoming obese) [3, 4, 8]. A study by Cluskey et al. found that 62% of first year college students ($n = 379$; mean age = 19 years) displayed weight increases between the months of October and December [4]. A significant weight gain of ≥ 5.7 lbs. was seen in 26% of females and 27% of males over the 8 week study period [4]. Interestingly, the study found greater weight gains (≥ 9.9 lbs.) among males who were within a healthy BMI range at baseline [4]. Supporting the findings from Cluskey et al., a study by Levitsky et al. showed that during the first 12 weeks on campus, Cornell University freshmen (n = 60) gained an average of 4.18 lbs. (range ±5.3 lbs.), which is 11 times greater than the 0.8 lb. average annual weight gain for an American adult. [3].

In a study by Karparek et al., the mean weight gain for college freshmen (n=193) between the ages of 17 to 19 years was 2.5 lbs. over the study's 6 month period with 57% reporting weight gain (n=110), 19.2% reporting no weight change (n=37), and 23.8% reporting weight loss (n=46) ($p<0.01$) [9]. Among those that reported gaining weight, mean weight gain was 7.1 pounds, ranging from 1.0 to 35 pounds [9]. The average BMI of subjects significantly increased from 23.0 kg/m^2 at baseline to 23.5 kg/m^2 (± 4.67 kg/m^2) ($p < 0.01$) [9]. Also notable were their results showing a larger weight gain amongst subjects who were overweight at baseline compared to those who were in the healthy weight range at baseline [9], which is the opposite of what Cluskey et al. observed [4]. In the study by Cluskey and colleagues, on average, subjects who were within a healthy BMI range baseline gained 10.96 lbs. (±8.30 lbs.), versus a mean 6.2 lbs. (±4.27 lbs.) gained for those who were overweight at baseline ($p<0.01$) [4].

Factors that Influence Weight Gain during the Freshmen Year in College

According to several studies, the two main variables that best predict weight gain among freshmen are an increase in the consumption of evening snacks and high fat foods [3, 8, 12, 29]. Another contributing factor to freshman weight gain is the buffet style dining offered at many colleges [3, 4, 8, 10]. The majority of food items served in buffet style dining halls are unhealthy, having a high caloric and/or fat content [10]. College students surveyed in a study by Nelson et al. and Greaney et al. reported being less inclined to choose the healthy food options that were available to them when there were other food items offered such as pizza, fries, and cookies [8, 10]. The students acknowledged the food selection in the dining halls as being an inhibiting factor in maintaining healthy body weight [8, 10]. In contrast, Brunt and Rhee found that students ≤21 years of age living off-campus consumed more sweets than those living on-campus, as determined by a food frequency questionnaire (approached significance $p=0.065$). There were no significant differences between daily intake, and fruit and vegetable intake for those living on-campus and those living off-campus (all p-values <0.037).

The 2010 American College of Health Association National College Health Assessment confirmed students' poor eating habits [50]. The assessment fount that only 4.8% of college students ate the recommended 5 or more servings of fruits and vegetables per day [50]. In addition, just 53.3% of college students participated in the recommended 30 minutes of moderate intensity exercise at least 5 days a week, or 20 minutes of vigorously intense exercise at least 3 days a week [50].

The students have also identified social factors as a contributor to weight gain [8, 10]. College freshmen participating in a study by Nelson et al. stated they would often find themselves eating late at night not due to hunger, but because of social reasons such as being out with friends [8]. Late night eating can also be influenced by alcohol consumption, which is often associated with uninhibited food intake and poor food choices, such as fast food and/or high fat food [5, 8, 10].

A study by Wechsler et al., found that 63% of college students from 116 college campuses, between the age 18 to 23 years, reported consuming alcohol within the past thirty days [51]. In the same study, 43% of college students admitted to drinking alcohol in excess [51]. A study by Lloyd-Richardson et al. (n = 282) found that of the 206 college freshmen who reported consuming alcohol within the past thirty days, 65.7% were unaware of the caloric content of the alcoholic beverage consumed [5]. Also, 32.5% of those who reported recent alcohol consumption stated that alcohol increased their appetite levels and 32.5% of these students reported making more unhealthy food choices compared to when they abstained from alcohol [5]. Subjects had an average baseline BMI of 22.9 kg/m2 (±3.1 kg/m2) and those freshmen classified as moderate-risk drinkers had greater increases from baseline BMI (1.25kg/m2±0.15 kg/m2) at the end of the first semester compared to low-risk drinkers (0.77 kg/m2±0.11 kg/m2) ($p = 0.04$) [5]. Increased caloric consumption from alcoholic beverages, as well as, an increased appetite while drinking may be a contributing factor to the weight gain and increasing obesity rates seen among college students [5].

Another factor associated with predicting weight gain is a decrease in physical activity [2, 5, 7-10]. The time constraints and lack of motivation that college students face greatly influences the amount of time spent being physically active [8, 10]. In the study by Nelson et al., participants discussed how most of their time was spent in class, studying, or sitting in front of a computer [8]. With the little amount of free time participants did have, exercise was one of their last priorities, with studying, sleeping and eating being more important [8]. In addition, negative experiences at campus recreation centers influenced physical activity levels [8]. Participants complained that the recreation centers were overly crowded requiring you to wait in line to use machines, which cut into their allotted gym time [8] Others stated that the recreation center could be an intimidating place, especially if they had never used the facility before or were new to exercising [8].

Although the amount of weight gained is generally less than 15 pounds, achieving and/or maintaining a healthy weight is important during young adulthood [1, 7, 9, 11, 29]. Those who are overweight or obese at 18 years old, the typical age of a college freshman, are more likely to become or remain obese for the remainder of their lives [1, 4, 7-9, 11, 29, 30]. Little is known if the segments of freshmen with low self-esteem (SE) and/or risk for disordered eating (DE) are more likely to gain weight or lose weight than students without those characteristics.

Self-Esteem (SE)

Existing low levels and/or changes in SE are common among adolescents and young adults who are either transitioning from high school to college or are already in college [17]. Many people have difficulties with SE and self-perceived body image, which is defined as either a favorable or unfavorable attitude towards the self and a feeling of pride in the self [18]. The Rosenberg's Self-Esteem Scare (RSES) is a reliable, valid, and widely used questionnaire used to assess an individual's overall SE, with higher scores indicating higher SE [18, 38]. A study by Puskar et al., found that for adolescents aged 14 to 18 years, the mean score on the RSES for males (n=90; mean=22.0 ±4.9) was significantly higher than the average score for females (n=103; mean=19.1 ±4.8) ($p<0.0001$) [18]. This does not indicate that males are immune from having low SE. A study by Perrin et al., explored the relationship between SE and self-perceived body image related to being normal weight or overweight in males and females aged 11-21 years (n=13,001) [52]. Table 2 displays the non-overweight BMI categories created by the investigators:

Table 2. Perrin et al. created separate non-overweight BMI categories for male and female participants

Males	Females
0 – 60th percentile	0 – 20th percentile
60th – 75th percentile	20th – 60th percentile
75th – 85th percentile	60th – 85th percentile

Approximately 50% of the subjects were classified as having low SE, determined by the RSES [52]. Among males (n=6,247) who were not overweight, low SE was significantly associated with an increased odds of misperceiving themselves as being overweight in the 60th - 75th percentile and 75th - 85th percentile categories ($p<0.05$) [52]. Among females (n=6,574) who were not overweight, low SE was predictive of misperceived overweight across all BMI percentile categories, with a stronger association seen between low SE and lower BMI categories ($p<0.05$) [52]. Females above the 85th percentile had lower SE when they correctly perceived themselves as being overweight, while those who perceived themselves as being normal weight had higher SE [52].

Disordered Eating (DE)

The Diagnostic and Statistical Manual of Mental Disorders defines DE as a wide range of irregular eating behaviors that are not severe enough to be diagnosed as a specific eating disorder such as anorexia nervosa or bulimia nervosa [26]. DE may be initiated by an altered view of body shape and perceived body weight, reflecting negative beliefs about the self (e.g., low SE) [27, 28, 32]. DE can lead to potentially serious physical consequences and can be a chronic condition resistant to intervention [25]. The prevalence of reported DE in various studies of college females has been seen to range from 1.3% to 28.5%, although it is speculated to be much higher [23-25].

A study by Costa et al., found that among 184 first year female college students (mean age = 20.2 ± 2.75 years), the prevalence of DE patterns was 8.3% [53]. They observed a significant difference between the prevalence of DE patterns among students who were dissatisfied with their body image (34.2%) when compared to students who were satisfied with their body image (2.3%) ($p<0.05$) [53]. Furthermore, the students who were classified as normal weight (BMI of 18.5 – 25 kg/m2) showed a greater prevalence of DE patterns (10.3%) when compared to students who were classified as underweight, with a BMI < 18.5 kg/m2 (2.9%) [53].

Kiziltan and Karabudak evaluated 568 college females between the ages of 19 and 22 years in regards to their eating attitudes, dieting practices, and perceived body image [54]. They found that 19% of the females were classified as having DE patterns [54]. A large percentage of subjects reported skipping main meals on a regular basis, with 40.8% skipping breakfast, 43.7% skipping lunch, and 22% skipping dinner [54]. Weight loss methods included dieting (13.2%), taking diet pills (7.4%), vomiting (3.7%), excessive exercise (6.5%), and all day fasting (51.2%) [54]. Also, 80.8% of subjects reported feeling overweight, even though only 5.8% were actually overweight or obese [54].

There are a limited number of studies regarding the prevalence of DE among males, but it appears to be a growing issue for young men [28, 55]. A study by Bas et al., found that among 326 male university students in Turkey (mean age 18.23 ±0.66 years), 9.2% had DE patterns [55]. Compared to the subjects without DE patterns, those with DE patterns had lower SE and higher physique anxiety [55].

A study by Hoerr et al., found that among college males (n=433), 1.4% had been previously treated for an eating disorder and 4.0% (n=17) had current DE patterns [28]. The reported weight loss methods used by these males included eliminating high-fat foods (42.7%), using laxatives/diet pills/diuretics (5.2%), and purging (2.6%) [28]. Hoerr et al., noticed that the frequency of DE patterns was higher among those who participated in intercollegiate athletics [28]. Of the 16 male athletes in their study, two reported vomiting as a means of weight control and two others reported taking diet pills for weight control [28].

Study Aims

Education level may be a mediating factor for obesity, which affects approximately 33.8% of individuals on a national level [39]. College freshmen, on average, gain weight, but the weight gain does not reach the perceived 15 pounds refereed to as “Freshman 15”. There is a lack of knowledge pertaining to both the associations of SE and DE in relation to energy balance (EB) (energy intake minus energy expenditure) amongst college freshmen. Including both aspects of the EB equation (intake and expenditure) will expand our understanding of SE and DE in relationship to weight change.

