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Changes in BMI Among First Semester College Students

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science at Virginia Commonwealth University

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Table of Contents

List of Tables

Table Page

Abstract

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The transition to college has been identified as a critical period for weight gain; however, only a limited number of studies have examined this phenomenon. The college setting may promote weight gain, thus the purpose of the present study was to quantify changes in BMI in first year students during their first semester of college and to understand factors associated with weight gain, such as eating behaviors, physical activity, and body shape ideals. Significant changes in weight were detected between Time 1 and 2 with a mean weight gain of 1.24 kg. The majority of participants (73.1%) gained weight and the percentage of participants categorized as overweight increased from 23.1% to 31.4%. Regression models did not reveal significant predictors of weight gain. Paired t-tests revealed significant decreases in disinhibition, binge eating, and number of days of physical activity over the semester. Participants who gained weight had greater body image dissatisfaction than those who did not gain weight. These findings underscore the need for more studies on factors related to weight gain and prevention efforts in the college population.

Introduction

The increasing prevalence of obesity in the United States (U.S.) is well known (Hedley, Ogden, Johnson, Carroll, Curtin, & Flegal, 2004; Mokdad, Serdula, Dietz, Bowman, Marks, Koplan, 1999; Flegal, Carroll, Ogden, Johnson., 2002). Nearly two-thirds (65.1%) of U.S. adults over age 20 are overweight or obese (Hedley et al., 2004). It has been suggested that weight gain among first-year college students is a model for understanding the increase in body weight among North Americans (Levitsky, Halbmaier, & Mrdjenovic, 2004). Significant weight gain in first semester college students has been noted anecdotally; however, only a limited number of studies have empirically examined this phenomenon (Levitsky et al., 2004; Anderson et al., 2003; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005; Butler, Black, & Gretebeck, 2004). Unfortunately, even less is known about the etiology of weight gain in this population. It is important to study first-year college students because they provide a unique opportunity to examine factors associated with weight gain, which might be relevant to understanding weight gain in the general population.

The following sections outline risks associated with obesity and summarize the extant literature on first year students' weight change. In addition, characteristics of the current U.S. environment that may contribute to this epidemic are presented. Finally, obesity promoting environmental factors specific to college campuses are reviewed.

Obesity

The prevalence of obesity has increased steadily in the U.S. over the last 30 years (Hedley et al., 2004; Mokdad et al., 1999, Flegal et al., 2002). Specifically, in the 1976 - 1980 National Health and Nutrition Examination Survey II (NHANES), 15% of adults over 20 years old were obese (Flegal et al., 2002). Obesity rates increased to 23.3% in NHANES III (1988-1994, Flegal et al., 2002). The most recent NHANES data indicate that almost one-third (30.6%) of American adults are obese and the majority (65.7%) of American adults are either overweight or obese (Hedley et al., 2004).

These obesity rates are based on Body Mass Index (BMI), a tool used to indicate weight status in adults (Garrow & Webster, 1985). BMI is calculated as weight (kg)/height $(m)^2$ (World Health Organization, WHO). For adults, BMI is categorized into the following weight statuses: underweight (below 18.5), normal weight (18.5 – 24.9), overweight (25.0 – 29.9), and obese (30.0 and above). BMI ranges are based on the effect body weight has on morbidity and mortality (WHO).

Specifically, as BMI increases, the risk for several diseases escalates (Calle, 1999). Some of the significant health risks associated with obesity include Type-II diabetes, cardiovascular disease, hypertension, stroke, osteoarthritis, sleep apnea, and certain forms of cancer (e.g., Mokdad et al., 1999; Must et al., 1999; Pi-Sunyer, 2002, Calle, 1999). Obese individuals with BMI's greater than 30 kg/m^2 have a 30% greater risk for premature death than individuals with a normal BMI; a BMI greater than 40 kg/m^2 places an individual at 100% greater risk for premature death (Stevens, Plankey, Williamson, Thun, Rust, Palesch, & O'Neil, 1998).

In addition to physical health risks, overweight and obesity are associated with numerous negative psychosocial and behavioral consequences (WHO, 1997, Neumark-Sztainer & Haines, 2004). Overweight adults face significant weight-related stigmatization (Rothblum, Brad, Miller & Oetjen, 1990; Falkner, French, Jeffery, & Neumark-Sztainer, 1999). For example, Gortmaker et al. (1993) found that overweight males and females were less likely to be married in an eight year follow-up than non-overweight individuals or individuals with other chronic physical conditions. Negative economic consequences for obesity also exist (Neumark-Sztainer & Haines, 2004; Gortmaker et al., 1993; Pagan & Davila, 1997; Register & Williams, 1997). For example, obese women tend to be paid less than nonobese women in similar jobs (Gortmaker et al., 1993; Pagan & Davila, 1997; Register & Williams, 1997). Obese individuals appear to have more difficulty being hired (Pingitore, Dugoni, Tindale, & Spring, 1994) and promoted (Brink, 1988) in the workplace due to negative weight stigmatization. Obtaining a college education may also be more difficult due to weight stigmatization manifested by negative academic evaluations, decreased college acceptance rates (Solovay, 2000; Weiler & Helms, 1993), and less financial support from parents (Crandall, 1995).

Overweight and obese individuals seeking treatment for weight related issues report greater emotional problems, such as depression and anxiety, than their non-treatment seeking counterparts (Freidman & Brownell, 1995). On the other hand, reviews of the literature (Neumark-Sztainer & Haines, 2004) note that studies of adults in the general population have not found overall differences in global psychosocial concerns

(such as self-esteem, anxiety, and depression) between overweight and nonoverweight individuals (O'Neil & Jarrell, 1992; Striegel-Moore & Rodin, 1986; Stunkard & Wadden, 1992; Wadden & Stunkard, 1985). Freidman & Brownell (1995) suggest that inconsistencies in studies comparing overweight and nonoverweight individuals may result from treating overweight people as a homogenous group. They suggest a more efficacious approach would be to study factors that may place some obese individuals at risk for negative psychological consequences.

Nonetheless, some differences in weight-specific psychosocial concerns and behaviors between overweight and nonoverweight individuals in the general population have been detected (Neumark-Sztainer & Haines, 2004). For example, a strong positive association between obesity and body dissatisfaction has been found (Neumark-Sztainer, Faulkner, Story, Perry, Hanna, & Mulert, 2002; French, Story, & Perry, 1995; Smith, Thompson, Raczynski, & Hilner, 1999). Evidence also suggests a link between weight stigmatization and body dissatisfaction (Grilo, Wilfley, Brownell, & Rodin., 1994). Furthermore, there is a strong association between obesity and unhealthy weight control practices, such as over-exercise, unhealthy dieting, binge eating, vomiting, and diet pill and laxative use (Neumark-Sztainer, Story, Falkner, Beuhring, & Resnick, 1999; Neumark-Sztainer, Story, et al., 2002). In adolescents, weight-stigmatization has been linked with unhealthy weight control behaviors and binge eating (Neumark-Sztainer, Faulkner, et al., 2002).

The etiology of obesity involves a combination of biological, psychological and environmental factors. Bouchard (2002) suggests that 25% - 40% of body weight is

genetically determined, while an individual's behavior and interactions with the environment and biology account for the remaining 60% - 75%. In an analysis of the heritability of BMI among twins and their families, Maes, Neale, and Eaves (1997) found that 67% of the variance in BMI was accounted for by genetic factors while unique environmental factors accounted for 27% of the variance. While the role of genetics in the development of obesity continues to be investigated, many researchers suggest that genetics "load the gun, but the environment pulls the trigger." In particular, Henderson & Brownell (2004) suggest that the *toxic environment* explains the dramatic increase in overweight and obesity observed in U.S. culture.

Further understanding of the etiology of obesity is important and could inform prevention efforts. Obesity prevention is key, as treatment for obesity is usually unsuccessful (Henderson & Brownell, 2004). Professionally directed behavioral treatments show initial weight loss, but most participants regain the weight (Douketis, Feightner, Attia, & Feldman, 1999). Drug therapies, such as Sibutramine and Orlistat also produce initial weight loss, (7% and 15% of weight), however it is unknown if weight losses can be maintained without medication (Bray & Greenway, 1999). For severely obese patients, gastric bypass has been effective in reducing weight and obesity-related diseases (Maggard, Shugarman, Suttorp, Maglione, Sugerman, Livingston, et al., 2005). However, this is a risky and expensive procedure which should not be regarded as a panacea. Thus, it is important to identify populations and periods of time where weight change occurs as an initial step towards developing effective obesity prevention and treatment programs. The transition to college appears to be a time when individuals are

vulnerable to weight gain. The following section provides an overview of the existing literature regarding weight change in first year college students.

"Freshman Fifteen" Studies

The transition to college is a time when relatively rapid weight change has been identified. The "freshman fifteen" is a colloquialism in American culture used to refer to an increase in weight occurring during the transition from high school to college. There have been a number of studies of the "freshman fifteen," but their results conflict. For example, Anderson et al. (2003) have suggested the first year of college is a critical period for weight gain. In their study, first year students' height and weight were recorded in September ($N = 192$), December ($N = 135$), and May ($N=46$). By December of the first semester, 74% of participants had gained weight (± .23 kg or approximately 0.5 lbs), 25% gained at least 2.3 kg, and 32% were classified as overweight or obese, compared to 21% in September. Weight seemed to stabilize in the second semester; however, overall weight gain may have been underestimated, as only a small subset of the original sample returned in May (Anderson et al, 2003).

A related study by Levitsky, Halbmaier, and Mrdjenovic (2004) also showed significant weight gain among first year college students. Incoming first year students ($N=60$) were weighed at the beginning and end of their first twelve weeks of school. Students also filled out a questionnaire assessing eating, exercise and sleeping habits. A mean weight gain of 1.9 ± 2.4 kg (or approximately 4.18 ± 5.28 lbs) was reported. On average, first year students gained approximately 158.3g/week, which is almost 11 times more than the weekly weight gain expected in 17- and 18-year-olds and almost 20 times

more than the average weekly weight gain of an American adult. In the first of two regression models, Levitsky et al. (2004) found that eating breakfast and lunch at all-you-can-eat dining facilities was the variable most strongly associated with weight gain in first year students. Other significant predictors of weight gain included greater consumption of evening snacks, "junk" and other high fat foods, and meals consumed on weekends. Interestingly, recent dieting was also associated with weight gain.

In a second regression model (Levitsky et al., 2004), initial body weight was used as a covariate. Results of this analysis indicated that consumption of junk food was most strongly associated with weight gain. Recent dieting, evening snacks, and eating lunch at restaurants were also associated with weight gain. The authors suggest that the weight gain observed in first year students could be an amplification of the process contributing to the epidemic of obesity among the general population. Specifically, they note that a relatively small increase in calories each week can have a cumulative effect of increasing weight over time. However, it should be noted that there were limitations to this study, including the lack of an ethnically diverse sample, and the inclusion of a limited number of correlated behaviors previously found to be associated with obesity. For example, the authors did not assess binge eating, disinhibited eating, cognitive restraint, or susceptibility to hunger.

Another study of first year students conducted by Hovell et al. (1985) matched female students from a private university who lived on campus with state and community college female students living off campus to evaluate weight change over three years. Students were assessed during their first year ($N = 158$), second year ($N =$

123) and third year ($N = 43$). Residential females' weight increased an average of .73 lbs/month (or 1.6 lbs/month), a rate 36 times greater than that of off-campus women during the first year. After the first year, students moved out of dormitories to apartments or sorority houses and no longer used university cafeteria services. The rate of weight gain decreased during sophomore year and stabilized by the end of junior year with some returning back to first-year baseline weight. The authors suggest that the students' dormitory lifestyle and all-you-can-eat cafeteria services contributed to the weight gain among on-campus residents during the first year.