The main aim of this study is to examine if low SE and/or risk for DE are associated with the degree of EB in college freshmen.

Method

Study Design

This is a cross-sectional study evaluating if low self-esteem (SE) and/or being at risk for disordered eating (DE) predict a college freshman's level of energy balance.

This study is a portion of a larger study, which follows University of Nevada, Reno (UNR) college students throughout their years in college. The larger study is evaluating the health behaviors of college students in relation to obesity. It was initiated in the Fall of 2010. This study includes data collected during the 2011 Fall semester (August 29, 2011 – December 21, 2011) at the UNR campus. Incoming freshmen were recruited using announcements at freshmen orientation and in classrooms, as well as advertisement flyers at a booth outside the student union center during the Fall semester (Appendix 1). Inclusion criteria include: 1) freshman status at UNR during the Fall 2011 semester, 2) enrolled in a minimum of 6 college credits, 3) the majority of courses held on campus, 4) between the ages of 18-25 years at study enrollment, 5) able to read and speak English, and 6) not pregnant. Freshman status is defined as the first academic year of an individual's college education. At recruitment those eligible and interested in participating in the study provided their contact information (phone number and/or email address) and could schedule their initial appointment. In addition, the consent form and a handout outlining the preparation for the initial visit were provided and reviewed. Subjects signed a consent form prior to data collection (Appendix 2). The University of Nevada, Reno Human Research Protection Institutional Review Board approved the study (Appendix 3).

Data Collection

Data obtained included the subject's dietary intake, physical activity level, anthropometric measurements, body composition and psychological factors. Subjects also provided information regarding their current living arrangements and economic status (Appendix X). Subjects came in twice to the nutrition research laboratory located on the UNR campus. As previously mentioned, their initial appointment was scheduled during the recruitment meeting or later by phone and/or email.

Sequence of data collection:

Two days prior to Day 1: Two days prior to their initial appointment a reminder call and/or email was made to confirm their appointment and review the preparation protocol for the Bioelectrical Impedance Analysis (BIA) (full description to follow).

Day 1: Subjects came to the UNR nutrition research laboratory and a researcher insured that the signed consent form was obtained. At the start of the appointment, the researcher asked the subject questions to assure that the BIA preparation protocol was followed such as, "When was the last time you consumed any food?" Subjects also completed the general lifestyle questionnaire, participated in the Automated Self-administered 24-hour (ASA24) dietary recall, and participated in obtaining anthropometric and body composition measurements (height, weight, and percent body fat). The subjects were given an accelerometer, which he/she began wearing upon leaving the laboratory (day 1). Subjects received instructions on how to care for and properly wear the device. Subjects were also provided an activity log to complete in conjunction with wearing the accelerometer and were instructed to continue wearing the device until they came back for their second appointment (day 5). Their follow up appointment time for day 5 was scheduled and an appointment card to help them remember the date and time was provided.

Days 2, 3, and 4: Subjects wore the accelerometer and completed their physical activity log.

Day 4: Subjects were called and/or emailed to remind them of their scheduled day 5 appointment time and date.

Day 5: Subjects returned to the nutrition research laboratory still wearing their accelerometer, which was then removed. Their physical activity log was reviewed for completion. Subjects also completed the Eating Attitudes Test (EAT), the Rosenberg's Self-Esteem Scale (RSES), the Food Frequency Questionnaire (FFQ) and the Three Factor Eating Questionnaire (TFEQ). The FFQ and TFEQ were conducted for use in the larger study, but the data were not included in the present study and therefore not discussed in the assessment methods.

General Lifestyle Questionnaire

The general lifestyle questionnaire obtained information about the subject’s demographics such as age, sex, race, marital status, address, and living arrangements (Appendix 4). Information pertaining to their education such as current major, course load (current number of enrolled credits) and the names of their classes were also collected. Other information including employment status (unemployed, part time, full time), usual physical activity level (low, moderate, high), sleeping patterns, health status (including any medications currently taken), and any other time constraints present in the subject's life (e.g., long commute to campus, caring for a parent or child, volunteering, etc.) and main food source (e.g., the resident dining hall or off campus dining) were obtained.

Energy Intake Assessment

Procedure for ASA24:

The ASA24 is based upon the United States Department of Agriculture Automated Multiple-Pass Method, which has been validated and shown to accurately estimate mean total energy intake [56, 57]. ASA24 was administered in the nutrition research laboratory located on the UNR campus in order to assess an individual’s kilocalorie per day intake. The multiple-pass five steps consists of a subject 1) recalling a quick list of foods and beverages consumed the previous day (beginning with the previous day’s breakfast and ending with the breakfast consumed that morning), 2) probing by the interactive program for forgotten foods that were not included in the quickly recalled list, 3) ascertaining the time and eating occasion for each food item, 4) collecting a detailed description of each food item and the amount of each food item consumed, as well as reviewing the 24-hour day, and 5) probing for any possibly forgotten items, eaten or drank. Measurement tools such as visual aids, measuring cups, and food pictures were used as a means to assist in serving size estimation during the 24-hour recall process.

The 24-hour recall was conducted using a desktop computer in a private room to ensure that the subject was completely engaged with limited interruptions.

For this study, the individual's total energy intake (kcal/day) was determined by the ASA24 recall and retained on a continuous scale.

Energy Expenditure Assessment

Data from the accelerometer and physical activity log provided information to calculate the subject's average energy expenditure in kilocalories per day. Procedures for uploading, downloading, and analyzing the activity data were complied with the Actiware CT Software Manual 2008, Respironics, Mini Mitter. Accelerometer output illustrates and scores intervals of rest, activity and intensity of the activity.

As indicated previously, subjects received written instructions and a demonstration on how to appropriately wear and care for the accelerometer (Mini Mitter IPX7; Bend, Oregon). The subject left the initial appointment (day 1) wearing their assigned accelerometer. They were instructed to wear the accelerometer as much as possible during the following three days, until their second study appointment (day 5), only taking it off to shower and sleep (if so desired). Subjects were instructed to fill out the activity log from the moment they left their initial appointment until they returned on day 5 for their second appointment, regardless of if they were wearing the accelerometer or not, to help track their activities. The physical activity log maintained by each subject also served as a means to verify the data gathered by the accelerometer and fill in any apparent gaps of data from the accelerometer.

Interpretation of Accelerometer Data:

An accelerometer provides information regarding intensity (acceleration) and duration of movement expressed as movement or activity counts per minute. A greater number of activity counts indicates a larger amount of energy expended during that minute. The activity counts are converted to Metabolic Equivalent of Task (MET) (3.5 ml/kg/min or about 1 kcal/kg/hr) [58]. METs are a way of expressing the amount of energy expended during physical activity as a multiple of an individual's resting metabolic rate (RMR), which is the amount of energy expended while at rest [58]. RMR was determined using the Harris Benedict equation [59].

For men: RMR = 66.5 + (13.75 * weight in kilograms) + (5.003 * height in centimeters) – (6.775 * age)

For women: RMR = 655.1 + (9.563 * weight in kilograms) + (1.850 * height in centimeters) – (4.676 * age)

When accelerometer data was not available, the energy expenditure for the missing timeframes were filled using one of the following scenarios:

A) In the event that one cell was missing data (equivalent to one minute of activity), the researcher determined the energy expended during that minute by averaging the cell before and the cell after and used the calculated average to fill in the one cell missing data.

B) In the event that two cells were missing data (equivalent to two minutes of activity), the researcher determined the energy expended during the two minutes by averaging two cells before and two cells after and used the calculated average to fill in the two cells missing data.

C) In the event that three cells were missing data (equivalent to three minutes of activity), the researcher determined the energy expended during the three minutes by averaging three cells before and three cells and used the calculated average to fill in the three cells missing data.

D) In the event that four of more cells were missing data, the researcher determined the energy expended during that time by accessing the subject's physical activity log. If the subject had recorded their activity during the timeframe of the missing data cells, the researcher calculated the energy expended during for time period using METs for the specific activity listed. For example, if the subject did not wear the accelerometer while they were sleeping, the researcher would use 0.92 METs as indicated on the National Cancer Institution's MET chart [60]. The researcher referred to the activity log to determine the duration of the subject's sleeping time. Next the researcher multiplied 0.92 METs by the subject's RMR, then divided by 24 (hours in the day), and multiplied by the number of hours the subject slept in order to calculate the amount of energy expended while the subject slept.

For example, if the subject slept for a total of 7 hours:

[(0.9 METs x individual's RMR) / 24 hours in a day] x 7 hours

= kilocalories expended while sleeping

E) In the event that four or more data cells were missing and the subject did not have their activity log filled out for that time period, the researcher averaged the same number of cells before and after the cells missing data to determine energy expenditure. For example, if there were eleven cells missing data, the researcher would average the eleven cells before and the eleven cells after and used the calculated average to fill in the eleven cells missing data.

The total amount of energy expended over the 3-day period (days 2, 3, 4), as measured by the accelerometer and supplemented by the activity log information, was averaged. Data obtained on day 1 and 5 were omitted. The average energy expended over the 24-hour period represented the individual's total energy expenditure (kcal/day) on a continuous scale.

Energy Balance Assessment

Energy balance (EB) is the dependent variable and represents when total energy intake is equal to total energy expenditure. When EB is established it is indicative of an individual maintaining their current body weight. A positive EB occurs when total energy intake exceeds total energy expenditure and may therefore cause weight gain. A negative EB occurs when total energy intake is less than total energy expenditure. An individual experiencing a negative EB may lose weight.

For the binary logistic regression, the outcome variable was categorized as a negative EB or a positive EB. Subjects were considered to be in EB if they were within one half of the standard deviation (SD) from zero EB in this population. Subjects that had an energy imbalance greater than half the standard deviation away from zero were classified as being in positive EB and those less than half the SD away from zero were classified as being in negative EB. For the linear regression analysis, the outcome variable was calculated as the difference of energy intake minus energy expenditure as a continuous outcome variable.

Anthropometric Measurements

Height was measured in centimeters using a stationary stadiometer (Height Rod Stadiometer, QuickMedical), without shoes. Body weight was measured in kilograms using the Tanita Scale (Tanita Scale, Model TBF-300A; Tokyo, Japan) in light clothing. These measurements were obtained privately in the nutrition research laboratory. From these measurements, Body Mass Index (BMI) was calculated as kg/m2. The classifications for BMI are as follows: underweight (BMI < 18.5 kg/m2), normal weight (BMI 18.5 - 24.95 kg/m2), overweight (BMI 25.0 - 29.9 kg/m2), and obese (BMI > 30.0 kg/m2) [39].