Racette et al. (2005) assessed changes in weight, exercise and dietary patterns among first and second year college students ($N = 764$). At the end of the first year, 75% had an increase in BMI with a mean weight gain of 2.5± 5.0 kg (or approximately 5.5 ± 11 lbs). By the end of the second year 70% of participants had a mean increase in weight of 4.1 ± 3.6 kg (or approximately 9 ± 7.9 lbs). However, there was no association between weight change and exercise or dietary patterns (Racette et al., 2005). The authors note that this may be attributable to some limitations in their study, including insensitive dietary and physical activity measures. For example, the self-report physical activity questionnaire, which assessed participation in regular aerobic exercise, strength training, and stretching, included only three questions. This may have limited assessment of actual physical activity behaviors. Additionally, the dietary questionnaire only asked about behaviors in the previous week, which may not reflect actual behavior over the course of the semester.

A related study examined diet, physical activity, and changes in body weight associated with the transition from home to college. Butler, Black, and Gretebeck (2004) assessed these factors among 54 first year women upon entry to college and again five months later. They found a significant decrease in caloric intake and a significant increase in body-weight parameters that may be attributed to significant decreases in total physical activity. Alternatively, participants may have underreported their caloric increase or over-reported physical activity.

A recent study measured changes in weight and percent body fat in 67 first year students between September and April of their first academic year (Hoffman, Policastro, & Lee, 2006). Participants mean weight gain was 1.32 kg (2.86 lbs). The mean percentage body fat change was 1.20. Among participants who gained weight (73.1%), the mean weight gain was 3.50 kg (6.82 lbs) and the percentage of body fat was .90. The authors suggest future research to understand the causes of these changes.

One study examined the role of restrained eating, disinhibition, and emotional eating as predictors of first year students' weight gain (Lowe et al., 2006). The average weight gain among the 69 participants was 2.1 kg. The investigators found two significant predictors of weight gain, which included a self-reported history of weight loss dieting and weight suppression (calculated discrepancy between highest weight ever and current weight). Interestingly, those who were currently dieting gained 5.0 kg (or 11 lbs) while former dieters gained 2.5 kg (or 5.5 lbs). The sample of those who had never dieted was too small to interpret. Standard measures of disordered eating did not yield significant predictors of weight gain.

Only one study has attempted to prevent weight gain in first year students (Levitsky, Garay, Nausbaum, Neighbors, & Della Valle, 2006). In two studies conducted in the 2002 and 2003 academic years, 34 female first year students were weighed and assigned to either a treatment or control group. Treatment group participants received an analog bathroom scale and were instructed to weigh themselves and email their weight to the researchers every morning for seven days. Then, a Tissue Monitoring System (TMS) algorithm was used to estimate changes in body tissue from the daily weight measures. In the first study, a slope of their change in daily weight was emailed to treatment participants, while the second study provided information about participants' caloric adjustment. Treatment and control participants were weighed by research staff at the end of the first semester. Results from the two studies indicated that the control groups gained significantly more weight (M = 3.1 kg or approximately 6.8 lbs and M = 2.0 kg or approximately 4.4 lbs respectively) than the treatment groups (M = 0.1 kg or approximately 0.22 lbs and M = -0.82 kg or approximately -1.8 lbs). Thus, the intervention effectively helped treatment participants maintain their initial weight; however, the TMS mechanism responsible for weight maintenance is uncertain.

In contrast, Hodge, Jackson, & Sullivan (1993) found no significant weight gain in 61 first year women during a six month period; however, 28% of participants were classified as gaining weight. Weight gain was defined as an increase of at least four pounds (1.8 kg or 4 lbs). The group that gained weight increased by an average of seven pounds (3.2 kg or 7 lbs). Perhaps these results were nonsignificant because the definition of weight gain used was too broad to observe a significant change. Another possible

explanation for the lack of significant findings may be that the sample size was too small to provide the statistical power required to detect a significant change. Additionally, reported results did not include the overall mean weight gain or the percent of individuals who experienced weight change, only those who gained at least four pounds. Students were weighed during their first and sixth month of college, but personal characteristics related to weight gain including body image, self-esteem, locus of control and self-monitoring were evaluated only in the first month. Physical activity and eating behaviors were not examined.

Another study examining the validity of the "freshmen fifteen" phenomenon also failed to find a significant change in weight among first year students; however, they detected an average weight gain of 4.6 pounds (Graham & Jones, 2002). Interestingly, 59% of students gained weight while 36% lost weight. Some limitations of this study are that the sample size was small ($N = 49$), thus restricting power. Further, the sample was from a small liberal arts school with a female population of 80%. No ethnicity data were included. Additionally, this study obtained initial weight data for participants by viewing their medical records from student health, and only measured their weight at the end of the first year. A significant difference may not have been evident because initial weight was not measured directly and the sample may have been so small that statistical power was insufficient.

In sum, although the concept of the "freshman fifteen" is interesting and could provide insight into the epidemic of obesity in the general population, results of previous empirical studies of this phenomenon have yielded conflicting results. This variation may

be due to a number of influences, including small sample sizes, inconsistent definitions of terms, and various approaches to the measurement and definition of weight gain. Furthermore, there is a dearth of studies examining predictors of weight gain in this population. Nonetheless, the college setting does include many characteristics of the "toxic" or obesogenic environment that several authors have suggested are to blame for the current obesity epidemic (e.g. Brownell, 2002; Horgen & Brownell, 2002, 1998). The following section describes these characteristics in greater detail.

Toxic Environment

The "toxic environment" is a term used to describe the preponderance of energy-dense foods of low nutritional value, combined with the increase of sedentary lifestyles which is characteristic of Western society (Brownell, 2002; Horgen & Brownell, 2002, 1998). Characteristics of the toxic environment associated with the increase in obesity rates include eating more meals away from home, snacking, increased portion sizes, decreased activity, and aggressive marketing of high fat, energy dense foods. The college setting is influenced by a number of these factors, and thus, may represent a particularly virulent form of the toxic environment.

Meals away from home. Eating meals away from home is associated with increased energy intake, as well as with overweight and obesity (McCrory et al., 1999; Binkley, Eales, & Jekanowski, 2000; French, Harnack, & Jeffrey, 2000; Clemens, Slawson, & Klesges, 1999). The number of meals U.S. families eat away from home is increasing. Families spent approximately 46% of their food expenditures on food and beverages consumed outside the home; 34% of total food dollars are spent on fast foods

(Putnam et al., 1999). Between 1994–1995, 57% of Americans consumed at least one food item away from home each day, compared to 43% in 1977–1978 (Lin, Guthrie, & Frazao, 1999). The most recent estimates suggest that the trend of eating meals away from home will continue to increase (ERS, US Dept of Agriculture, 2005).

Commercially prepared foods are usually higher in energy and fat than foods prepared at home (Lin, et al., 1999). McCrory (2001) found that the frequency of consuming restaurant food was positively correlated with increased body fatness in adults. In a study of premenopausal women, 56% reported eating outside of the home five times or less during the week, and 44% reported eating out six to thirteen times during the week. Women who ate out more frequently each week reported greater total energy intake. They also consumed a poorer quality diet (Clemens, Slawson, & Klesges, 1999).

Fast food restaurants account for more than half of meals consumed outside of the home (Lin et al., 1999). Fast food is a popular meal choice because it is convenient, tasty, and affordable (Henderson & Brownell, 2004). It is also aggressively marketed (Wadden, Brownell, & Foster, 2002). A three year study of healthy adult women found that those who increased their fast food restaurant intake by one or more meals per week gained 43% more than women who did not increase fast food intake (French, Harnack, & Jeffrey, 2000). Additionally, increased fast food restaurant use was associated with higher total energy intake, percentage energy from fat, and servings of hamburgers, French fries and soft drinks. Increases in fast food frequency were also associated with less frequent vegetable intake and reduced restrained eating. An increase of one fast food meal per week was associated with an increase of 56 kcal/ day, 0.6% in fat energy/day,

and a weight gain of 0.72 kg (1.6 lb) above the average weight gain of 1.68 kg (3.7 lb) over the three year period of the study. Thus, research suggests that regular use of fast food restaurants may contribute to excess weight gain over time. In another study of adults, investigators found that eating in fast food restaurants was associated with the development of insulin resistance, which increases diabetes risk (Pereira et al., 2005).

Approximately 47% of college students live on campus (ACHA, 2005). Residential college students consume the majority of their meals on campus and therefore are eating commercially prepared meals most of the time. In particular, with fast food items available for purchase on a pre-paid meal plan, the college environment could be considered an extreme version of the toxic environment. Findings from the American College Health Association-National College Health Assessment (ACHA-NCHA, ACHA, 2005) indicated that only 6.9% of students ($N = 1,312$) consumed five or more servings of fruits and vegetables daily. Further, among residential students, intake of total fat, saturated fat, and monounsaturated fat was higher than recommended levels (Brevard & Ricketts, 1996). Overall, college students' percentage of energy from fat reportedly ranges from 34% to 36% (Brevard & Ricketts, 1996; Hernon, Skinner, Andrews, & Penfield, 1986), which is higher than recommended. For example, active, healthy people should eat no more than 30% of their total caloric intake from fat, and no more than 10% of their caloric intake from saturated fat each day (Dietary Guidelines for Americans, 2005).

Portion Sizes. Food portion sizes have increased in the marketplace over the last 30 years and now exceed federal dietary guidelines (Young & Nestle, 2002). Serving

sizes initially rose in the 1970s, increased sharply in the 1980s, and have continued to grow in parallel with the increase in overweight and obesity (Young & Nestle, 2002). "Super-sizing" in fast food restaurants has also been linked to weight gain (Jeffrey & French, 1998). Increased portion sizes have been shown to increase food intake (Edelman et al., 1986; Rolls, Morris, & Roe, 2002, 2004; Levitsky et al., 2004; Levitsky & Youn, 2004). Research has found that people eat more food when served larger portions, regardless of actual hunger. Moreover, they do not reduce their food intake after being overfed (Levitsky & Youn, 2004).

For example, Dilberti et al., (2004) conducted an experiment at a restaurant where participants were served 100% or 150% of an entrée. Those who were served the larger portion consumed 43% more energy from the entrée and 25% more energy in the entire meal than those who received the standard portion. When eating away from home, people are offered a large variety of low-cost, energy-dense foods in large portions which encourages overconsumption of energy and may lead to obesity (Rolls, 2003).

Increased portions of sweetened beverages have also been linked to the rise in weight gain and obesity in recent years (Bray, Nielsen & Popkin, 2004; WHO/FAO). The standard soft drink portion size has increased from 6.5 ounces in 1950 to 20 ounces in 2001 (French, Story, & Jeffrey, 2001). Soft drink consumption is increasing and has been identified as a significant contributor to total caloric intake at meals and as a snack (Nielsen & Popkin, 2005). Specifically, from 1977 to 2001, calories from sugar-sweetened beverages increased by 135%, while calories from milk decreased by 35%.

Various studies have shown that humans tend to eat the amount of food they are served (Rolls, 2002, 2004, 2005). An experimental study of a college population produced similar results; the amount of food consumed increased as serving sizes increased (Levitsky & Youn, 2004). All-you-can eat dining halls on college campuses may, thus, encourage overconsumption. This hypothesis is consistent with the finding that weight gain in first year students was associated with use of all-you-can-eat dining facilities (Levitsky et al., 2004; Hovell et al., 1985).

Snacking. Studies suggest that increased energy intake is also associated with the increase in snacking from 1977 to 1996 (Nielsen, Siega-Riz, & Popkin, 2002; Zizza, Siega-Riz, & Popkin, 2001; Hampl, Heaton, & Taylor, 2003). Research has found that when snacks are part of the daily intake, individuals do not alter their consumption at meals (Levitsky, 2004). Increased snacking frequency is associated with higher body weight (Nicklas, 2003) as well as overconsumption of energy in children and adolescents (Dwyer et al., 2003; Zizza, Siega-Riz & Popkin, 2001; Nicklas, 2003). Another study found that obese individuals were more frequent snackers than controls. In addition, women snacked more than men, and snacks were positively related to energy intake, regardless of physical activity (Forsland et al., 2005).