Body Composition Measurements

Percent total body fat was measured using the Bioelectrical Impedence Analysis (BIA) method (Tanita Scale, Model TBF-300A; Tokyo, Japan). Subjects were asked to adhere to the following pretest requirements: 1) no eating or drinking for 4 hours prior to testing, 2) no caffeine or alcohol consumption at least 12 hours prior to testing, and 3) no vigorous exercise at least 12 hours prior to testing. Pretest requirements were reviewed with the subject during their day 1 appointment reminder call and/or email. Adherence to these requirements was confirmed before initializing the test. If subjects did not meet one or more of the pretest preparation requirements, the test was postponed until their second appointment (day 5). Foot-to-foot BIA was conducted following the manufacture's protocol. The subject stood with their bare feet making contact with the electrode pads indicated on the BIA. Height, weight, age, sex, and athleticism level were entered into the device prior to measurement. According to the Tanita manual, athleticism is classified in two categories: athletic and non-athletic. The researcher selected the "athletic" classification when individuals reported participating in at least 10 hours of intense physical activity per week or had a resting heart rate of 60 beats per minute or less. The athletic setting is not for "enthusiastic beginners" who are just beginning to participate in vigorously intense physical activity, but whose body has not recently changed. Tanita also takes into account "lifetime fitness". Lifetime fitness includes those who have been physically fit for years but are currently participating in less than 10 hours of intense physical activity per week. This has been interpreted as being physically fit for 5 plus years prior to participating in the study. According to the Centers for Disease Control and Prevention, 5 hours a week of moderate to intense physical activity plus at least 2 days of strength training will give an individual greater health benefits than those who do not partake in that amount of exercise [39]. More than 5 hours a week of moderate to intense physical activity will provide the individual with increasingly more health benefits as the time per week increases [39]. Examples of moderately intense physical activity include fast walking and pushing a lawn mower [39]. Examples of vigorously intense physical activity include running and swimming laps in a pool [39]. Anyone not meeting the criteria for "athletic" was categorized as "non-athletic" for the test. Percent body fat was estimated using the Tanita's proprietary programmed equation, which is not disclosed.

The BIA device was not used on any subjects who have metal inserts or pacemakers. Each subject was asked if he/she have any metal inserts, pacemakers, or heart conditions prior to conducting the BIA measurements and their response was documented. Those who were unable to participate in the BIA measurements could participate in any other aspects of the study.

Psychological Factors Assessment

Risk for Disordered Eating (DE):

The Eating Attitudes Test (EAT 26) was used to assess the potential risk for disordered eating. EAT-26 contains 26 questions that provide insight into individual attitudes towards food and eating (Appendix 5). An example of a question asked in the EAT 26 assessment is "I avoid eating when I am hungry". Subject's response choices are always, usually, often, sometimes, rarely, or never. There are also 5 Yes/No questions in the questionnaire. EAT 26 assigns scores of zero to three for each question, according to the EAT 26 scoring sheet.

A total score above 20 or answering "yes" to any of the 5 Yes/No questions is considered indicative of potential DE. For subjects at risk for having DE, the researcher recommended the subject discuss their answers with a counselor. Contact information for UNR campus counselors was provided and subjects were strongly encouraged to make an appointment. Subjects were classified as "at risk" or "not at risk" for DE.

Individual Self-Esteem (SE):

The Rosenberg's Self-Esteem Scale (RSES) is a 10-item questionnaire used to measure general SE within individuals (Appendix 6). It is the most widely used self-esteem questionnaire and has been shown to be valid and reliable [38]. An example of a question asked in the RSE is "I feel that I am a person of worth, at least on an equal plane with others". Subject's response choices are strongly agree, agree, disagree, or strongly agree. The researcher scores each question, giving it 0 to 3 points based upon the RSES rating system. Total possible scores range from 0 to 30, with the normal range being from 15 to 25 and higher scores indicating higher SE. Any score below 15 is indicative of a subject having low SE. Subjects were classified as having low SE, normal SE, or high SE.

Statistical Analysis

The outcome variable was an individual's energy intake minus energy expenditure as a continuous variable. Analysis of Variance (ANOVA) and t-tests were conducted for comparison of means for energy intake, total energy expenditure, and energy balance between subjects at risk and not at risk for DE, SE categories, and BMI categories.

Binary logistic regression analysis was used to evaluate if SE and/or risk for DE variables predict the dependent dichotomous outcome EB variable (positive or negative

EB). Linear regression was conducted to evaluate if independent SE and risk for DE variables predict the dependent outcome EB as a continuous variable.

Different linear and logistic regression models were constructed to evaluate the SE and risk for DE independently and having both SE and risk for DE in a model as predictors for EB adjusted for age, sex, race, and BMI categories (kg/m^2). The "best" linear model and logistic model were determined by examining significant alteration in adjusted R-squared value. Age, sex, and race were retained in every model. Forward stepwise regression was also conducted. All statistical testing was conducted using SPSS, version 19. A p-value < 0.05 was considered statistically significant.

Results

Demographics

Twenty-one college freshmen entered the study and a total of 20 completed the study (15 females, 5 males), with a mean age of 18.4 years (±1.6 years). One subject dropped due to a busy school schedule and was unable to complete the second appointment. The study sample was 60% Caucasian, 20% Hispanic, 10% African America, and 10% Asian. Table 3 displays the study sample characteristics.

Table 3. Study Subject Characteristics: Mean ±Standard Deviation

Characteristics	Total (n=20)	Males (n=5)	Females (n=15)
Age	18.4 ± 1.6	19.4 ±3.1	18.07 ± 0.3
Race	White: 60% (n = 12)	White: n = 4	White: n = 8
	Hispanic: 20% (n = 4)	Hispanic: n = 1	Hispanic: n = 3
	Black: 10% (n=2)	Black: n=0	Black: n=2
	Asian: 10% (n=2)	Asian: n = 0	Asian: n = 2
Height (centimeters)	167.76 ± 8.5	177.58 ± 5.7	164.49 ± 6.5
Weight (kilograms)	64.85 ± 15.9	77.96 ± 18.2	60.48 ± 12.9
Body Mass Index (kg/m^2)	22.8 ± 4.1	20.55 ± 5.5	22.19 ± 3.6
Body Fat (%)	19.73 ± 8.9	15.04 ± 7.2	21.29 ± 9.0
Energy Intake (kcalories/day)	1891 ±718	2040 ±741	1841 ±730
Total Energy Expenditure (kcalories/day)	2128 ±342	2349 ±406	2055 ±298

Independent Variables

Table 4 displays the mean, standard deviation, minimum, and maximum scores of the Rosenberg Self-Esteem Scale (RSES) and the Eating Attitudes Test (EAT), which evaluated SE level and risk for DE, respectively. The RSES establishes a dichotomous variable (low and normal SE) based on RSES scores. However, higher scores of above 25 are indicative of higher SE.

Table 4. Subjects' Rosenberg Self-Esteem Scale (RSES) and Eating Attitudes Test (EAT) Scores

Questionnaires	Mean	Standard Deviation	Minimum	Maximum
RSES Score* Low SE: n=0 Normal SE: n=4 High SE: n=16	26	3.13	18	30
EAT Score** Not At Risk: n=14 At Risk: n=6	8.75	7.51	0	33

*RSES Score Range: 0 – 30 (Low self-esteem score <15; normal self-esteem score 16-25; high self-esteem score >30)
**EAT Score Range: 0 – 78 (At risk for disordered eating score >20)

<u>Energy Results</u>

Energy balance (EB) in this study was calculated as [energy intake (EI) – total energy expenditure (TEE)], and was analyzed on a continuous scale for the linear regression analysis. For the binomial regression analysis, subjects were considered to be in EB if they were within one half of the standard deviation (SD) from zero for calculated EB (SD=832 kcalories). Subjects that had an energy imbalance between -416 to 416 calories were classified as being in EB (Coded as 0). If the subject had an energy imbalance of < -416 kcalories they were classified as having a negative energy imbalance

(Coded as 1). If the subject had an energy imbalance of > 416 kcalories they were classified as having a positive energy imbalance (Coded as 2). Table 5 displays the mean, standard deviation, minimum and maximum kcalorie levels for overall energy balance and the energy balance categories of negative balance, in balance, positive balance.

Table 5. Calorie Mean, Standard Deviation, Minimum and Maximum values for Overall Energy Balance, Negative Energy Balance, In Energy Balance, Positive Energy Balance

	Mean	**Standard Deviation**	**Minimum**	**Maximum**
Overall Energy Balance (Energy Intake - Energy Expenditure)	-237	832	-1512	1128
Negative Energy Balance (n=8)	-1135	249	-1512	-735
In Energy Balance (n=8)	131	268	-407	385
Positive Energy Balance (n=4)	822	246	557	1128

Negative energy balance: < -416 kcalorie difference from 0; In energy balance: between the range of -416 – 416 kcalories; Positive energy balance: > 416 kcalorie difference from 0

Based on the t-test, there were no significant differences in mean EI (p=0.458), TEE (p=0.931), and EB (p=0.499) between those subjects at risk for DE compared to those subjects not at risk for DE (Table 6). There were no significant differences found between SE categories of normal and high when comparing mean EI (p=0.198), TEE (p=0.181), and EB (p=0.091) (Table 6). In addition, no significant differences were found between BMI categories (underweight, normal weight, overweight, and obese) for mean EI (p=0.447), TEE (p=0.213), and EB (p=0.212) (Table 6).

Table 6. Comparison of Means for Energy Intake, Total Energy Expenditure, and Energy Balance Between Subjects at Risk and Not at Risk for Disordered Eating (DE), Self-Esteem (SE) Categories and Body Mass Index (BMI) Categories

	N	**Mean**	**Standard Deviation**	**t-test or Analysis of Variance p-value**
Energy Intake (calories/day)				
Risk for DE				
No Risk	14	1972	680	t-test 0.458
At Risk	6	1703	835	
SE Category				
Normal	7	1605	679	t-test 0.198
High	13	2045	716	
BMI (kg/m^2)				
Underweight	4	1587	894	Analysis of Variance 0.447
Normal Weight	10	2161	789	
Overweight	5	1642	289	
Obese	1	1656		
Total Energy Expenditure (calories/day)				
Risk for DE				
No Risk	14	2124	294	t-test 0.931
At Risk	6	2139	469	
SE Category				
Normal	7	2270	280	t-test 0.181
High	13	2052	358	
BMI (kg/m^2)				
Underweight	4	2080	460	Analysis of Variance 0.213
Normal Weight	10	2014	231	

Overweight	5	2297	381	
Obese	1	2626		
Energy Balance (energy intake - energy expenditure)				
Risk for DE				
No Risk	14	-152	720	t-test 0.499
At Risk	6	-436	1101	
SE Category				
Normal	7	-665	664	t-test 0.091
High	13	-7	843	
BMI (kg/m^2)				
Underweight	4	-492	879	Analysis of Variance 0.212
Normal Weight	10	147	850	
Overweight	5	-655	544	
Obese	1	-970		

Risk for DE = score of >20 on the Eating Attitudes Test
SE Category: Normal = 15-25 on the Rosenberg Self-Esteem Scale; High = >25 on the Rosenberg Self-Esteem Scale

<u>Logistic Regression Analysis</u>

Model A indicated that with only SE in the model (excluding risk for DE) the odds of having a negative EB did not significantly differ between those with normal SE compared to those with high SE, adjusting for age, sex, race, and BMI categories (kg/m^2) (p=1.000) (Table 7). Coding for analysis is as follows: Normal SE = 0; High SE = 1.