Food selection when snacking is also concerning. Various energy-dense foods including desserts, sweetened beverages and salty snack foods have been associated with snacking in normal weight and obese populations (Zizza, Siega-Riz & Popkin, 2001). Further, palatable, energy-dense foods are associated with reduced satiety (Rolls & Barnett , 2000; Drewnowski, 1998) as well as "passive overconsumption" (Blundell &

MacDiarmid, 1997). Finally, consumption of energy-dense foods, such as potato chips, doughnuts, and sodas, are linked to increases in energy intake (Prentice, 1996). Snack foods tend to be more energy-dense than meals. Thus, the number of snacks consumed each day can make a significant contribution to daily caloric intake.

On the contrary, foods with higher water content, such as fruits and vegetables, create a feeling of fullness that leads to decreased energy intake in that meal and throughout the day (Rolls, Castellanos, & Halford, 1998). However, energy-dense foods provide the most calories at the lowest financial cost (Drewnowski, 2003). Drewnowski & Specter (2004) suggest that the low cost of energy-dense foods may mediate the association between poverty and obesity. Additionally, these authors suggest that the high palatability of sugar and fat reinforces consumption.

Interestingly, Levitsky et al. (2004) found that consumption of high fat junk food, meal frequency, and number of snacks accounted for 47% of weight gain in first year students. Given the association between financial stress and the adjustment to college (Murphy, 1996), low cost, energy dense food may be chosen more frequently by students, and thus contribute to weight gain in the first semester. Further, snacking among college students has been shown to increase during stressful periods (Oliver & Wardle, 1999), which may lead to passive overconsumption or binge eating behaviors.

In a study examining the eating patterns of Asian college students immigrating to the U.S., 73% increased consumption of salty and sweet snack items in U.S. college settings (Pan, Dixon, Himburg, & Huffman, 1999). Additionally, students ate more American-style fast foods when eating away from home and significantly increased

consumption of fats/sweets, dairy products, and fruit; however, they significantly decreased consumption of meat/meat alternatives and vegetables.

Energy consumption has also been found to increase significantly for individuals over age two on weekend days (Friday, Saturday, and Sunday, Haines, Hama, Guilkey, & Popkin, 2003). For all age groups, 82 extra kilocalories (kcal) were consumed on weekend days than on weekdays. The greatest increase (115 kcal/d) was seen among 19- to 50-year-olds on the weekend day compared to a weekday. On weekend days, energy from fat increased by 0.7% and energy from alcohol increased by 1.4%. The investigators point out that 10 kcal of positive energy imbalance per day would result in an increase of an individual's weight by 1 pound over a year. The increase of 115 kcal observed in the 19- to 50-year-old age group each weekend day (Friday through Sunday) over a year would total 17,940 additional kcal (approximately 5 pounds).

Snacking while watching television (TV) is associated with increased overall caloric intake and calories from fat (Gore et al., 2003, Jeffery & French, 1998). The majority of snacking occurs while watching TV (French et al., 2001). Buckworth & Nigg (2004) reported that male college students spend approximately 12.02 hours/week watching TV, while females spend 9.57 hours/week viewing TV. TV commercials for junk food are ubiquitous and may trigger individuals to engage in eating behavior while viewing (Gore et al., 2003; Falciglia & Gussow, 1980). Viewers also tend to eat larger portion sizes while watching TV (Coon, 2001).

Media Advertising. TV advertisements for food products are also associated with the increase in overweight and obesity. Studies have shown that TV advertisements

contribute to increased energy and fat intakes (Jefferey & French, 1998; Wilson & Quigley, 1999). In particular, the marketing of energy-dense foods has contributed to the increased intake of energy and fat (WHO, 2002). For example, Furnham, Abramsky, and Gunter (1997) reported that 37% of the advertisements on TV were for food items; the majority of which were snack foods, followed by breakfast cereals and then fast food outlets. Research suggests that the number of purchase-influencing attempts directed at parents in the grocery store by children age 3 to 11 is positively associated with the number of commercials watched (Galts & White, 1976). In a similar study, children age 2 to 6 were influenced by a 10-30 second exposure to a food advertisement with the effect doubling when the advertisement was shown twice during the same program break (Borzekowski & Robinson, 2001).

Inactivity. Inactivity is also associated with the increase in body weight (Deitz, 1985). Modern technologies such as television, computer, and video game use, have contributed to increases in sedentary lifestyles (Henderson & Brownell, 2004, French, Story, & Jeffrery, 2001). In particular, TV viewing has increased (Nelson Media Research, 2000) and is associated with decreased physical activity (Hu et al., 2001) and measures of obesity (Gortmaker, 1996). A study by Kaur, Choi, Mayo, and Harris (2003) evaluated a sample of 2223 adolescents over a three-year period and found that participants who watched two or more hours of TV per day were twice as likely to be overweight at the three-year follow up. When sedentary activities were examined among college students, computer use was identified for males and television viewing for

females as the strongest negative correlates with exercise and physical activity (Buckworth & Nigg, 2004).

In addition, the availability, advertisement, and sale of automobiles have increased in recent years which may have also contributed to decreased physical activity levels (French, Harnack, & Jeffrey, 2001). Additionally, states that increased the amount of developed land, also known as the "suburban sprawl," showed greater increases in obesity (Vandegrift &Yoked, 2004). In particular, "suburban sprawl" is associated with driving longer distances to supermarkets, work, and to other activities instead of walking.

College students may be particularly vulnerable to weight gain due to decreased physical activity. The sharpest decline in physical activity appears during adolescence (ages 15-18) and young adulthood (ages 20-25, Stephens et al., 1985). A decline in the level of physical activity has been seen from high school to college (Kimm et al., 2000). Although national objectives for physical activity suggest an accumulation of at least 30 minutes of moderate physical activity most days of the week and participation in vigorous physical activity that promotes the development of cardio-respiratory fitness for 20 or more minutes at least three days per week, (Pate et al., 1995; US Dept of Health and Human Services, 1988, 1996, 2000), only 38% of college students participate in regular vigorous activity, and only 20% participate in regular moderate activity. (Lowry et al., 2000; Douglas et al., 1997). In contrast, 65% of high school students report regular vigorous activity, and 26% report regular moderate activity (Grunbaum et al., 2002). Additional declines in physical activity continue for almost half of college students following graduation (Calfas, 1994).

Other Possible Factors Associated with Weight Gain in First Year Students

Disinhibition. The college environment may also promote disinhibited eating, which is the tendency to overeat in the presence of palatable foods or in emotionally distressing situations (Lowe et al., 1988). Higher disinhibition scores on the Three Factor Eating Questionnaire (TFEQ, Stunkard & Messick, 1985) are strongly associated with greater weight gain in adults and higher current BMI (Hays et al., 2002). However, this construct has not been included in studies of the freshman fifteen phenomenon.

Binge eating. The college atmosphere may also encourage binge eating (BE) behaviors. BE is characterized by frequent episodes of eating large quantities of food within a short period of time (2-hour period), and feeling out of control over eating behavior (American Psychiatric Association: *Diagnostic and statistical manual of mental disorders,* Fourth Edition, Text Revision, 2000). Episodes of binge eating are associated with eating rapidly, eating until feeling uncomfortably full, eating when not hungry, eating in secret, and feeling disgusted, depressed and/or guilty after overeating. A study of Virginia Commonwealth University (VCU) undergraduate women found that 13.3% reported moderate or severe binge eating (Mitchell and Mazzeo, 2004). Yet, despite the prevalence of binge eating behaviors in the college population, previous "freshman fifteen" studies have not included this variable.

Night eating. In addition to these factors, college students may be vulnerable to night eating. Night eating is defined as consuming 25% of food in the late evening and at night, morning anorexia, and insomnia associated with either falling or staying asleep (Stunkard et al., 1955, Geliebter, 2002). Marshall et al. (2004) found Night Eating

Syndrome (NES) to occur among obese and average weight individuals, and further posit that NES may contribute to the development of obesity. Although the college environment seems conducive to late night eating, NES has not been assessed in college students.

Body ideals. Body shape ideals may also play a role in weight status among first year students. Body image is a multidimensional construct that encompasses self-perceptions and attitudes regarding one's physical appearance. Variations in body image ideals have been proposed as a possible explanation for some of the differences in rates of obesity across ethnic groups. There is support for a model of body dissatisfaction defined as the discrepancy between current and ideal body image (Williamson et al., 1993). Body image dissatisfaction has been identified as a significant predictor of disordered eating (Jacobi et al., 2004; Killen et al., 1994). Negative body image is associated with depression, social anxiety, impaired sexual functioning, poor self-esteem, and diminished quality of life (Neumark-Sztainer & Haines, 2004). Additionally, Presnell, Bearman, and Stice (2004) found that higher BMI and negative affect, perceived pressure for thinness, and social support deficits predicted body image disturbances among adolescent girls as well as boys.

Sondhaus, Kurtz, and Strube (2001) compared the body image attitudes of college students at the same institution in 1966 and 1996. They found that women were significantly more satisfied with their bodies in 1966 than in 1996. However, no differences were seen in men's body image attitudes between the two time points. While research from the 1980's through the mid 1990's shows that college women reported

increasingly negative evaluations of their appearance and more overweight preoccupation, a recent study indicates that women's psychological investment in their appearance is becoming less pronounced (Cash & Morrow, 2004). Nonetheless, the average body weight has increased (Hedley et al., 2004). The factors mediating this shift are unclear. Although body image has not been assessed in previous studies of the "freshman fifteen" phenomenon, the information may be valuable in understanding shifts in obesity rates.

Thus, the purpose of the present study was to quantify changes in Body Mass Index (BMI) in first year students during their first semester of college and to understand factors associated with weight gain, such as eating behaviors, physical activity, and body shape ideals. It was hypothesized that significant weight gain in first year students would be observed over the first semester. Specifically, it was hypothesized that increases in weight would be associated with night eating, disinhibited eating, binge eating, lower physical activity, number of meals consumed in all-you-can-eat dining facilities, and campus residence. Body discrepancy (BD) scores (i.e. the difference between ideal and current body image) from Time 1 were expected to be significantly different from Time 2 BD scores. In particular, BD was expected to increase more for those whose BMI increased the most over the semester.

Method

Participants

Participants were recruited from introductory psychology courses. Time 1 of the study yielded 212 participants and 155 (73.1%) returned for Time 2 of the study. Participants received one research credit for participation at each time point of the study. Participants were all at least 18 years old and first year students. Those who completed both parts of the study were entered into a drawing to win one of two $50 Visa gift cards.

The final sample included the following ethnic groups: 62.3% White, 18.5% African American, 4.0% Hispanic, 7.9% Asian, and 7.3% other ethnicities; 23.7% male and 76.3% female. Participants' mean age at baseline was 18.13 (*SD* = .56). Mean BMI was 24.35 (*SD* = 4.98).

Measures

International Physical Activity Questionnaire, Long, Last 7 Days, Self-administered Format. (IPAQ-LLF, Appendix A). The purpose of the IPAQ-LLF is to provide data on health–related physical activity that is internationally comparable. Items ask participants to recall their vigorous and moderate activities in the last seven days. Physical activities considered vigorous require hard physical effort and increase breathing rates significantly (e.g. running). Moderate activities require average physical effort and increase breathing somewhat (e.g. bicycling at a regular pace).

The IPAQ-LLQ has acceptable measurement properties (Craig et al., 2003). Spearman's Rho indicated reliable responses with a clustering around 0.8 for all countries, and 0.96 for the United States sample. Reliability was tested within eight days. Criterion validity comparing the physical activity and sitting data from the self-report

IPAQ forms yielded a median rho of 0.33 when compared with an accelerometer worn by subjects for seven consecutive days to measure minutes of moderate, vigorous, walking, and sedentary behaviors. The IPAQ-LLF is recommended for monitoring levels of physical activity levels in various countries for participants between the ages of 18 and 69 (Craig et al., 2003).

Binge Eating Scale (BES, Appendix B). The BES is a 16 item self-report measure used too assess binge eating symptomatology continuously or to screen individuals who may have BED. Participants are asked to select the statement that best describes their eating habits. Sample items include: "I don't have any difficulty eating slowly in the proper manner" and "At times, I tend to eat quickly and then, I feel uncomfortably full afterwards."

The BES discriminates effectively between individuals with no, moderate, and severe binge eating problems (Gormally, Black, Daston, & Rardin, 1982). Gormally et al. (1982) report that the BES yields internally consistent scores (Cronbach's alpha = .85).

Body Rating Scale (BRS, Appendix C). The Body Rating Scale includes nine schematic figures of adolescent females ranging from "1" representing the most underweight figure to "9" representing the most overweight figure. Validity of the measure has been demonstrated among females with correlations between the BRS and other measures of body dissatisfaction (.62), bulimia (.35), drive for thinness (.45), and self-esteem (-.20), Thompson & Altabe, 1990). Moderate to high two-week test-retest reliability has also been found (ideal rating: men [.82], women [.71]; current rating: men [.81], women [.83] (Thompson & Altabe, 1990).

Body Discrepancy (BD) is calculated from response ratings (ranging from 1 to 9) to two items: "Which silhouette is closest to what you look like now?" and "Which silhouette is closest to what you prefer to look like now?" BD scores are derived by subtracting the current body image rating score from the ideal body image rating score (Stunkard, Sorenson, & Schulsinger, 1983). Scores greater than zero indicate that current body image is heavier than ideal body image while scores below zero indicate lighter current than ideal body image. A score of zero indicates that current and ideal body image are equivalent.

Night Eating Questionnaire (NEQ, Appendix D). The NEQ assesses core and associated Night Eating Syndrome (NES) symptoms and has been used in several studies (e.g. Marshall, Allison, O'Reardon, Birketvedt, & Stunkard, 2004; Gluck, M.E., Geliebter, A., & Satov, T., 2001). It is comprised of 14 items and is rated on a scale of 0-4. Previous research has compared the self-administered NEQ to face-to-face interviews and found highly similar results (Marshall, et al., 2004).

Three Factor Eating Questionnaire (TFEQ, Appendix E). This measure is a 51-item, self-report questionnaire with three subscales: cognitive restraint, disinhibition, and susceptibility to hunger (Stunkard & Messick, 1988). The restraint subscale is comprised of 21 items and measures intentions to restrict food intake and actual food intake. Higher scores reflect more restrained eating. Disinhibition is a 16 item subscale which measures the tendency to overeat in the presence of palatable foods or in emotionally distressing situations (Lowe et al., 1988). Higher disinhibition scores (Stunkard & Messick, 1985) are associated with greater weight gain in adults and higher current BMI (Hays et al., 2002). The 14 item hunger subscale assesses subjective feelings of hunger and food

cravings. The developers found content, construct, and criterion-related validity of the TFEQ with all subscales yielding internally consistent scores (Cronbach's alpha = .93, Stunkard & Messick, 1988). A more recent study reported reliability scores for each subscale: cognitive restraint (Cronbach's alpha = .84), disinhibition (Cronbach's alpha = .78), and hunger (Cronbach's alpha = .80, Karlsson, Persson, Sjöström, & Sullivan, 2000).

Eating Behaviors Questionnaire (Appendix F). This measure is a modified version of the one developed by Levitsky et al. (2004) for their study of weight gain in first year students. The questionnaire yielded significant results in their study. It inquires about eating frequency, quantity and type of food consumed, as well as the number of people with whom one consumes meals. It uses a numerical scale ranging from -3 ('much less/often') to +3 ('much more/often').

Demographic Questionnaire (Appendix G) This questionnaire asks participants to report their age, year in school, ethnicity, gender, current living situation, and time spent using media. In addition, participants are asked to report their current height and weight (so that BMI can be calculated) and their lowest and highest weights at their current height.

Procedure

This study used a longitudinal survey design. The study took place at two time points. At Time 1, participants reviewed and signed consent forms. Then, they completed a packet of questionnaires related to eating behaviors and physical activity. The packet ended with the demographic questionnaire. With the exception of the demographic questionnaire, survey presentation was randomized to control for order effects. Next, in a

private area, participants were asked to remove shoes, heavy outer clothing such as coats and heavy sweaters, and objects in pockets. Body weight was assessed to the nearest 0.2 kg using a digital floor scale. Height was measured using a measuring tape. All height and weight measurements at both time points were assessed by the same investigator (Rachel Walker). Completing the weight and height measures and the questionnaires took about 1 hour. One research credit was given for participation in Time 1 of the study.

Time 2 occurred approximately 12 weeks after Time 1. Students were contacted via email with details about Time 2 appointments. Time 2 questionnaire packets contained the same items as in Time 1. Additionally, height and weight were measured in the same manner. Participants received one credit for completion of Time 2.

Participants were assigned identification codes in order to track them over the two time points. Identifying information was collected and stored separately from participant responses in a locked laboratory throughout the study.

Statistical Procedures

Differences between completers (completed Time 1 and 2) and non-completers (completed Time 1 only) were assessed using independent samples t-tests and chi-square analyses. Descriptive statistics, such as means and standard deviations, were used to summarize participants' BMI scores and their scores on all of the continuous measures used in this study.

Paired t-tests were used to compare weight change among first year students at the first and second time points. Two separate multiple regression analyses assessed predictors of weight gain over the first semester. In Model 1, a standard multiple regression analysis was used to examine predictors of weight gain. Based on previous

research (Levistsky et al, 2004), initial body weight was controlled in Model 2 using a hierarchical linear regression. Body discrepancy (BD) was calculated by subtracting the ideal body image rating from the current body image rating. A paired t-test was used to examine the difference between Time 1 and Time 2 BD scores and a Pearson's product moment correlation was used to compare BD scores. Paired t-tests were used on all measures to examine changes from Time 1 to Time 2.

A repeated measures mixed between-within ANOVA was used to explore differences in ethnicity, gender, and residency (i.e. on campus vs off campus) on all measures from Time 1 to Time 2. Also, to examine potential ethnic differences in weight change among freshmen college students, paired t-tests were conducted for the White and African American subsamples. These analyses were not conducted separately for the other ethnicities in the sample due to their relatively low representation in our sample.

Results

Differences between Completers and Non-completers

Differences in baseline scores for participants who completed Time 1 and 2 of the study and those who participated in Time 1 only were assessed using independent samples t-tests. See Table 1 for means and standard deviations for baseline scores for completers and noncompleters. A significant group difference was found for BMI scores at the beginning of the semester ($t_{210} = 2.09$, $p = .04$), such that the individuals who completed the study ($M = 24.35$, $SD = 4.98$) had significantly higher Time 1 BMI scores than the individuals who chose not to participate in Time 2 ($M = 22.85$, $SD = 3.41$). No significant differences were observed on the BES, TFEQ, IPAQ, FRS, NEQ, number of meals consumed in all-you-can-eat dining facilities, or campus residence (all $ps > .05$). The chi-square analysis failed to identify any significant differences between completers and non-completers in ethnicity, gender, or campus residence (all $ps > .05$).

Table 1.

Mean Scores on Time 1 Measures for Completers and Non-completers

Measure	Completers	Non-completers
Body Weight (kg)	68.48	64.12
BMI	24.35	22.85
BES	8.59	8.42
TFEQ-Restraint	8.01	8.94
TFEQ-Disinhibtion	8.4	8.63
TFEQ-Hunger	8.71	8.77
IPAQ	6034.78	5919.14
NEQ	16.74	19.73
BD	-1.08	-0.79

* Denotes significant differences between Completers and Non-completers.
BMI = *Body Mass Index;* BES = *Binge Eating Scale*; TFEQ = *Three-Factor Eating Questionnaire;* IPAQ = *International Physical Activity Questionnaire;* NEQ = *Night Eating Questionnaire*; BD = *Body Discrepancy.*

Weight Change over the First Semester

A significant change in weight was detected between Time 1 and 2 ($t_{155} = -6.66, p = .00$). Weight was higher at Time 2 ($M = 69.72$ kg, $SD = 15.39$ kg or $M = 153.4$ lbs, $SD = 33.9$ lbs) than Time 1 ($M = 68.48$, $SD = 15.27$ or $M = 150.6$ lbs, $SD = 33.6$ lbs). The mean weight gain was 1.24 kg +/- 2.32 (2.7 lbs +/- 5.1 lbs) ranging from -5.7 to 13.9 kg (-12.5 lbs to 30. lbs). From Time 1 to Time 2, 73.1% of participants gained weight, while 21.8% lost weight with weight change defined as an increase or decrease of .23 kg (.5 lb). The definition of weight change (.23 kg) was based on Anderson et al's (2003) study of weight gain in first year students. The average weight increase for those who gained weight was 2.11 kg +/- 1.84 (4.7 lbs). An increase of approximately 5 pounds (2.3 kg) was observed for 25.7% of participants. The percent of participants who gained at least 10 pounds was 6.4%. Both females ($M = 1.35$ kg +/- 2.40) and males ($M = 1.04$ kg +/-

2.01) gained weight; however, there was not a significant difference in the amount of weight each gender gained. Table 2 contains means and standard deviations for weight.

Similarly, a significant difference between BMI scores at Time 1 and Time 2 was found ($t_{155} = -6.07$, $p = .00$), such that participants had higher BMI scores at Time 2 ($M = 24.77$, $SD = 5.05$) than at Time 1 ($M = 24.35$, $SD = 5.00$). The number of participants whose BMI was in the normal range decreased over the semester from 58.3% to 51.3%. The number of participants categorized as overweight increased from 23.1% to 31.4%. The percentage of individuals considered obese remained relatively the same as 12.8% were categorized as obese at the beginning of the semester and 12.2% at the end of the semester. See Table 2 for BMI means and standard deviations.

Table 2.

Mean Scores for Time 1 and Time 2 Measures for the Total Sample

Measure	**Time 1**		**Time 2**	
	Mean	**SD**	**Mean**	**SD**
Body weight	68.48*	15.27	69.72*	15.39
BMI	24.35*	5	24.77*	5.05
Weight Change			1.24	2.32
BES	8.59*	6.27	7.6*	6.31
TFEQ-Restraint	8.01	5.19	8.99	8.97
TFEQ-Disinhibtion	8.4*	3.21	7.94*	3.35
TFEQ-Hunger	8.71	3.44	8.35	3.53
IPAQ	6034.78	6198.15	6384.92	7521.48
NEQ	16.74	4.89	16.35	4.44
BD	-1.08	1.18	-1.15	1.07

* Denotes significant differences between Time 1 and 2.

BMI = *Body Mass Index;* BES = *Binge Eating Scale*; TFEQ = *Three-Factor Eating Questionnaire;* IPAQ = *International Physical Activity Questionnaire;* NEQ = *Night Eating Questionnaire*; BD = *Body Discrepancy.*

Analyses of Weight Gain Models

Full Sample. In regression Model 1, night eating, disinhibited eating, binge eating, lower physical activity, number of meals consumed in all-you-can-eat dining facilities, and campus residence were entered as independent variables. These variables were not associated with weight gain ($F_{6, 131} = 1.65, p = .14, R^2 = .07$). Multicollinearity was not detected among variables (all r values < .70, Tabachnick and Fidell, 2001). Because the overall model was not significant, regression coefficients were not interpreted. See Table 3 for the correlations between the variables, the unstandardized regression coefficients (B), the standardized regression coefficients (β), and R^2 for Model 1.

Table 3.