Table 7. Model A: Adjusted Logistic Regression Analysis of Self-Esteem Categories Related to Being in Energy Balance in College Freshmen (n=20)

Variable	Odds Ratio	p-value
Age	7.449E15	0.997
Sex		
Female vs. Male	0.000	0.998
Race		
White vs. Black	1.000	1.000
White vs. Asian	1.000	1.000
White vs. Hispanic	0.000	0.998
Body Mass Index Categories (kg/m^2)		
Normal vs. Underweight	1.000	1.000
Normal vs. Overweight	1.000	1.000
Normal vs. Obese	0.000	1.000
High Self-Esteem Category vs. Normal Self-Esteem Category	1.000	1.000

Self-Esteem categories: 0= normal self-esteem; 1= high self-esteem

Model B indicated that with only risk for DE in the model, those classified as at risk for DE are not significantly more likely to be in a negative EB compared to those subjects who are not at risk (p=0.999), adjusting for age, sex, race, and BMI categories (kg/m^2) (Table 8). Coding for analysis is as follows: No Risk for DE = 0; Risk for DE = 1.

Table 8. Model B: Adjusted Logistic Regression Analysis of the Risk for Disordered Eating Related to Being in Energy Balance in College Freshmen (n=20)

Variable	Odds Ratio	p-value
Age	8.337E15	0.997
Sex		
Female vs. Male	0.000	0.998
Race		
White vs. Black	1.367	0.859
White vs. Asian	1.599	0.785
White vs. Hispanic	0.000	0.998

Body Mass Index Categories (kg/m2)		
Normal vs. Underweight	1.367	0.859
Normal vs. Overweight	1.599	0.785
Normal vs. Obese	0.000	1.000
At Risk for Disordered Eating vs. Not At Risk for Disordered Eating	5.570E8	0.999

Risk for disordered eating categories: 0= no risk; 1= at risk

A logistic binary regression was conducted, which included age, sex, race, BMI categories (kg/m^2), SE, and risk for DE (Model C). The age, sex, race, and BMI category (kg/m^2) adjusted logistic regression showed no significant association between SE and negative energy balance (p=0.918) and risk for DE and negative energy balance (p=0.999) (Table 9). Coding for analysis is as follows: No Risk for DE = 0; Risk for DE = 1; Normal SE = 0; High SE = 1.

Table 9. Model C: Adjusted Logistic Regression Analysis of Self-Esteem Categories and the Risk for Disordered Eating Related to Being in Energy Balance in College Freshmen (n=20)

Variable	**Odds Ratio**	**p-value**
Age	7.111E15	0.997
Sex		
Female vs. Male	0.000	0.998
Race		
White vs. Black	1.324	0.876
White vs. Asian	1.524	0.814
White vs. Hispanic	0.000	0.999
Body Mass Index Categories (kg/m^2)		
Normal vs. Underweight	1.324	0.876
Normal vs. Overweight	1.524	0.814
Normal vs. Obese	0.000	1.000
At Risk for Disordered Eating vs. Not At Risk for Disordered Eating	6.217E8	0.999
High Self-Esteem Category vs. Normal Self-Esteem Category	0.870	0.918

Age coding: 1= male; 2= female
Risk for disordered eating categories: 0= no risk; 1= at risk
Self-Esteem categories: 0= normal self-esteem; 1= high self-esteem

Linear Regression Analysis

The Model 1 linear regression included age, sex, race, BMI categories (kg/m^2), and SE categories, with risk for DE left out. Model 1 found that SE category did not significantly predict energy balance (p=0.176). Model 1 (Table 10) indicates that 52.9% of energy balance is explained when including age, sex, race, BMI categories (kg/m^2) and SE categories (R^2 = 0.529).

Table 10. Model 1 Linear Regression for Self-Esteem Categories and Energy Balance in College Freshmen (n=20)

	Unstandardized Coefficient	**p-value**	**95.0% Confidence Interval for β**	
	β		**Lower Bound**	**Upper Bound**
Age	-211.515	0.166	-527.301	104.272
Sex				
Female vs. Male	-512.127	0.363	-1708.732	684.478
Race				
White vs. Black	185.423	0.782	-1270.391	1641.237
White vs. Asian	931.644	0.194	-560.534	2423.823
White vs. Hispanic	440.949	0.417	-718.790	1600.689
Body Mass Index Categories (kg/m^2)				
Normal vs. Underweight	-310.557	0.617	-1649.492	1028.377
Normal vs. Overweight	-319.560	0.551	-1472.354	833.234
Normal vs. Obese	-768.061	0.457	-2979.844	1443.721
High Self-Esteem Category vs. Normal Self-Esteem Category	636.843	0.176	-336.969	1610.654

a. R Squared = .529 (Adjusted R Squared = .104)

The Model 2 linear regression included age, sex, race, BMI categories (kg/m^2), and risk for DE, leaving out SE categories. Risk for DE did not significantly predict energy balance (p=0.107). Model 2 (Table 11) indicates that 56.5% of energy balance is explained when including age, sex, race, BMI categories (kg/m^2), and risk for DE (R^2 = 0.565).

Table 11. Model 2 Linear Regression for Risk for Disordered Eating and Energy Balance in College Freshmen (n=20)

	Unstandardized Coefficients	p-value	95.0% Confidence Interval for β	
	β		Lower Bound	Upper Bound
Age	53.148	0.774	-348.080	454.376
Sex				
Female vs. Male	-277.094	0.605	-1433.482	879.295
Race				
White vs. Black	-65.967	0.919	-1468.388	1336.454
White vs. Asian	421.218	0.523	-997.032	1839.468
White vs. Hispanic	1909.687	0.060	-101.641	3921.014
Body Mass Index Categories (kg/m^2)				
Normal vs. Underweight	-828.630	0.165	-2060.727	403.467
Normal vs. Overweight	-752.531	0.148	-1820.720	315.657
Normal vs. Obese	-1361.876	0.161	-3367.027	643.276
At Risk for Disordered Eating vs. Not At Risk for Disordered Eating	-1460.081	0.107	-3296.377	376.215

a. R Squared = .565 (Adjusted R Squared = .174)

The Model 3 linear regression included age, sex, race, BMI categories (kg/m^2), SE categories, and risk for DE. With all variables included in the model, SE categories (p=0.080) did not significantly predict EB. Risk for DE (p=0.053) and being Hispanic (p=0.039) significantly predicted EB. An individual at risk for DE would have a greater EB deficit of 1,630 kcalories when compared to an individual not at risk for DE, holding all other variables constant. An individual who is White would have a 1,917 kcalorie higher EB compared to an individual who is Hispanic, holding all other variables constant. Model 3 (Table 12) indicates that 69.7% of energy balance is explained when including age, sex, race, BMI categories (kg/m^2), SE categories, and risk for DE (R^2 = 0.697). The interaction term between the risk for De and SE categories was non-significant and therefore left out of the model. Dropping non-significant age, sex, and BMI categories (kg/m^2) did not improve the R Squared value (R^2 = 0.599). Therefore the final model was Model 3.

Table 12. Model 3 Linear Regression for Self-Esteem Categories and Risk for Disordered Eating and Energy Balance in College Freshmen (n=20)

	Unstandardized Coefficients	p-value	95.0% Confidence Interval for β	
	β		Lower Bound	Upper Bound
Age	22.552	0.891	-337.898	383.002
Sex				
Female vs. Male	-363.675	0.449	-1402.360	675.009
Race				
White vs. Black	36.619	0.949	-1222.793	1296.032
White vs. Asian	689.640	0.262	-615.224	1994.504
White vs. Hispanic	1917.143	0.039	118.787	3715.498
Body Mass Index Categories (kg/m^2)				
Normal vs. Underweight	-496.960	0.360	-1662.352	668.433
Normal vs. Overweight	-482.889	0.305	-1486.738	520.960
Normal vs. Obese	-812.691	0.359	-2712.835	1087.452
At Risk for Disordered Eating vs. Not At Risk for Disordered Eating	-1630.030	0.053	-3283.388	23.328
High Self-Esteem Category vs. Normal Self-Esteem Category	734.688	0.080	-107.544	1576.921

a. R Squared = .697 (Adjusted R Squared = .359)

Discussion

Study results did not support hypothesis 1 or 2, stating that college freshmen with either low self-esteem (SE) or risk for disordered eating (DE) would have greater odds of being in a negative energy balance (EB) when compared to freshmen with normal/high SE or were not at risk for DE. For hypothesis 3, the current study examined the probability that SE and/or risk for DE would predict a negative EB in freshmen college students. In the final model, when both SE and risk for DE were included in the linear regression model, SE was not a significant predictive factor for EB ($p=0.080$). Risk for DE ($p=0.053$) and race (White vs. Hispanic) ($p=0.039$) were significant predictive variables for the magnitude an individual is in (or not in) EB. A negative EB is indicated by a greater total energy expenditure (TEE) compared to total energy intake (EI). SE categories and risk for DE were not significantly predictive when EB was constructed into categories for logistic regression analysis.

While no subject had a Rosenberg self-esteem scale (RSES) score below 15, which indicated a low SE, 7 subjects had scores classifying them as having normal SE, and 13 subjects were classified as having high SE. In addition, mean EI, TEE, and EB did not significantly differ between subjects at risk for DE or not at risk for DE and subjects with normal SE or high SE (all p-values >0.05).

After an extensive literature research, no study was found that specifically evaluated SE and the risk for DE and their association with EB in college freshmen students. One study evaluated EI, but not TEE, in college freshmen [53]. Costa et al. found a significant association between risk for DE and EI ($p=0.002$) [53]. They observed that in a group of female freshmen university students in Brazil, with a mean age of 20.2 years, the prevalence of DE was significantly higher among students with a low EI (<2,200 kcal/day) when compared to students with an EI >2,200 kcal/day ($p=0.002$) [53]. The highest prevalence of DE was among students whose EI (mean = 1,781 kcals/day ±749 kcals) were below the average daily EI requirement for women of their age group (Daily EI requirement not stated) [53]. The study results did not indicate if the student was in positive or negative EB, which depends on the individual's energy expenditure. It is possible that those students with DE were also very sedentary and would therefore not be at risk for weight loss because a low TEE would concur with a low EI, putting them in EB. The subjects could also have a greater TEE compared to EI, putting them in a negative EB. This exemplifies why the current study design evaluated both EI and TEE.

Contrary to Costa et al., the current study did not observe a significant mean difference in EI between those at risk for DE and those not at risk for DE [53]. Even though both studies were conducted in college freshmen and evaluated risk for DE and EI with the Eating Attitudes Test and 24-hour recall, respectively, opposite findings were observed [53].

Previous research studies examined the association between SE and risk for DE upon EB or weight change, an indication of energy imbalance, in adults [61-63]. The remainder of the discussion will compare this study's findings in young adults (18-25 years of age) to those conducted in adults. Unfortunately, these prior study findings cannot be directly extrapolated to young adults.

In a study comparing the risk for developing DE and possible weight change in a United States military cohort, Jacobson et al. found that women (mean age not disclosed) (n=12,641) who were exposed to combat were 1.78 times more likely to develop new-onset DE when compared to women who were not exposed to combat (95% confidence interval (CI): 1.02, 3.11) [63]. Based on self-reported weights at baseline (before deployment) and after deployment, Jacobson et al. found that women with new-onset DE were 1.33 times more likely to lose a moderate amount of weight (>3% but <10% loss of body weight) (95% CI: 1.03, 1.73) and 2.35 times more likely to lose an extreme amount of weight (>10% loss of body weight) (95% CI: 1.17, 4.70) compared to women without new-onset DE after deployment [63]. Although this study did not directly measure EB, they observed that the development of new-onset DE was associated with a woman being more likely to lose weight, which relates to being in a negative EB [63]. The current study found those at risk for DE predicted being in a negative EB, but only when the final model included both risk for DE and SE. It is possible that new-onset DE coincides with low SE.

Serdar et al., categorized a group of Caucasian men (mean age = 37.7 ±4.5 years) and women (mean age = 37.8 ±8.1 years) (n=2,621) as either weight-stable or weigh-unstable, based on subject's perspective of body shape throughout their lifespan [61]. Using figural stimuli and silhouettes based on Stunkard's standard silhouettes, subjects were instructed to circle the most appropriate figure for their childhood, adolescence, and adulthood [61]. If their selected silhouettes changed ≤2 times for all of the three time periods, subjects were classified as weight stable [61]. They found that the weight-unstable group had greater body dissatisfaction and lower SE, differing significantly from those classified as weight-stable (all p-values ≤0.01) [61]. Women identified as weight-unstable were more likely to meet the diagnostic criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders for an eating disorder when compared to women classified as weight-stable (p=0.04) [61]. Serdar et al. do not specify if the weight-unstable individuals experienced weight loss or weight gain, but their results did show that greater body dissatisfaction and lower SE are associated with changes in body weight and therefore energy imbalance [61].

The current study helps to support the findings of Serdar et al. that show weight cycling women are more likely to meet the diagnostic criteria for an eating disorder when compared to weight stable women. Although the current study did not find SE to be a significant predictor of whether an individual is in or out of EB, when SE was included in the final linear regression model DE became a significant predictor of EB. The risk for DE and SE categories interaction was non-significant. The relationship between SE and risk for DE needs further exploration.

Binge eating disorder (BED) is a type of DE associated with uncontrolled eating and higher caloric intake levels [62]. Raymond et al., found significant differences in EI, assessed by 24-hour recall, during binge eating days for women who were overweight or obese with or without BED (p<0.0001) [62]. Yet, no significant differences in EI were found between the two groups on non-binge eating days (p=0.665) [62]. However, over a longer 6 day period, Raymond et al. again observed that the BED group consumed more kcalories (kcal) per day, on average, than the control group (BED mean = 2,587 kcal/day ±640 kcal vs. control mean = 2,140 kcal/day ±659 kcal) (p=0.053) [62]. When comparing TEE, assessed by doubly-labeled water, between the BED group and control group, there was no significant difference, even on binge eating days for the BED group (BED mean = 3,214 kcal/day ±553 kcal vs. control mean = 3,172 kcal/day ±525 kcal) (p=0.835) [62].

Differences from the reported EI values and measured TEE values showed that there was a 20% negative energy imbalance in the BED group and a 32.5% negative imbalance in the control group [62]. The authors stated that the negative imbalance findings might be misleading [62]. Since there was no reported weight change in subjects during the study period, researchers assumed that TEE and EI were equal, with the negative EB probably due to underreported EI values [62].

The current study results do not support the Raymond et al. findings. The current study found a higher mean negative EB among those at risk for DE compared to those not at risk for DE (-436 EB vs. -152 EB), although this difference was non-significant (p=0.499). A reason for these differences may be due to Raymond et al. looking specifically at BED. The current study looked at the risk for DE in general, which allowed for restrictive forms of DE to be included in the analysis. However, the possibility of subjects underreporting their EI in the current study cannot be ruled out.

The current study found that in the final regression model, when compared to being White, being Hispanic was a significant predictive variable for the magnitude of change in EB (p=0.039) (Table 12). Being Black or Asian were non-significant predictive variables of EB, when compared to being White, in the final regression model (p=0.949 and p=0.262, respectively) (Table 12). When comparing the females who were at risk for DE and not at risk for DE in the current study, 100% of Hispanic females were at risk (n=3), 11% of White females were at risk (n=1), and 0% of Black and Asian females were at risk. This does not support the past findings of Hoerr et al., whose results reported a higher percentage of Caucasian females at risk for eating disorders (11.1% vs. 6.3%) when compared to non-Caucasian females [28]. However, these results support the findings of Hrabosky and Grilo, who observed that when compared to Black women, Hispanic women reported greater body shape concerns and greater disordered eating behaviors [64]. These differences did not reach significance (all p-values >0.05) [64].

Strengths and Limitations

There are limitations to this study that should be noted. Seventy-five percent of the study sample was female, which may have introduced bias towards increased prevalence of risk for DE among the study sample. Previous studies found that when compared to males, females have a higher risk for developing DE or being diagnosed with an eating disorder [4, 28, 61, 63]. Compared to males, females are also more likely to be concerned with their weight and using more strategies to control or lose weight [4]. This study supports these findings. Four out of the six subjects who were at risk for DE were females.

The current study used accelerometers to determine energy expenditure, which relied on subjects' compliance with wearing their accelerometers between the first and second appointment times. Some subjects reported forgetting to wear their accelerometers for extended periods of the day. A detailed description of how the gaps of data were filled can be found in the method section. Other studies validating the methods used to fill in the gaps of accelerometer data have shown the method used in this study to be valid [65]. A more accurate method to determining TEE is by doubly labeled water, however, the current study did not have the funding or resources to employ this method.

There is also the possibility of subject inaccurately reporting their EI using the Automated Self Administered (ASA) 24-hour recall. The range for EI, as assessed by ASA 24, was 710 – 3039 kcals/day. Based on the ratios of the "Goldberg cut-off" for assessing EI under-reporters (EI/TEE <0.76) and EI over-reporters (EI/TEE >1.24), the current study had 8 subjects classified as an under-reporter and 5 subjects classified as an over-reporter [66]. The remaining 7 subjects were classified as acceptable reporters, falling in the Goldberg cut-off of EI/TEE = 0.77 – 1.23 [66]. Making the assumption that TEE was accurately measured by accelerometers and subjects were in EB, the under and over-reporting of the subjects serves as a limitation to calculating the true level of EB.

Calculating the true level of an individual's EB was also limited in the current study due to the single measurement of EI. Black et al. state that an absolute agreement between TEE and EI cannot be expected from a one time measurement of EI due to intrapersonal variation of food choices and intake on a daily basis [67]. Research by Basiotis et al. estimates that a total of 27 days are required for men and 35 days are required for women to accurately analyze the "true" average EI, taking into account daily variation [68]. Conducting more than one 24-hour recall for each subject could have improved accuracy of estimated energy intake, but it would have increased subject burden and the duration of the study was only 5 days.

The current study had no subject with a low SE, as determined by the RSES. Although low SE was not observed, subjects did have varying categories SE ranging from normal to high. Creating two categories for SE (normal vs. high) was not found to be significantly associated with EB in either of the logistic regressions (Model A p-value=1.000; Model C p-value=0.918) or linear regressions (Model 1 p-value=0.176; Model 3 p-value=0.080). One possible explanation for no subject having a low SE is that the study used college freshmen volunteers. Research studies have shown that individuals who volunteer generally have a higher SE than those individuals who do not volunteer [69].

The limited sample size of 20 college freshmen students limits this study's power and increases the chances of a type II error occurring (false negative conclusion). The subject sample size needed to reduce the probability of a type II error in the final logistic regression model is 75 subjects with 80% power and $\alpha = 0.05$. Linear regression model 1 (Table 8) looking at SE as a predictor of EB had a power of 0.61. Table 8 showed SE to be a non-significant predictive factor for EB (p=0.176). Linear regression model 2 (Table 9) looking at the risk for DE of EB had a power of 0.69. Table 9 showed the risk for DE to be a non-significant factor in predicting EB (p=0.107). The final linear regression model (Table 10) had a high 0.93 power for the evaluation of SE and risk for DE as predictive factors of EB in college freshmen (p=0.080 and p=0.053, respectively). If the current study had a larger sample size, or reached a sample size of $\geq$75 subjects, a level of significance for SE as a predictive factor in EB may have been reached.

Despite these limitations, the present study had strengths. The ASA 24-hour recall follows the United States Department of Agriculture Automated Multiple-Pass Method to assess an individual's EI [56]. This method has been validated and shown to accurately assess an individual's EI per day [56, 57].

The inclusion of physical activity logs in this study strengthened the analysis of TEE by the accelerometers. All subjects completed their physical activity logs and returned them to the researcher during their second appointment. The log was accessed to verify the data shown by the accelerometer and also assisted in filling in any missing data cells from the accelerometer.

The questionnaires used in this study were EAT and RSES to evaluate risk for DE and SE levels, respectively. Both of these questionnaires are the most commonly used assessment tools for their intended use and are also used internationally [21, 32, 36-38, 55, 70-73].

Conclusion

The major findings in this study were that t-tests revealed no significant difference between EI, TEE, EB, for those at risk for DE and not at risk for DE and between subjects with normal SE vs. high SE. Adjusted linear regression found that the combination of risk for DE, and race (Whites and Hispanics) were significant predictors of EB. When these factors were analyzed separately they were no longer found significant. Analysis by odds ratio was also non-significant when comparing the subjects who were in a positive EB to those who were in a negative EB. Due to the absence of individuals with low levels of SE in this study, it was not possible to evaluate the association between low SE and EB. This study provides insight into the relationship between risk for DE and EB and SE levels and EB in 18-25 year old college students. These findings may potentially explain the weight change observed during the freshmen year in college and the roles that DE and SE have in affecting EB. Evaluating an individual's risk for DE may predict weight gain or weight loss.