Multiple Regression of Eating and Exercise Behaviors on Weight Change in the Full Sample.

	Weight Change (DV)	**BES**	**TFEQ -D**	**IPAQ**	**NEQ**	**Buffet**	**Residence**	***B***	**β**	**R^2**
Weight Change (DV)	1	0.12	-0.02	0.07	0.03	0.116	-0.13			
BES		1	0.73	-0.03	0.53	-0.13	0.12	0.11	0.33	
TFEQ-D			1	-0.09	0.42	-0.1	0.06	-0.14	-0.23	
IPAQ				1	-0.17	0.08	0.19	0	0.07	0.07
NEQ					1	-0.13	-0.06	-0.02	-0.04	
Buffet						1	-0.51	0.02	0.06	
Residence							1	-0.7	-0.14	

BES = *Binge Eating Scale*; TFEQ-D = *Three-Factor Eating Questionnaire (Disinhibition subscale);* IPAQ = *International Physical Activity Questionnaire;* NEQ = *Night Eating Questionnaire*; Buffet = *Number of meals at all-you-can-eat dining facility,* Residence = *Participant residence (on- or off-campus).*
*p<.05

The overall regression for Model 2 was also not significant ($F_{1, 140} = .10, p = .76,$ $R^2 = .00$) with initial weight entered at step 1. The second step of the analysis with all

variables included was not significant (F-change $_{6,135}$ = 1.42, p = .21, R^2-change = .06). Therefore, regression coefficients for the model were not interpreted. Table 4 contains the correlations between the variables, the unstandardized regression coefficients (*B*), the standardized regression coefficients (β), the semipartial correlations (sr^2), and R^2 for each step of Model 2.

Table 4.

Hierarchical Regression of Eating and Exercise Behaviors on Weight Change Controlling for Initial Weight in the Full Sample.

	Weight Change (DV)	Initial Weight	Buffet	NEQ	IPAQ	TFEQ-D	BES	*B*	β	sr^2	R^2
Weight Change (DV)	1.00	0.03	0.12	0.02	0.06	0.00	0.13				
Initial Weight		1.00	0.12	0.04	-0.11	0.06	0.04	0.00	0.02	0.00	0.00
Buffet			1.00	-0.13	0.08	-0.08	-0.11	0.03	0.13		
NEQ				1.00	-0.17	0.41	0.52	-0.02	-0.04		
IPAQ					1.00	-0.10	-0.03	0.00	0.04	0.06	0.06
TFEQ-D						1.00	0.74	-0.13	-0.21		
BES							1.00	0.11	0.32		

BES = *Binge Eating Scale*; TFEQ-D = *Three-Factor Eating Questionnaire (Disinhibition subscale);* IPAQ = *International Physical Activity Questionnaire;* NEQ = *Night Eating Questionnaire*; Buffet = *Number of meals at all-you-can-eat dining facility*
*p<.05

Subsample of participants who gained weight. Among individuals who gained weight over the semester regression Model 1 was conducted with night eating, disinhibited eating, binge eating, lower physical activity, number of meals consumed in all-you-can-eat dining facilities, and campus residence entered as independent variables. These variables were not associated with weight gain ($F_{6, 104}$ = .97, p = .45, R^2 = .06). Multicollinearity was not detected among variables (all r values < .70, Tabachnick and

Fidell, 2001). Because the overall model was not significant, regression coefficients were not interpreted. See Table 5 for the correlations between the variables, the unstandardized regression coefficients (*B*), the standardized regression coefficients (β), and R^2 for Model 1 for this subsample.

Table 5.

Multiple Regression of Eating and Exercise Behaviors on Weight Change among participants who gained weight.

	Weight Change (DV)	**Buffet**	**IPAQ**	**TFEQ-D**	**BES**	**NEQ**	**Residence**	***B***	**β**	**R^2**
Weight Change (DV)	1.00	0.18	-0.12	0.02	0.04	0.01	-0.13			
Buffet		1.00	0.11	-0.17	-0.18	-0.23	-0.46	0.04	0.19	
IPAQ			1.00	-0.14	-0.07	-0.19	0.23	0.00	-0.13	
TFEQ-D				1.00	0.73	0.46	0.07	-0.01	-0.03	.06
BES					1.00	0.55	0.17	0.02	0.1	
NEQ						1.00	-0.03	-0.01	-0.02	
Residence							1.00	-0.12	-0.03	

BES = *Binge Eating Scale*; TFEQ-D = *Three-Factor Eating Questionnaire (Disinhibition subscale);* IPAQ = *International Physical Activity Questionnaire;* NEQ = *Night Eating Questionnaire*; Buffet = *Number of meals at all-you-can-eat dining facility,* Residence = *Participant residence (on- or off-campus).*
*p<.05

In Model 2, initial weight was entered in the first step and was statistically significant ($F_{1, 103} = 4.81$, $p = .03$, $R^2 = .05$). The second step of the analysis, with all variables included, was not significant (F-change $_{6,97} = 0.75$, $p = .61$, R^2-change = .04). Therefore, regression coefficients for the model were not interpreted. Table 6 contains the correlations between the variables, the unstandardized regression coefficients (*B*), the standardized regression coefficients (β), the semipartial correlations (sr^2), and R^2 for each step of Model 2.

Table 6.

Hierarchical Regression of Eating and Exercise Behaviors on Weight Change Controlling for Initial Weight among participants who gained weight.

	Weight Change (DV)	Initial Weight	Buffet	IPAQ	TFEQ-D	BES	NEQ	Residence	*B*	β	sr^2	R^2
Weight Change (DV)	1.00	0.21	0.18	-0.12	0.02	0.04	0.01	-0.13				
Initial Weight		1.00	0.12	-0.13	-0.04	0.02	0.03	0.02	0.02	0.18	0.05	0.05*
Buffet			1.00	0.11	-0.17	-0.18	-0.23	-0.46	0.03	0.15		
IPAQ				1.00	-0.14	-0.07	-0.19	0.23	0	-0.09		
TFEQ-D					1.00	0.73	0.46	0.07	0	0		
BES						1.00	0.55	0.17	0.02	0.09	0.04	0.09
NEQ							1.00	-0.03	-0.01	-0.03		
Residence								1.00	-0.24	-0.06		

BES = *Binge Eating Scale*; TFEQ-D = *Three-Factor Eating Questionnaire (Disinhibition subscale);* IPAQ = *International Physical Activity Questionnaire;* NEQ = *Night Eating Questionnaire*; Buffet = *Number of meals at all-you-can-eat dining facility,* Residence = *Participant residence (on- or off-campus).*
*p<.05

Changes in Body Discrepancy (BD) scores from Time 1 to Time 2.

A paired t-test did not reveal a significant difference between Time 1 and Time 2 BD scores. A Pearson's product moment correlation was used to compare BD scores with weight change and revealed a small, significant negative relationship between the two variables (r = -.194, n=149, p = .02), with increased weight gain associated with larger negative BD scores which indicates a desire to be smaller than one's current size.

Analyses of Factors Associated with Weight Gain in First Year Students

A paired t-test revealed a significant change in disinhibition scores ($t_{148} = 2.15$, $p = .03$) with lower scores at Time 2 ($M = 7.94$, $SD = 3.35$) than at Time 1 ($M = 8.40$, $SD = 3.21$). Lower scores indicate less disinhibited eating behaviors. Similarly, BES scores

were significantly lower ($t_{139} = 2.68, p = .01$) at Time 2 ($M = 7.60$, $SD = 6.31$) than at Time 1($M = 8.59$, $SD = 6.27$) of the study. Lower BES scores indicate less binge eating behaviors. Further, the number of days per week of vigorous physical activity significantly decreased ($t_{155} = 2.21, p = .03$) from Time 1 ($M = 1.67$, $SD = 1.98$) to Time 2 ($M = 1.35$, $SD = 1.78$).

Paired t-tests were used to assess changes in the Eating Behavior Questionnaire from Time 1 to Time 2 among all participants. Number of snacks before dinner significantly decreased ($t_{154} = 1.94, p = .05$) from Time 1 ($M = 1.39$, $SD = 0.85$) to Time 2 ($M = 1.25$, $SD = 0.84$). The average size of snacks consumed before dinner significantly decreased ($t_{152} = 3.18, p = .00$) from Time 1 ($M = 1.28$, $SD = 0.68$) to Time 2 ($M = 1.09$, $SD = 0.62$). A significant increase ($t_{149} = -2.44, p = .02$) in the number of times per week participants ate breakfast in all-you-can-eat dining facilities from Time 1 ($M = 0.95$, $SD = 0.14$) to Time 2 ($M = 1.25$, $SD = 0.15$). The number of times per week participants at lunch at a place other than their room, on campus, or at a restaurant (e.g. vending machine) significantly increased ($t_{142} = -2.89, p = .00$) from Time 1 ($M = 0.09$, $SD = 0.46$) to Time 2 ($M = 0.37$, $SD = 1.02$). The average size of participants' lunch significantly decreased ($t_{154} = 2.43, p = .02$) from Time 1 ($M = 2.03$, $SD = 0.57$) to Time 2 ($M = 1.90$, $SD = 0.62$). The number of people that participants ate lunch with decreased significantly ($t_{132} = 2.34, p = .02$) from the beginning ($M = 2.28$, $SD = 1.75$) to the end ($M = 1.97$, $SD = 1.69$) of the semester. The number of times per week participants ate at a fast food restaurant decreased significantly ($t_{145} = 2.83, p = .01$) from Time 1 ($M = 0.87$, $SD = 1.18$) to Time 2 ($M = 0.60$, $SD = 0.87$).

A repeated measures mixed between-within ANOVA was used to explore differences in ethnicity, gender, and residency on all measures from Time 1 to Time 2. No significant changes were observed from Time 1 to Time 2 for the various ethnic, gender, or residence categories (all *p*s >.05) on study measures.

Within the White Subsample. Because of potential ethnic differences in weight change in the current study, separate analyses were conducted for the white subsample (see Table 7 for means and standard deviations for this subsample). A paired samples t-test revealed a significant increase in weight from Time 1 to Time 2 of the study (t_{93} = -4.83, p = .00) such that weight in kilograms at Time 2 (M = 70.11, SD = 13.82) was higher than at Time 1 (M = 68.86, SD = 14.07). Similarly, BMI increased from Time 1 to Time 2 of the study (t_{93} = -4.76, p = .00) such that BMI at Time 2 (M = 24.11, SD = 3.88) was greater than at Time 1 (M = 23.67, SD = 3.87). A significant difference was found for Binge Eating scores (t_{85} = 2.65, p =.01) with scores decreasing from Time 1 (M = 9.05, SD = 6.63) to Time 2 (M = 7.87, SD = 6.50), indicating less binge eating behaviors. Night Eating also significantly decreased (t_{91} = 2.28, p =.03) from Time 1 (M = 16.9, SD = 4.93) to Time 2 (M = 15.98, SD = 4.29). Number of days of vigorous exercise decreased significantly (t_{94} = 3.20, p =.00) from Time 1 (M =1.87, SD = 1.95) to Time 2 (M = 1.30, SD = 1.70). Significant changes in Disinhibition scores were not found for the White subsample (t_{87} = 1.90, p = .06).

Table 7.

Mean Scores for Time 1 and Time 2 Measures for the White Subsample

Measure	**Time 1**		**Time 2**	
	Mean	SD	Mean	SD
Body weight (kg)	68.86*	14.07	70.11*	13.82
BMI	23.67*	3.87	24.11*	3.88
Weight change			1.25*	2.52
BES	9.05*	6.63	7.87*	6.5
TFEQ-Restraint	8.2	5.54	8.65	5.63
TFEQ-Disinhibtion	8.8	3.43	8.31	3.52
TFEQ-Hunger	8.86	3.54	8.54	3.87
IPAQ	5595.24	5485.13	5949.98	5534.76
NEQ	16.9*	4.93	15.98*	4.29
BD	-1.07	1.13	-1.09	0.99
Days Vig PA	-1.07*	1.13	-1.09*	0.99
Days Mod PA				

* Denotes significant differences between Time 1 and 2.