Future research should be conducted with a larger sample size to confirm the current study's findings. A larger sample size will also increase the likelihood of including subjects with low SE and provide insight regarding the relationship between low SE and EB. Using doubly labeled water, a method more accurate than accelerometers, to assess individual TEE would strengthen future research. Other psychological components such as, social physique anxiety and social desirability were not included in the current study. Social physique anxiety and social desirability have been associated with decreased EI as well as under-reporting EI, respectively [21, 74]. Including other psychological questionnaires would possibly identify more psychological factors associated with predicting EB.

Longitudinal research should also be conducted to examine if weight change, the outcome of energy imbalance, occurs among those at risk for DE or those with low SE and if there is a causal relationship. Employing a longitudinal study design that includes TEE measured by doubly labeled water will allow researchers to see if energy imbalance is the result of changes in an individual's EI or TEE. Inclusion of additional independent variables could possibly identify factors that cause energy imbalance.

Health care providers could implement the analysis of an individual's risk for DE to screen for those who are at risk for energy imbalance and better direct an individual's treatment plan.

References

1. Morrow, M.L., et al., *Freshman 15: Fact or Fiction.* International Journal of Obesity, 2006. **14**(8): p. 1438-1443.
2. Wengreen, H. and C. Moncur, *Change in diet, physical activity, and body weight among young-adults during the transition from high school to college.* Nutrition Journal, 2009. **8**(32).
3. Levitsky, D.A., C.A. Halbmaier, and G. Mrdjenovic, *The freshman weight gain: a model for the study of the epidemic of obesity.* International journal of obesity and related metabolic disorders : journal of the International Association for the Study of Obesity, 2004. **28**(11): p. 1435-42.
4. Cluskey, M., PhD, RD and D. Grobe, PhD, *College Weight Gain and Behavior Transitions: Male and Female Differences.* American Dietetic Association 2009. **109**(2): p. 325-329.
5. Lloyd-Richardson, E., PhD, et al., *The Relationship Between Alcohol Use, Eating Habits and Weight change in College Freshmen.* National Institutes of Health, 2008. **9**(4): p. 504-508.
6. Sareen Gropper, P., et al., *The Freshman 15 - A Closer Look.* Journal of American College Health, 2009. **58**(3): p. 223-231.
7. Jung, M.E., MSc, S.R. Bray, PhD, and K.A.M. Ginis, PhD, *Behavior Change and the Freshman 15: Tracking Physical Activity and Dietary Patterns in 1sr-Year University Women.* Journal of American College Health, 2008. **56**(5): p. 523-530.
8. Nelson, M.C., PhD, RD, et al., *Understanding the Perceived Determinants of Weight-related Behaviors in Late Adolescence: A Qualitative Analysis Among College Youth.* Journal of Nutrition Education and Behavior, 2009. **41**(4): p. 287-292.
9. Karparek, D., PhD, et al., *Selected Health Behaviors That Influence College Freshman Weight Change.* Journal of American College Health, 2008. **56**(4): p. 437-445.
10. Greaney, M.L., PhD, et al., *College Students' Barriers and Enablers for Heathful Weight Management: A Qualitative Study.* Journal of Nutrition Education and Behavior, 2009. **41**(4): p. 281-286.
11. Freedman, M.R., PhD, *Gender, Residence and Ethnicity Affect Freshman BMI and Dietary Habits.* Am J Health Behavior, 2010. **34**(5): p. 513-524.
12. Al-Rethaiaa, A.S., A.-E. Fahmy, and N. Al-Shwaiyat, *Obesity and Eating Habits Among College Students in Saudi Arabia: A Cross Sectional Study.* Nutrition Journal, 2010. **9**(39).
13. Delinsky, S.S. and G.T. Wilson, *Weight Gain, Dietary Restraint, and Disordered Eating in the Freshman Year in College.* Eating Behaviors, 2007. **9**(1): p. 82-90.
14. Puhl, R.M. and C.A. Heuer, *The stigma of obesity: a review and update.* Obesity, 2009. **17**(5): p. 941-64.

15. Heuer, C.A., K.J. McClure, and R.M. Puhl, *Obesity Stigma in Online News: A Visual Content Analysis.* Journal of health communication, 2011: p. 1-12.
16. Andreyeva, T., R.M. Puhl, and K.D. Brownell, *Changes in perceived weight discrimination among Americans, 1995-1996 through 2004-2006.* Obesity, 2008. **16**(5): p. 1129-34.
17. Harring, H.A., MSPH, K. Montgomery, DrPH, and J. Hardin, PhD, *Perceptions of Body Weight, Weight Management Strategies, and Depressive Symptoms Among US College Students.* Journal of American College Health, 2010. **59**(1): p. 43-49.
18. Puskar, K., et al., *Self-Esteem and Optimism in Rural Youth: Gender Differences.* Contemporary Nurse, 2010. **34**(2): p. 190-198.
19. Derenne, J., MD and E. Beresin, MD, *Body Image, Media, and Eating Diorders.* Academic Psychiatry, 2006. **30**(3): p. 257-261.
20. Wong, Y., MS, RD, et al., *Weight Satisfaction and Dieting Practices among College Males in Taiwan.* Journal of the American College of Nutrition, 1999. **18**(3): p. 223-228.
21. Gargari, B.P., et al., *Eating Attitudes, Self-Esteem and Social Physique Anxiety Among Iranian Females Who Participate in Fitness Programs.* Sports Psychology, 2010. **50**(1): p. 79-84.
22. Pruneti, C., F. Fontana, and L. Bicchieri, *Eating Behavior and Body Image Perception: An Epidemiological Study on Italian Adolescents.* Acta Bio Medica Ateneo Parmense, 2004. **75**(1): p. 179-184.
23. Schotte, D. and M. Standard, *Bulimia and Bulimic Behaviors on a College Campus.* JAMA, 1987. **258**: p. 1213-1215.
24. Kurtzman, F., et al., *Eating Disorders Among Selected Female Student Populations at UCLA.* Journal of American Dietetic Association, 1989. **89**: p. 45-53.
25. Tozun, M., MD, et al., *Prevalence of Disordered Eating and its Impact on Quality of Life Among a Group of College students in a Province of West Turkey.* Salud Publica de Mexico, 2010. **52** (3): p. 190-198.
26. Association, A.P., *Diagnostic and Statistical Manual of Mental Disorders*. Vol. 4. 1994: American Psychiatric Association.
27. Goldschmidt, A., MA, et al., *The Sigmificance of Overvaluation of Shate and Weight in Binge Eating Disorder.* National Institutes of Health, 2010. **48**(3): p. 187-193.
28. Hoerr, S.L., RD, PhD, et al., *Risk for Disordered Eating Relates to both Gender and Ethnicity for College Students.* Journal of the American College of Nutrition, 2002. **21**(4): p. 307-314.
29. Vella-Zarb, R.A., MA and F.J. Elgar, PhD, *The 'Freshman 5': A Meta-Analysis of Weight Gain in the Freshman Year of College.* Journal of American College Health, 2009. **58**(2): p. 161-166.
30. Levitsky, D., C. Halbmaier, and G. Mrdjenovic, *The Freshman Weight Gain: A Model For the Study of the Epidemic of Obesity.* International Journal of Obesity, 2004. **28**: p. 1435-1442.

31. Karpowicz, E., I. Skarsater, and L. Nevonen, *Self-Esteem in Patients Treated for Anorexia Nervosa.* International Journal of Mental Health Nursing, 2009. **18**: p. 318-325.
32. Soo, K.L., Z. Mohd Shariff, and M. Nasir Mohd Taib, *Eating Behaviour, Body Image, and Self-Esteem of Adolescent Girls in Malaysia.* Perceptual and Motor Skills, 2008. **106**(3): p. 833-844.
33. Sysko, R., et al., *Eating Behavior Among Women with Anorexia Nervosa.* The American Journal of Clinical Nutrition, 2005. **85**(1): p. 296-301.
34. Rouveix, M., et al., *Eating Attitudes, Body Esteem, Perfectionism and Anxiety of Judo Athletes and Nonathletes.* International Journal of Sports Medicine, 2007. **28**: p. 340-345.
35. Wong, Y., MS, RD and Y.-C. Huang, PhD, *Obesity Concerns, Weight Satisfaction and Characteristics fo Female Dieters: A Study on Female Taiwanese College Students.* Journal of the American College of Nutrition, 1999. **18**(2): p. 194-200.
36. Garfinkel, P.E. and A. Newman, *The eating attitudes test: twenty-five years later.* Eating and weight disorders : EWD, 2001. **6**(1): p. 1-24.
37. Alvarez-Rayon, G., et al., *Validity of the Eating Attitudes Test: a study of Mexican eating disorders patients.* Eating and weight disorders : EWD, 2004. **9**(4): p. 243-8.
38. Marsh, H., F. Scalas, and B. Nagengast, *Longitudinal Tests of Competing Factor Structures for the Rosenberg Self-Esteem Scale: Traits, Ephemeral Artifacts, and Stable Response Styles.* American Psychological Association, 2010. **22**(2): p. 366-381.
39. *Centers for Disease Control and Prevention*. Available from: http://www.cdc.gov.
40. *Healthy People 2010*. January 10, 2010]; Available from: http://healthypeople.gov.
41. *Healthy People 2020*. January 10, 2012]; Available from: http://healthypeople.gov.
42. Hermann, S., et al., *The association of education with body mass index and waist circumference in the EPIC-PANACEA study.* BMC public health, 2011. **11**: p. 169.
43. *NHANES - National Health and Nutrition Examination Survey*. [cited 2012 January 11, 2012]; Available from: http://www.cdc.gov/nchs/nhanes.htm.
44. *Summaries for patients: Obesity and the ability to carry out daily activities.* Annals of internal medicine, 2011. **154**(10): p. I-28.
45. Puhl, R.M. and K.D. Brownell, *Confronting and coping with weight stigma: an investigation of overweight and obese adults.* Obesity, 2006. **14**(10): p. 1802-15.
46. Sheets, V. and K. Ajmere, *Are romantic partners a source of college students' weight concern?* Eating Behaviors, 2005. **6**(1): p. 1-9.
47. Ball, K., D. Crawford, and J. Kenardy, *Longitudinal relationships among overweight, life satisfaction, and aspirations in young women.* Obesity research, 2004. **12**(6): p. 1019-30.