BMI = *Body Mass Index;* BES = *Binge Eating Scale*; TFEQ-D = *Three-Factor Eating Questionnaire;* IPAQ = *International Physical Activity Questionnaire;* NEQ = *Night Eating Questionnaire*; Buffet = *Number of meals at all-you-can-eat dining facility;* Days Vig PA = *Days of Vigorous Physical Activity;* Days Mod PA = *Days of Moderate Physical Activity*

Within the African American Subsample. Significant weight gain was also detected in the African American subsample (t_{27} = -3.55, p =.00), with higher weights at Time 2 (M = 71.20, SD = 17.86) than at Time 1 (M = 69.76, SD = 17.02). BMI also increased significantly (t_{28} = -2.73, p =.01) from Time 1(M = 26.04, SD = 6.41) to Time 2 (M = 26.47, SD = 6.6). Paired t-tests revealed significant changes across the semester for Disinhibition (t_{26} = 2.59, p =.02) such that scores decreased from Time 1 (M = 8.00, SD = 3.08) to Time 2 (M = 6.67, SD = 2.88), indicating less disinhibited eating behaviors at Time 2. Binge Eating scores also decreased significantly (t_{23} = 2.04, p =.05) from Time 1

($M = 6.92$, $SD = 5.40$) to Time 2 ($M = 5.42$, $SD = 5.22$). Further, the number of days per week of moderate physical activity significantly increased ($t_{27} = 2.26$, $p = .03$) from Time 1 ($M = 0.07$, $SD = 0.26$) to Time 2 ($M = 0.75$, $SD = 1.62$). Table 8 contains the means and standard deviations for this subsample.

Table 8.

Mean Scores for Time 1 and Time 2 Measures for the African American Subsample

Measure	**Time 1**		**Time 2**	
	Mean	**SD**	**Mean**	**SD**
Body weight (kg)	69.76*	17.02	71.2*	17.86
BMI	26.04*	6.41	26.47*	6.6
Weight change			1.44*	2.15
BES	6.92*	5.4	5.42*	5.22
TFEQ-Restraint	6.33	4.6	6.85	5.13
TFEQ-Disinhibtion	8.0*	3.08	6.67*	2.88
TFEQ-Hunger	8.5	3.31	8.31	2.77
IPAQ	5469.18	5340.94	5618.11	6743.15
NEQ	16.64	5.47	15.96	5.03
BD	-0.85	1.31	-0.96	1.11
Days Vig PA	1.32	2.02	1.18	1.61
Days Mod PA	.07*	.26	.75*	1.62

* Denotes significant differences between Time 1 and Time 2.

BMI = *Body Mass Index;* BES = *Binge Eating Scale*; TFEQ-D = *Three-Factor Eating Questionnaire;* IPAQ = *International Physical Activity Questionnaire;* NEQ = *Night Eating Questionnaire*; Buffet = *Number of meals at all-you-can-eat dining facility;* Days Vig PA = *Days of Vigorous Physical Activity;* Days Mod PA = *Days of Moderate Physical Activity*

Discussion

The findings of the current study indicated that first year students gained a statistically significant amount of weight in their first three months of college. These results are consistent with previous findings of weight gain in first year students (Levitsky et al., 2004; Anderson et al., 2003; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005; Butler, Black, & Gretebeck, 2004). In particular, the average increase in weight (M = 1.24 kg, 2.7 lbs) was similar to that reported by Levitsky et al. (M = 1.9kg; 2004). In addition, the current study found that 25.7% gained at least 2.3 kg (approximately 5 lbs). This is similar to Anderson et al.'s (2003) finding that 25% of first year students gained at least 2.3 kg. Other studies found similar weight gain in first year students ranging from 2.09 kg to 3.2 kg (Racette et al., 2005; Hodge, Jackson, & Sullivan, 1993; Graham & Jones, 2002).

Participants in the current study experienced an average weight gain of 103.3g/week (.23 lbs/week), a rate much greater than that observed in the general population. For example, in an analysis of the literature on weight gain studies, Levitsky et al. (2004) reported a central tendency of 8g/week increase in weight in adults and 15g/week increase among 17-18 year olds in the general population; rates considered extremely problematic. Thus, the current study validates the belief that first year college students may be particularly vulnerable to weight gain. However, it also challenges the belief that first year students gain 15 pounds as very few participants gained this much weight.

Further, the number of individuals classified as overweight increased by 36% (from n = 36 to n = 49) in the three months of the study. These findings support previous

studies' claims that rates of obesity have increased most rapidly among individuals ages 18 to 29 and among those with some college education (Mokdad et al., 1999; Mokdad, Ford, Bowman, Dietz, Vincor, Bales, et al., 2003). Interestingly, the mean BMI (24.35) at the beginning of the first semester was borderline overweight (BMI >25). Thus, it appears that a relatively small increase in weight (e.g. $M = 1.24$ kg) can alter an individuals BMI status to overweight which, in turn, increases the associated health risks. For example, a study of college students reported that being overweight increased the risk for developing at least one component of the metabolic syndrome, such as abnormal waist circumference, impaired fasting glucose, impaired glucose tolerance, impaired fasting insulin, hypertriacylglycerolemia, low HDL cholesterol, and high blood pressure (Huang, Kempf, Strother, Li, Lee, et al., 2004). Metabolic syndrome is a cluster of metabolic dysfunctions that increase risk for cardiovascular disease and type 2 diabetes. Furthermore, a recent study of women showed that even modest increases in weight between first and second pregnancies was associated with an increased risk of several adverse outcomes including gestational diabetes, gestational hypertension, and stillbirth (Villamor and Cnattingius, 2006). Women did not have to be overweight for increased weight to be associated with elevated risk. Increased BMI also elevates the risk for several other diseases (Calle, 1999). Thus, current results underscore the need to identify risk factors for weight gain and develop interventions to prevent the increase in overweight status in first year college students.

Unfortunately, the regression models for the full sample and subsample of participants who gained weight failed to explain the variance in weight gain among first year students. One explanation is that the measures used were not sensitive enough to

detect changes within this population. In particular, the IPAQ included items about physical activity at work which were not relevant to this population. Items inquiring about physical activity related to college campus lifestyle may have been more sensitive. In addition, the NEQ was intended to detect night eating syndrome, but may not have been a good measure for this population as late night snacking behaviors are anecdotally associated with college students. NES is not equivalent to late night snacking (Vander Waller, Klurfeld, McBurney, & Dhurandhar, 2005). There is also the possibility that participants over reported their exercise and under reported disordered eating behaviors. Finally, the independent variables were weakly associated (all r's $< .3$, Tabachnick and Fidell, 2001) with the dependent variable (weight change). Thus, the predictor measures may not have been sufficient representations of weight change in this population. Of note, in the subsample of participants who gained weight, initial weight was a significant predictor of weight gain by itself; however when the other predictors were included, the model was no longer significant. This finding suggests that initial weight may be a useful means for identifying at risk individuals to target with prevention efforts.

Previous findings (Levitsky et al., 2005) found that eating in all-you-can-eat dining facilities predicted increased weight during the first semester of college. Although frequency of eating in these facilities was not predictive of weight gain in the current study, increases in the number of times per week participants ate breakfast in all-you-can-eat dining facilities was observed. Additionally, a decrease in the size of participants' lunch was observed while vending machine and snack food consumption increased for lunch. Snack foods tend to be more energy-dense than meals and consumption of energy-dense foods is related to increases in energy intake (Prentice, 1996). Thus, it is possible

that a larger breakfast in the all-you-can-eat dining facility decreased hunger and led to a desire for a smaller lunch in participants. Instead of choosing a healthy small meal, students seem to have selected snack food items which were more energy dense. Since increased snack consumption is associated with higher body weight (Nicklas, 2003), this combination of eating behaviors may play a role in the increased weight observed in this population.

An unexpected finding was the significant decrease in disinhibited and binge eating scores for the total sample. I expected the opposite to occur as disinhibition (Stunkard & Messick, 1985) and binge eating (de Zwaan et al., 1994) have been linked to increases in BMI and obesity respectively. The current finding may suggest that students do not perceive themselves as overeating in the presence of palatable foods. For example, students may become accustomed to eating an abundance of energy dense foods in all-you-can-eat dining facilities and, thus, do not realize what they are eating is considered an unusually large amount of food. Another explanation could be that the Time 1 data was collected two weeks after classes began, and as a result, may be reflective of students who were already engaging in the college lifestyle, rather than reflective of their pre-college behaviors. Based on Levitsky et al.'s (2004) findings that recent dieting was associated with weight gain in first year students, the current study's findings of decreased disinhibition and binge eating could be evidence of compensatory attempts for perceived weight gain. Thus, it is difficult to interpret the changes over the course of the semester in disinhibition, binge eating, and other behaviors. Future research in this area should collect data prior to students arriving to campus in order to detect changes caused by the college environment. Interestingly, the white subsample did not show significant

decreases in disinhibition over the semester. However, the white subsample demonstrated significant decreases in NEQ scores from Time 1 to Time 2. This change was not seen in the whole sample or the African American subsample. Further examination of ethnic differences in disinhibition, night eating, and its role in weight gain is also necessary to enhance understanding of the association between ethnicity and weight gain.

While there was not a significant change in body image discrepancy over the semester, there was a relationship between increased weight and a desire to be smaller than one's current size. These results indicate that participants who gained weight had greater body image dissatisfaction than those who did not gain weight. Body image dissatisfaction has been found to significantly predict disordered eating behaviors (Jacobi et al., 2004; Killen et al., 1994). Studies also show that negative body image is linked to depression, social anxiety, impaired sexual functioning, poor self-esteem, and diminished quality of life (Neumark-Sztainer & Haines, 2004). Thus, these findings further support the need for additional investigation of the role of weight gain in body image changes, as well as interventions with first year students. In particular, the interventions should include a psychoeducational component about body image dissatisfaction and weight concerns in addition to promoting healthy eating and exercise behaviors.

The number of days each week that students engaged in vigorous physical activity decreased over the semester. Furthermore, the frequency and duration of moderate and vigorous physical activity reported in this study did not meet national recommendations (Pate et al., 1995; US Dept of Health and Human Services, 1988, 1996, 2000). Physical inactivity is associated with increased mortality (Myers et al, 2002) and several degenerative diseases, including heart disease, cancer, stroke, diabetes, and hypertension

(Lee, Rexrode, Cook, Manson, Buring, 2001). Further, individuals who are physically active have less body fat and more lean muscle mass than sedentary individuals at the same weight (Kyle et al., 2001). Thus, decreased physical activity may help explain the increase in weight observed in this population.

Ethnic disparities were not detected in the entire sample; however, when White and African American subsamples were evaluated independently, slight differences were detected. African Americans experienced the greatest increase in weight (1.44 kg). In addition, the number of African Americans classified as overweight increased at a higher rate (40%) than the entire sample (36%) or the White subsample (26%). This finding is consistent with research indicating that African Americans have elevated risk and prevalence of obesity (Flegal et al., 2002). Nonetheless, it should be noted that the African American subsample (n=28) was much smaller than the White subsample (n=94). Thus, these findings should be replicated with a larger sample of African Americans.

Another interesting finding was that the White subsample reported similar decreased vigorous exercise as the whole sample, but this was not seen in the African American subsample. Initial vigorous and moderate physical activity scores were lower for this subsample than the entire sample, but this group was the only one to show significant increases in moderate activity. Nonetheless, both subsamples remained below the national recommendations.

There are several limitations to this study. Results may not generalize well to non-college populations as college students represent a unique portion of the population. However, based on previous research, this study posits that the college environment is an

extreme version of the toxic environment in the U.S. and thus, the findings may still have implications for the larger obesity epidemic. A second limitation is that the sample sizes were not sufficiently representative of various ethnic groups. Therefore, results of this study may not apply to ethnically diverse groups. Additionally, sampling may have been biased by attracting certain students while deterring others. For example, there were baseline differences in weight such that those who completed the study had higher weight than those who did not return for Time 1 of the study. A possible explanation for this is that students who were more concerned about their weight status may not have completed the study.

Also, Time 2 data collection occurred a week after Thanksgiving, which may be a confounding variable. It is unlikely, however, that a significant weight gain occurred over Thanksgiving break. Further, because Time 2 occurred the last week of the semester, lower attendance at this time point may be because participants had already fulfilled their research requirements for the semester. Another issue is that this study could not include measures of alcohol consumption; a factor that may be associated with weight gain. The Internal Review Board (IRB) would not permit this study to inquire about alcohol consumption in this population because they were not of legal age and their identity could be connected to this information. Thus, the increase in weight could be explained by increased alcohol consumption.

More research is needed to understand factors influencing weight gain in first year college students. Future research should consider measuring participant behaviors during senior year of high school and the summer prior to college. Also, applying multiple measurements throughout the first semester and follow-up at the end of the first year

would be useful. In addition, use of more sensitive measures of eating behaviors, such as dietary recall, and physical activity, such as Personal Digital Assistant (PDA) records or text messaging of physical activity would further clarify factors related to weight gain. Assessing for family history of overweight and obesity could also provide valuable information. For example, are individuals with family histories of obesity more vulnerable to weight gain during the transition to college?

Finally, results of this study underscore the need for future research on the prevention of weight gain. In particular, interventions targeting first year students as they transition to college are important; however, only one study has focused on prevention in this population (Levitsky et al., 2006). Interventions should focus on healthy lifestyle behaviors such as choosing balanced, nutritional meals and snacks in all-you-can-eat dining facilities. Additionally, encouraging physical activity and demonstrating the role of physical activity in energy balance will be valuable. Further, inclusion of an eating disorder prevention component would be important considering the prevalence of eating disorder symptomatology (Mintz and Betz, 1988) in this population as well as the association between increased weight and lower body image satisfaction. It may be particularly important to target interventions to individuals in the upper range of normal weight who may be at greater risk for becoming overweight in the first semester of college.

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Appendix A

International Physical Activity Questionnaire, Long, Last 7 Days, Self-administered Format. (IPAQ-LLF)

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** and **moderate** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

TIME 1: JOB-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1. Do you currently have a job or do any unpaid work outside your home?

   ☐ Yes

   ☐ No → ***Skip to TIME 2: TRANSPORTATION***

The next questions are about all the physical activity you did in the **last 7 days** as part of your paid or unpaid work. This does not include traveling to and from work.

2. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, heavy construction, or climbing up stairs **as part of your work**? Think about only those physical activities that you did for at least 10 minutes at a time.

   _____ **days per week**

   ☐ No vigorous job-related physical activity → ***Skip to question 4***

3. How much time did you usually spend on one of those days doing **vigorous** physical activities as part of your work?

   _____ **hours per day**
   _____ **minutes per day**

4. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads **as part of your work**? Please do not include walking.

_____ **days per week**

☐ No moderate job-related physical activity → ***Skip to question 6***

5. How much time did you usually spend on one of those days doing **moderate** physical activities as part of your work?

_____ **hours per day**
_____ **minutes per day**

6. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **as part of your work**? Please do not count any walking you did to travel to or from work.

_____ **days per week**

☐ No job-related walking → ***Skip to TIME 2: TRANSPORTATION***

7. How much time did you usually spend on one of those days **walking** as part of your work?

_____ **hours per day**
_____ **minutes per day**

TIME 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you traveled from place to place, including to places like work, stores, movies, and so on.

8. During the **last 7 days**, on how many days did you **travel in a motor vehicle** like a train, bus, car, or tram?

_____ **days per week**

☐ No traveling in a motor vehicle → ***Skip to question 10***

9. How much time did you usually spend on one of those days **traveling** in a train, bus, car, tram, or other kind of motor vehicle?

_____ **hours per day**
_____ **minutes per day**

Now think only about the **bicycling** and **walking** you might have done to travel to and from work, to do errands, or to go from place to place.

10. During the **last 7 days**, on how many days did you **bicycle** for at least 10 minutes at a time to go **from place to place**?

_____ **days per week**

☐ No bicycling from place to place → ***Skip to question 12***

11. How much time did you usually spend on one of those days to **bicycle** from place to place?

_____ **hours per day**
_____ **minutes per day**

12. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time to go **from place to place**?

_____ **days per week**

☐ No walking from place to place → ***Skip to PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY***

13. How much time did you usually spend on one of those days **walking** from place to place?

_____ **hours per day**
_____ **minutes per day**

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the **last 7 days** in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

14. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, chopping wood, shoveling snow, or digging **in the garden or yard**?

_____ **days per week**

☐ No vigorous activity in garden or yard → ***Skip to question 16***

15. How much time did you usually spend on one of those days doing **vigorous** physical activities in the garden or yard?

_____ **hours per day**
_____ **minutes per day**

16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, sweeping, washing windows, and raking **in the garden or yard**?

_____ **days per week**

☐ No moderate activity in garden or yard → ***Skip to question 18***

17. How much time did you usually spend on one of those days doing **moderate** physical activities in the garden or yard?

_____ **hours per day**
_____ **minutes per day**

18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, washing windows, scrubbing floors and sweeping **inside your home**?

_____ **days per week**

☐ No moderate activity inside home → ***Skip to PART 4: RECREATION, SPORT AND LEISURE-TIME PHYSICAL ACTIVITY***

19. How much time did you usually spend on one of those days doing **moderate** physical activities inside your home?

_____ **hours per day**
_____ **minutes per day**

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the **last 7 days** solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20. Not counting any walking you have already mentioned, during the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **in your leisure time**?

_____ **days per week**

☐ No walking in leisure time → ***Skip to question 22***

21. How much time did you usually spend on one of those days **walking** in your leisure time?

_____ **hours per day**
_____ **minutes per day**

22. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like aerobics, running, fast bicycling, or fast swimming **in your leisure time**?

_____ **days per week**

☐ No vigorous activity in leisure time → ***Skip to question 24***

23. How much time did you usually spend on one of those days doing **vigorous** physical activities in your leisure time?

_____ **hours per day**
_____ **minutes per day**

24. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis **in your leisure time**?

_____ **days per week**

☐ No moderate activity in leisure time → ***Skip to PART 5: TIME SPENT SITTING***

25. How much time did you usually spend on one of those days doing **moderate** physical activities in your leisure time?
_____ **hours per day**
_____ **minutes per day**

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk,

visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

26. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekday**?

_____ **hours per day**
_____ **minutes per day**

27. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekend day**?

_____ **hours per day**
_____ **minutes per day**

Appendix B

Binge Eating Scale (BES)

Instructions: Below are groups of lettered statements. Read all of the statements in each group and CIRCLE the letter of the statement that best describes the way you feel about your eating habits.

1. A. I don't feel self-conscious about my weight or body when I'm with others.
   B. I feel concerned about how I look to others, but it normally does not make me feel disappointed with myself.
   C. I do get self-conscious about my appearance and weight which makes me feel disappointed in myself.
   D. I feel very self-conscious about my weight and frequently, I feel intense shame and disgust for myself. I try to avoid social contacts because of my self-consciousness.

---

2. A. I don't have any difficulty eating slowly in the proper manner.
   B. Although I seem to "gobble down" foods, I don't end up feeling stuffed because of eating too much.
   C. At times, I tend to eat quickly and then, I feel uncomfortably full afterwards.
   D. I have the habit of bolting down my food, without really chewing it. When this happens I usually feel uncomfortably stuffed because I've eaten too much.

---

3. A. I feel capable to control my eating urges when I want to.
   B. I feel like I have failed to control my eating more than the average person.
   C. I feel utterly helpless when it comes to feeling in control of my eating habits.
   D. Because I feel so helpless about controlling my eating I have become very despondent about trying to get in control.

---

4. A. I don't have the habit of eating when I'm bored.

   B. I sometimes eat when I'm bored, but often I'm able to "get busy" and get my mind off food.
   C. I have a regular habit of eating when I'm bored, but occasionally, I can use some other activity to get my mind off eating.
   D. I have a strong habit of eating when I'm bored. Nothing seems to help me break the habit.

5. A. I'm usually physically hungry when I eat something.

   B. Occasionally, I eat something on impulse even though I really am not hungry.
   C. I have the regular habit of eating foods, that I might not really enjoy, to satisfy a hungry feeling even though physically, I don't need the food.
   D. Even though I'm not physically hungry, I get a hungry feeling in my mouth that only seems to be satisfied when I eat a food, like a sandwich, that fills my mouth. Sometimes, when I eat the food to satisfy my mouth hunger, I then spit the food out so I won't gain weight.

6. A. I don't feel any guilt or self-hate after I overeat.

   B. After I overeat, I feel guilt or self-hate.
   C. Almost all the time I experience strong guilt or self-hate after I overeat.

7. A. I don't lose total control of my eating when dieting even after periods when I overeat.

   B. Sometimes when I eat a "forbidden food" on a diet, I feel like I "blew it" and eat even more.
   C. Frequently, I have the habit of saying to myself, "I've blown it now, why not go all the way" when I overeat on a diet. When that happens, I eat even more.
   D. I have a regular habit of starting strict diets for myself, but I break the diets by going on an eating binge. My life seems to be either a "feast" or "famine."

8. A. I rarely eat so much food that I feel uncomfortably stuffed afterwards.

   B. Usually about once a month, I eat such a quantity of food, I end up feeling very stuffed.
   C. I have regular periods during the month when I eat large amounts of food, either as mealtime or at snacks.
   D. I eat so much food that I regularly feel quite uncomfortable after eating and sometimes a bit nauseous.

9. A. My level of calorie intake does not go up very high or go down very low on a regular basis.

   B. Sometimes after I overeat, I will try to reduce my calorie intake to almost nothing to compensate for the excess calories I've eaten.
   C. I have a regular habit of overeating during the night. It seems that my routine is not to be hungry in the morning but overeat in the evening.
   D. In my adult years, I have had week-long periods where I practically starve myself. This follows periods when I overeat. It seems I live a life of either "feast or famine."

10. A. I usually am able to stop eating when I want to. I know when "enough is enough."

    B. Every so often, I experience a compulsion to eat which I can't seem to control.
    C. Frequently, I experience strong urges to eat which I seem unable to control, but at other times I can control my eating urges.
    D. I feel incapable of controlling urges to eat. I have a fear of not being able to stop eating voluntarily.

11. A. I don't have any problems stopping eating when I feel full.

    B. I usually can stop eating when I feel full but occasionally overeat, leaving me feeling uncomfortably stuffed.
    C. I have a problem stopping eating once I start and usually I feel uncomfortably stuffed after I eat a meal.
    D. Because I have a problem not being able to stop eating when I want, I sometimes have to induce vomiting to relieve my stuffed feeling.

12. A. I seem to eat just as much when I'm with others (family, social gatherings), as when I'm by myself.

    B. Sometimes, when I'm with other persons, I don't east as much as I want to eat because I'm self-conscious about my eating.
    C. Frequently, I eat only a small amount of food when others are present, because I'm very embarrassed about my eating.
    D. I feel so ashamed about overeating that I pick times to overeat when I know no one will see me. I feel like a "closet eater."

13. A. I eat three meals a day with only an occasional between meals snack.

    B. I eat three meals a day, but I also normally snack between meals.
    C. When I am snacking heavily, I get in the habit of skipping regular meals.
    D. There are regular periods when I seem to be continuously eating, with no planned meals.