48. Puhl, R. and K.D. Brownell, *Bias, discrimination, and obesity.* Obesity research, 2001. **9**(12): p. 788-805.
49. Puhl, R.M., T. Andreyeva, and K.D. Brownell, *Perceptions of weight discrimination: prevalence and comparison to race and gender discrimination in America.* International Journal of Obesity, 2008. **32**(6): p. 992-1000.
50. Association, T.A.C.o.H., *The American College Health Association National College Health Assessment (ACHA-NCHA), Fall 2010 Reference Group report*, in *Journal of American College Health*2010. p. 2-18.
51. Wechsler, H., et al., *Environmental correlates of underage alcohol use and related problems of college students.* American journal of preventive medicine, 2000. **19**(1): p. 24-9.
52. Perrin, E., MD, MPH, et al., *Perception of Overweight and Self-Esteem During Adolescence.* International Journal of Eating Disorders, 2010. **43**(5): p. 447-454.
53. Costa, L.d.C.F., F.d.A. Guedes de Vasconcelos, and K. Glazer Peres, *Influence of Biological, Social and Psychological Factors on Abnormal Eating Attitudes among Female University Students in Brazil.* J Health Popul Nutr, 2010. **28**(2): p. 173-181.
54. Kiziltan, G. and E. Karabudak, *Risk of Abnormal Eating Attitudes Among Turkish Dietetic Students.* Adolescence, 2008. **43**(171): p. 681-689.
55. Bas, M., et al., *Eating Attitudes and Their Psychological Correlates Among Turkish Adolescents.* Adolescence, 2004. **39**(155): p. 593-600.
56. *National Cancer Institute* March 13, 2012]; Available from: http://riskfactor.cancer.gov/tools/instruments/asa24/validation/.
57. Tom, B., PhD, et al., *Comparison of a Web-Bases versus Traditional Diet Recall among Children.* Journal of the American Dietetic Association, 2012. **10**.
58. *Sports Medicine, Sports Performance, Sports Injury - Information About Sports Injuries and Workouts for Athletes*. August 15, 2011]; Available from: http://sportsmedicine.about.com/.
59. Roza, A.M. and H.M. Shizgal, *The Harris Benedict equation reevaluated: resting energy requirements and the body cell mass.* The American Journal of Clinical Nutrition, 1984. **40**(1): p. 168-82.
60. *National Cancer Institute* [cited 2012 March 14, 2012]; Available from: http://riskfactor.cancer.gov/tools/atus-met/met.php.
61. Serdar, K.L., et al., *Correlates of weight instability across the lifespan in a population-based sample.* The International journal of eating disorders, 2011. **44**(6): p. 506-14.
62. Raymond, N.C., et al., *Comparisons of Energy Intake and Energy Expenditure in Overweight and Obese Women With and Without Binge Eating Disorder.* Obesity, 2011.
63. Jacobson, I.G., et al., *Disordered eating and weight changes after deployment: longitudinal assessment of a large US military cohort.* American journal of epidemiology, 2009. **169**(4): p. 415-27.

64. Hrabosky, J.I. and C.M. Grilo, *Body image and eating disordered behavior in a community sample of Black and Hispanic women.* Eating Behaviors, 2007. **8**(1): p. 106-14.
65. Choi, L., et al., *Validation of Accelerometer Wear and Nonwear Time Classification Algorithm.* Med Sci Sports Exerc., 2011. **42**(2): p. 357-364.
66. Trabulsi, J. and D.A. Schoeller, *Evaluation of dietary assessment instruments against doubly labeled water, a biomarker of habitual energy intake.* American journal of physiology. Endocrinology and metabolism, 2001. **281**(5): p. E891-9.
67. Black, A.E., et al., *Measurements of total energy expenditure provide insights into the validity of dietary measurements of energy intake.* Journal of the American Dietetic Association, 1993. **93**(5): p. 572-9.
68. Basiotis, P., et al., *Number of days of food intake records required to estimate individual and group nutrient intakes with defined confidence.* J Nutr, 1987. **117**(9): p. 1638-1641.
69. Cemalcilar, Z., *Understanding Individuals Characteristics of Adolescents Who Volunteer.* Elsevier, 2009. **46**: p. 432-436.
70. Grange, D., PhD, C. Telch, PhD, and J. Tibbs, MA, *Eating Attitudes and Behaviors in 1,435 South African Caucasion and Non-Caucasian College Students.* American Journal of Psychiatry 1998. **155**(2): p. 250-254.
71. Grange, D., et al., *Eating Attitudes and Behaviours in South African Adolescents and Young Adults.* Transcultural Psychiatry, 2006. **43**(3): p. 401-417.
72. Thomas, C., A. James, and M. Bachmann, *Eating Attitudes in English Secondary School Students: Influences of Ethnicity, Gender, Mood, and Social Class.* International Journal of Eating Disorders, 2002. **31**: p. 92-96.
73. Fisher, M., et al., *Eating Attitudes in Urban and Suburban Adolescents.* International Journal of Eating Disorders, 1994. **16**(1): p. 67-74.
74. Taren, D.L., et al., *The association of energy intake bias with psychological scores of women.* European journal of clinical nutrition, 1999. **53**(7): p. 570-8.

Appendix 1:

Booth Recruitment Script and Sign for booth outside Joe Crowley Student Union Building

<u>Sign posted at the booth</u> will state "Freshman Research Study – Does your intake and physical activity change during your freshman year?".

<u>Initial booth recruitment script:</u>
Hello my name is (insert research assistant's name). I am recruiting for a freshman research study. Here is a flier regarding the study called "Determining the risk factors for weight change in a cohort of college students."

You will not be monetarily compensated for study participation. However, this is an opportunity to learn more about your body composition (height, weight and percent body fat), diet and physical activity.

Study participation is voluntary and you may discontinue being in the study at any time.

Interested?

Do you have any questions?

<u>If the student states they are interested, the following script will be used:</u>
We have a signup sheet if you are interested in participating.

You can make your initial Day 1 appointment today or be contacted at a later date. Your contact information will not be shared with anyone besides the research assistants.

If you are interested, here is a copy of the study consent form for your review. It outlines the specifics of the study in detail. Please read it over carefully. We will not collect any data until you are sure you want to be in the study and turn in a signed consent form.

The full time commitment is 3 hours over 5 days.

<u>If the student requests additional information, the following script will be used:</u>
Studies have shown that college students are particularly vulnerable to gaining weight, especially during their freshman year of college. However, other studies indicate that individuals with a college education have a lower risk of being obese. So what is happening? No study has followed a group of college students for a period of time looking at their diet, physical activity and other personal factors. In addition, after leaving college it is unclear if there is a weight change.

You are eligible to participate in the study if: (1) you are enrolled at UNR as a freshman during the Fall 2009 semester (2) taking 6 or more credits with the majority of these credits held on campus (3) read and write English (4) between 18 and 25 years of age, and (5) are not enrolled in a class with Dr. Karen Spears or Dr. Chris Pritsos, both professors in the Nutrition Department.

Let me explain what you would be doing over those 5 days in both the Fall and Spring semesters:

Day 1:

1) First, you will meet with a researcher in the nutrition research laboratory located at Sarah Fleicshman Building, Room 112 were your weight, height, and body fat will be measured.
2) Second, you will fill out a general lifestyle questionnaire
3) Lastly, tell us what you ate over the past 24 hours

These activities will take approximately60 minutes.

Day 2 through 4:

You will wear an accelerometer (an instrument to measure physical activity) and complete a daily physical log.

These activities will take about 60 minutes or 20 minutes per day.

Day 5:

1) Come back to the nutrition research laboratory to return the accelerometer and physical activity log.
2) Then, you will complete a questionnaire that asks about your usual food eating patterns.
3) Finally, you will fill out 3 questionnaires that inquire about your eating attitudes.

These activities will take approximately 60 minutes to complete.

Remember, study participation is voluntary and you may discontinue being in the study at any time.

Your information will be kept confidential. Students enrolled in Special Projects Nutrition 400 are research assistants in this study. They have extensive training in research ethics.

We will be retaining your contact information to potentially contact you to collect the same data once a year after you leave UNR.

Appendix 2:

UNIVERSITY OF NEVADA, RENO BIOMEDICAL INSTITUTIONAL REVIEW BOARD CONSENT TO PARTICIPATE IN A RESEARCH STUDY

TITLE OF STUDY: Determining the Risk Factors for Weight Change in a Cohort of College Students
INVESTIGATOR(S): Dr. Karen Spears 775-784-1775, Dr. Chris Pritsos 775-784-6443
PROTOCOL #: B09/10-005
SPONSOR: none

PURPOSE

You are being asked to participate in a research study. Researchers from the University of Nevada, Reno (UNR), Department of Nutrition are conducting a study to learn about the factors involved in weight change during the course of your college education and potentially after you leave UNR.

PARTICIPANTS

You are being asked to participate because you are a freshman at the University of Nevada, Reno, enrolled in 2011 with a minimum of 6 and credits and the majority of your courses are held on the main campus.

You must be > 18 and <25 years of age, read and speak English, and not a student enrolled in any of Drs. Spears' or Pritsos' Nutrition classes.

We anticipate 190 freshman students will be enrolled in 2011.

PROCEDURES

If you consent to participate in this research study, over 5 days you will be asked to:

1) Come to the nutrition research laboratory in the Sara Fleishmann Building, Room 112 to have your weight, height, and body fat measured. To measure your body fat, you will stand on a machine that sends a low amount of electrical current. There are guidelines to improve the accuracy of body fat measurements such as: no caffeine or alcohol consumption 12 hours prior to the test and no eating or drinking 4 hours before the test. In addition, you will fill out questionnaires. Some questions ask about your mood and factors that may affect you're eating behavior. Total time 20-30 minutes.
2) Tell us what you ate over the past 24 hours (20-30 minutes)
3) Wear an accelerometer (instrument to measure physical activity) for 3 days and complete a daily physical activity log (20 minutes per day, total 60 minutes)
4) Come back to the nutrition research laboratory on Day 5 to return the accelerometer and physical activity log, complete a questionnaire that asks about your usual food eating patterns and fill out 3 eating attitude questionnaires (60 minutes)

This information will be obtained twice a year (during the Fall and Spring) while you are in college. Your time commitment will be about 3 hours per year.

Phase 2 of study: we may contact you to obtain the same information after you leave the University of Nevada, Reno. Your decision to participation in the research study after graduation will be noted on your student demographics form. For phase 2, you will come in for data collection once per year for the first 2 years after leaving UNR, time commitment will be 1.5 hours per year (3 hours total).

To assist us in confirming you enrollment at UNR, we will refer to Degree Audit Reporting System (DARS). To obtain current contact information, we may contact the University Registration and Records, Alumni Association, or your emergency contact information.
You will be withdrawn from the study if the accelerometer is not returned.

DISCOMFORTS, INCONVENIENCES, AND/OR RISKS

Some people may feel mild discomfort in completing questionnaires, reporting their intake, having body measurements obtained and wearing an accelerometer. Body fat measurement may not be taken if you have any metal inserts, a pacemaker or a heart condition. All measurements will be conducted in a private room. Because some questions ask about your mood and factors that may affect you’re eating behavior, there is a possible risk that you may have suicide ideation, increase in eating disorder and/or reduced self-esteem. If these are observed, we will refer you to the Student Counseling Center 784-4648.

BENEFITS

There is no direct benefit to you as a participant in this study. The study will help identify potential factors that change the weight status of college students. This information may be helpful in establishing obesity intervention programs.

CONFIDENTIALITY

The investigators, Dr. Karen Spears and Dr. Chris Pritsos, will treat your identity with professional standards of confidentiality and protect it to the extent allowed by law. The Department of Health and Human Service (HHS), and the University of Nevada, Reno Biomedical Institutional Review Board may inspect your study records. You will not be personally identified in any reports or publications that may result from this study.

All of your records will be secured in a locked cabinet in the principle investigator’s office and on a password protected computer database. The principal investigator will assign you a code number to be used when obtaining research date. Only the research team will have the connecting information between your name, date of birth and the assigned code number. Your name will not be on any reports or published papers.

COSTS/COMPENSATION

There will be no cost to you nor will you be compensated for participating in this research study.

If we do receive funding and you continue to participate in the study after you leave the University, we will provide some compensation to you for the second phase.

If you think you have suffered a research related injury, you should immediately contact the investigator Dr. Karen Spears at 775-784-1775.

DISCLOSURE OF FINANCIAL INTERESTS:

The investigators have no conflict of interest or financial interests in the study.

RIGHT TO REFUSE OR WITHDRAW

You may refuse to participate or withdraw from the study at any time. If the study design or use of the data is to be changed, you will be so informed and your consent re-obtained. You will be told of any significant new findings developed during the course of this study, which may relate to your willingness to continue participation.

Volunteering to participate or choosing not to participate in this study will not have any positive or negative impact on your standing at the University of Nevada, Reno, or your grade in any UNR course.

QUESTIONS

If you have questions about this study or wish to report a research-related injury, please contact Dr. Karen Spears, Assistant Professor, 775-784-1775 or Dr. Chris Pritsos, Professor, 775-784-6443 at any time.

You may ask about your rights as a research subject or you may report (anonymously if you so choose) any comments, concerns, or complaints to the University of Nevada, Reno Biomedical Institutional Review Board, telephone number (775) 327-2368, or by addressing a letter to the Chair of the Board, c/o UNR Office of Human Research Protection, 205 Ross Hall / 331, University of Nevada, Reno, Reno, Nevada, 89557.

CLOSING STATEMENT

I have read this consent form.
The study investigator or research assistant has explained the study to me and all of my questions have been answered. I have been told of the risks or discomforts and possible benefits of the study. I have been told of other choices of treatment available to me.

If I do not take part in this study, my refusal to participate will involve no penalty or loss of rights to which I am entitled. I may withdraw from this study at any time without penalty.

I have been told my rights as a research subject, and I voluntarily consent to participate in this study. I have been told what the study is about and how and why it is being done. All my questions have been answered.

I will receive a signed and dated copy of this consent form.

Signature of Participant Date

Signature of Person Obtaining Consent Date

Signature of Investigator Date

Office of Human Research Protection
205 Ross Hall / 331, Reno, Nevada 89557
775.327.2368 / 775.327.2369 fax
www.unr.edu/ohrp

Appendix 3:

Certification of Approval for Modifications
Biomedical Institutional Review Board

Date: August 24, 2011
To: Karen Spears, PhD, RD Department of Nutrition

Copy:

UNR Protocol Number: B09/10-005
Protocol Title: Determining the Risk Factors for Weight Change in a Cohort of College Students
Type of Review: Expedited 4 & 7 Minimal risk
Approval Period: September 17, 2010 to September 17, 2011

This approval is for:

Modifications:
Addition of Jamie Shirley and Chenin Treftz as research team members
Addition of recruitment booth at Joe Crowley Student Union Building
Revised recruitment script
Addition of recruitment poster.
Approved number of subjects: 190

The above-referenced protocol was reviewed and approved by one of UNR's Institutional Review Boards in accordance with the requirements of the Code of Federal Regulations on the Protection of Human Subjects (45 CFR 46 and 21 CFR 50 and 56).

PI Responsibilities

- Maintain an accurate and complete protocol file.
- Submit continuing projects for review and approval prior to the expiration date.
- Submit proposed changes for review and approval prior to initiation, except when
necessary to eliminate apparent immediate hazards to subjects. Such exceptions must be reported to the IRB at once.
- Report any unanticipated problems which may increase risks to human subjects or
unanticipated adverse events to the IRB within 5 days.
- Submit a closure request 10 days after project completion to the IRB.

Reference the protocol number on all related correspondence with the IRB. If you have any questions, please contact J. Logan Hamill at 775.327.2368.

For Veteran's Administration research only

VA Research: No
Flag VA Medical Record: No

Appendix 4:

General Information Form

Study: Determining the Risk Factors for Weight Change in a Cohort of College Students

Name:____
Mailing address at UNR:____
Phone:___________________________ Cell phone:______________________________
Email address:____
Alternate email address:____
Alternate contact information while attending UNR:
____

Freshman Year:_________ Started at UNR Semester: Fall___ Spring _____Summer___
Freshman transfer student___ Yes ___ No
Number of credits currently enrolled in at UNR: __________
Number of credits from courses conducted off UNR campus: _________________
Major: ____________________________________

Contact information prior to attending UNR or alternate contact:
Name: ____
Home mailing address: ____
Phone number: ________________________
Email address: _______________________________

Gender:Male___Female___

Race or Ethnicity(check all that apply)
☐Hispanic or Latino
☐Black or African American
☐White
☐Asian
☐American Indian or Alaska Native
☐Native Hawaiian or other Pacific Islander
☐Other_________________

age____________

Age between 18 and 25 years of age: ___Yes ___No

Marital status:
single ________married__________ divorced__________ widower________

Living arrangements:
____on-campus: ___dorm ___ UNR apartment ____ fraternity/sorority other:_______
____off-campus: type of housing____
____ no roommate ___ 1 roommate ___ 2 roommates ___>2 roommates

Major dining:

____ UNR meals ______ cook own food ____ roommate cooks ____ dine out
other____

Work status:
____ unemployed ____work on campus ____work off campus
____ full time ____ part-time

Any other time constraints: ____
____
(i.e. caring for a parent or child, long communing time, extensive volunteering, etc.)

Physical Activity:
List the number of times during an average week you do the following types of exercise for more than 15 minutes during your free time (write in each square the number of times per week).

☐☐ **a. Strenuous Exercise**
(During exercise activities the heart beats rapidly and examples include running, jogging, hockey, football, soccer, squash, basketball, skiing, judo, vigorous swimming, vigorous long distance bicycling)

☐☐ **b. Moderate Exercise**
(During exercise activities are not exhausting and examples include fast bowling, baseball, tennis easy: bicycling, baseball, tennis, volleyball, swimming, dancing)

☐☐ **c. Mild Exercise**
(Exercise activities have minimal effort and examples include yoga, archery, bowling, horseshoes, golf, easy walking)

Consider a 7-day period, during your leisure-time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?
___ Often
___ Sometimes
___Never/rarely

Any reasons/disabilities that may limit your physical activity? ______________________

Usual sleeping pattern:
What time do you go to be?_______________ What time do you wake up?_____________
No pattern_______

Health status:
Current medical conditions:____

____

Please list all current medications you are taking: ________________________________

____

Do you have any metal inserts in your body, a pacemaker or a heart condition?
______Yes ______ No

2nd Appointment day:___________________ time;_______________________

Appendix 5:

EATING ATTITUDES TEST (EAT-26)

Height ____
Current Weight ____
Highest Weight (excluding pregnancy) ____
Lowest Adult Weight ____

Code Number ________

Do you participate in athletics at any of the following level:

- O Intramural
- O Inter-Collegiate
- O Recreational
- O High School teams

	Always	Usually	Often	Sometimes	Rarely	Never	Score
1. Am terrified about being overweight	O	O	O	O	O	O	___
2. Avoid eating when I am hungry	O	O	O	O	O	O	___
3. Find myself preoccupied with food	O	O	O	O	O	O	___
4. Have gone on eating binges where I feel that I may not be able to stop	O	O	O	O	O	O	___
5. Cut my food into small pieces	O	O	O	O	O	O	___
6. Aware of the calorie content of foods that I eat	O	O	O	O	O	O	___
7. Particularly avoid foods with a high carbohydrate content (i.e. bread, rice, potatoes, etc.)	O	O	O	O	O	O	___
8. Feel that others would prefer if I ate more	O	O	O	O	O	O	___
9. Vomit after I have eaten	O	O	O	O	O	O	___
10. Feel extremely guilty after eating	O	O	O	O	O	O	___
11. Am preoccupied with a desire to be thinner	O	O	O	O	O	O	___
12. Think about burning up calories when I exercise	O	O	O	O	O	O	___
13. Other people think that I am too thin	O	O	O	O	O	O	___
14. Am preoccupied with the thought of having fat on my body	O	O	O	O	O	O	___
15. Take longer than others to eat my meals	O	O	O	O	O	O	___
16. Avoid foods with sugar in them	O	O	O	O	O	O	___
17. Eat diet foods	O	O	O	O	O	O	___
18. Feel that food controls my life	O	O	O	O	O	O	___
19. Display self-control around food	O	O	O	O	O	O	___
20. Feel that others pressure me to eat	O	O	O	O	O	O	___
21. Give too much time and thought to food	O	O	O	O	O	O	___
22. Feel uncomfortable after eating sweets	O	O	O	O	O	O	___
23. Engage in dieting behavior	O	O	O	O	O	O	___
24. Like my stomach to be empty	O	O	O	O	O	O	___
25. Enjoy trying new rich foods	O	O	O	O	O	O	___
26. Have the impulse to vomit after meals	O	O	O	O	O	O	___

Total Score (see below for scoring instructions) ________

EAT-26 David M. Garner & Paul E. Garfinkel (1979), David M. Garner et al., (1982)

Appendix 6:

Rosenberg's Self-Esteem Scale

Code Number___________________

	STATEMENT	Strongly Agree	Agree	Disagree	Strongly Disagree	
1.	I feel that I am a person of worth, at least on an equal plane with others.					0
2.	I feel that I have a number of good qualities..					0
3.	All in all, I am inclined to feel that I am a failure.					0
4.	I am able to do things as well as most other people.					0
5.	I feel I do not have much to be proud of.					0
6.	I take a positive attitude toward myself.					0
7.	On the whole, I am satisfied with myself.					0
8.	I wish I could have more respect for myself.					0
9.	I certainly feel useless at times.					0
10.	At times I think I am no good at all.					0

Your score on the Rosenberg self-esteem scale is: ___.

Scores are calculated as follows:

- *For items 1, 2, 4, 6,* and *7:*

  Strongly agree = 3
  Agree = 2
  Disagree = 1

Strongly disagree = 0

- *For items 3, 5, 8, 9,* and *10* (which are reversed in valence):

Strongly agree = 0
Agree = 1
Disagree = 2
Strongly disagree = 3

The scale ranges from 0-30. Scores between 15 and 25 are within normal range; scores below 15 suggest low self-esteem.