14. A. I don't think much about trying to control unwanted urges.

    B. At least some of the time, I feel my thoughts are pre-occupied with trying to control my urges.
    C. I feel that frequently I spend much time thinking about how much I ate or about trying not to eat anymore.
    D. It seems to me that most of my waking hours are pre-occupied by thoughts about eating or not eating. I feel like I'm constantly struggling not to eat.

15. A. I don't think about food a great deal.

    B. I have strong cravings for food but they last only for brief periods of time.
    C. I have days when I can't seem to think about anything else but food.
    D. Most of my days seem to be pre-occupied with thoughts about food. I feel like I live to eat.

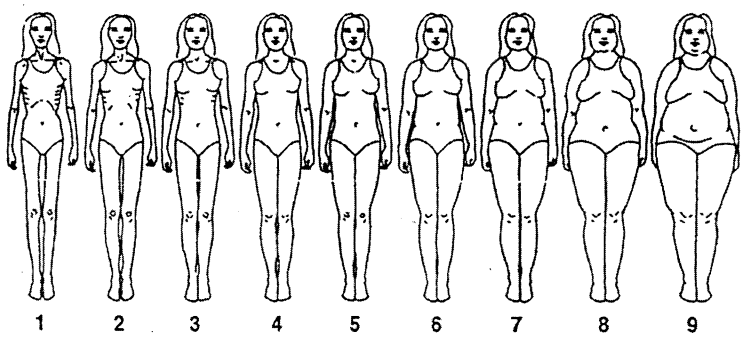
16. A. I usually know whether or not I'm physically hungry. I take the right portion of food to satisfy me.

B. Occasionally, I feel uncertain about knowing whether or not I'm physically hungry. At these times it's hard to know how much food I should take to satisfy me.
C. Even though I might know how many calories I should eat, I don't have any idea what is a "normal" amount of food for me.

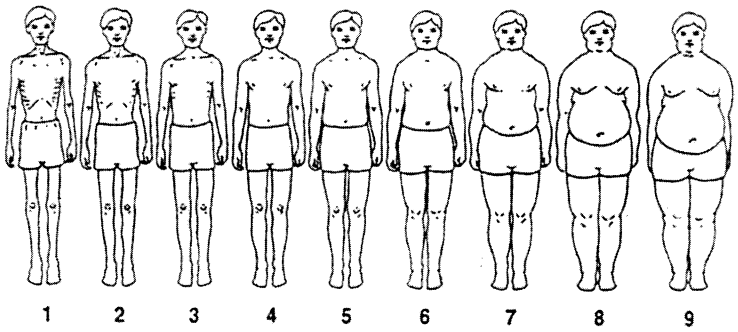
Appendix C

Body Rating Scale (BRS)

Females, please use this diagram to answer questions 1 and 2.



Males, please use this diagram to answer questions 1 and 2.



1. Which silhouette is closest to what you look like now?

   Silhouette number _____

2. Which silhouette would you prefer to look like now?

   Silhouette number _____

Appendix D

Night Eating Questionnaire (NEQ)

Directions: Please circle ONE answer for each question.

1. **How hungry are you usually in the morning?**

0	1	2	3	4
Not at all	A little	Somewhat	Moderately	Very

2. **When do you usually eat for the first time?**

0	1	2	3	4
Before 9am	9:01 to 12pm	12:01 to 3pm	3:01 to 6pm	6:01 or later

3. **Do you have cravings or urges to eat snacks after supper, but before bedtime?**

0	1	2	3	4
Not at all	A little	Somewhat	Very much so	Extremely so

4. **How much control do you have over your eating between supper and bedtime?**

0	1	2	3	4
None at all	A little	Some	Very much	Complete

5. **How much of your daily food intake do you consume *after* suppertime?**

0	1	2	3	4
0% (none)	1-25% (up to a quarter)	26-50% (about half)	51-75% (more than half)	76-100% (almost all)

6. **Are you currently feeling blue or down in the dumps?**

0	1	2	3	4
Not at all	A little	Somewhat	Very much so	Extremely

7. **When you are feeling blue, is your mood lower in the:**

0	1	2	3	4	
Early Morning	Late Morning	Afternoon	Early Evening	Late Evening/ Nighttime	_____check here if your mood does not change during the day

8. **How often do you have trouble getting to sleep?**

0	1	2	3	4
Never	Sometimes	About half the time	Usually	Always

9. Other than only to use the bathroom, how often do you get up at least once in the middle of the night?

0	1	2	3	4
Never	Less than once a week	About once a week	More than once a week	Every night

********** *IF 0 on #9, PLEASE STOP HERE* **********

10. Do you have cravings or urges to eat snacks when you wake up at night?

0	1	2	3	4
Not at all	A little	Somewhat	Very much so	Extremely so

11. Do you need to eat in order to get back to sleep when you awake at night?

0	1	2	3	4
Not at all	A little	Somewhat	Very much so	Extremely so

12. When you get up in the middle of the night, how often do you snack?

0	1	2	3	4
Never	Sometimes	About half the time	Usually	Always

********** *IF 0 on #12, PLEASE SKIP TO # 15* **********

13. When you snack in the middle of the night, how aware are you of your eating?

0	1	2	3	4
Not at all	A little	Somewhat	Very much so	Completely

14. How much control do you have over your eating while you are up at night?

0	1	2	3	4
None at all	A little	Some	Very much	Complete

15. How long have your current difficulties with night eating been going on?

_____ mos. _____ years

Appendix E

Three Factor Eating Questionnaire (TFEQ)

Directions: Please answer the following questions by circling T for true and F for false.

1. When I smell a sizzling steak or see a juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal. T F
2. I usually eat too much at social occasions, like parties and picnics. T F
3. I am usually so hungry that I eat more than three times a day. T F
4. When I have eaten my quota of calories, I am usually good about not eating more. T F
5. Dieting is so hard for me because I just get too hungry. T F
6. I deliberately take small helpings as a means of controlling my weight. T F
7. Sometimes things just taste so good that I keep on eating even when I am no longer hungry. T F
8. Since I am often hungry, I sometimes wish that while I am eating, an expert would tell me that I have had enough or that I can have something more to eat. T F
9. When I feel anxious, I find myself eating. T F
10. Life is too short to worry about dieting. T F
11. Since my weight goes up and down, I have gone on reducing diets more than once. T F
12. I often feel so hungry that I just have to eat something. T F
13. When I am with someone who is overrating, I usually overeat too. T F
14. I have a pretty good idea of the number of calories in common food. T F
15. Sometimes when I start eating, I just can't seem to stop. T F
16. It is not difficult for me to leave something on my plate. T F
17. At certain times of the day, I get hungry because I have gotten used to eating then. T F
18. While on a diet, if I eat food that is not allowed, I consciously eat less for a period of time to make up for it. T F
19. Being with someone who is eating often makes me hungry enough to eat also. T F
20. When I feel blue, I often overeat. T F
21. I enjoy eating too much to spoil it by counting calories or watching my weight. T F
22. When I see a real delicacy, I often get so hungry that I have to eat right away. T F
23. I often stop eating when I am not really full as a conscious means of limiting the amount that I eat. T F
24. I get so hungry that mystomach often seems like a bottomless pit. T F
25. My weight has hardly changed at all in the last ten years. T F

26. I am alwayshungry so it is hard for me to stop eating before I finish the food on my plate. T F
27. When I feel lonely, I console myself by eating. T F
28. I consciously hold back at meals in order not to gain weight. T F
29. I sometimes get very hungry late in the evening or at night. T F
30. I eat anything I want, any time I want. T F
31. Without even thinking about it, I take a long time to eat. T F
32. I count calories as a conscious means of controlling my weight. T F
33. I do not eat some foods because they make me fat. T F
34. I am always hungry enough to eat at any time. T F
35. I pay a great deal of attention to changes in my figure. T F
36. While on a diet, if I eat a food that is not allowed, I often then splurge and eat other high calorie foods. T F

Directions: Please answer the following questions by circling the number above the response that is appropriate to you.

37. How often are you dieting in a conscious effort to control your weight?

1	2	3	4
Rarely	Sometimes	Usually	Always

38. Would a weight fluctuation of 5 pounds affect the way you live your life?

1	2	3	4
Not at all	Slightly	Moderately	Very much

39. How often do you feel hungry?

1	2	3	4
Only at mealtimes	Sometimes between meals	Often between meals	almost always

40. Do your feelings of guilt about overeating help you to control your food intake?

1	2	3	4
Never	Rarely	Often	Always

41. How difficult would it be for you to stop eating half-way through dinner and not eat for the next four hours?

1	2	3	4

Easy	Slightly difficult	Moderately difficult	Very difficult

42. How conscious are you of what you are eating?

1	2	3	4
Not at all	Slightly	Moderately	Extremely

43. How frequently do you avoid "stocking up" on tempting foods?

1	2	3	4
Almost never	Seldom	Usually	Almost always

44. How likely are you to shop for low calorie foods?

1	2	3	4
Unlikely	Slightly unlikely	Moderately likely	Very likely

45. Do you eat sensibly in front of others and splurge alone?

1	2	3	4
Never	Rarely	Often	Always

46. How likely are you to consciously eat slowly in order to cut down on how much you eat?

1	2	3	4
Unlikely	Slightly unlikely	Moderately likely	Very likely

47. How frequently do you skip dessert because you are no longer hungry?

1	2	3	4
Almost never	Seldom	At least once a week	Almost every day

48. How likely are you to consciously eat less than you want?

1	2	3	4
Unlikely	Slightly unlikely	Moderately likely	Very likely

49. Do you go on eating binges though you are not hungry?

1	2	3	4
Never	Rarely	Sometimes	At least once a week

50. On a scale of 0 to 5, where 0 means no restraint in eating (eating whatever you want, whenever you want it), and 5 means total restraint (constantly limiting food intake and never "giving in"), what number would you give yourself?

0
eat whatever you want, whenever you want it
1
usually eat whatever you want, whenever you want it
2
often eat whatever you want, whenever you want it
3
often limit food intake, but often "give in"
4
usually limit food intake, rarely "give in"
5
constantly limiting food intake, never "giving in"

Appendix F

Eating Behaviors Questionnaire

Snacks

1. How many snacks did you consume before dinner in a day?
   ___ 0 ___1 ___2 ___3 ___4

2. How many snacks did you consume after dinner in a day?
   ___ 0 ___1 ___2 ___3 ___4

3. What was the average size of your before dinner snack?
   ___ light ___moderate ___large ___did not

4. What was the average size of your after dinner snack?
   ___ light ___moderate ___large ___did not

5. Average number of people with whom you ate pre-dinner snack? _____
6. Average number of people with whom you ate post-dinner snack?_____
7. What would you usually snack on before dinner?
   _____

8. Did you snack more or less before lunch compared to high school?
   ___more ___less ___same

9. What would you snack on before lunch?
   _____

Breakfast

10. What was the average size of your breakfast?
    ___ light ___moderate ___large ___skipped or did not

11. The average number of people you ate breakfast with? _____
12. Number of times per week you prepared yourself breakfast (in room, kitchen, etc.)? _____
13a. Number of times per week you ate your breakfast in an all-you-can-eat dining hall? ____
13b. Number of times per week you ate your breakfast at a fast food restaurant? _____
14. Number of times per week you ate your breakfast at a restaurant (off-campus)? _____

15. Number of times per week you ate your breakfast at a place other than room, campus, or restaurant? _____
16. Where? _____
17. The average number of people you ate breakfast with? _____

Lunch

18. What was the average size of your lunch?
___ light ___moderate ___large ___skipped or did not

19. The average number of people you ate lunch with? _____
20. Number of times per week you prepared yourself lunch (in room, kitchen, etc.)?
_____
21a. Number of times per week you ate your lunch in an all-you-can-eat dining hall?
_____
21b. Number of times per week you ate your lunch at a fast food restaurant? _____
22. Number of times per week you ate your lunch at a restaurant (off campus)?
_____
23. Number of times per week you ate your lunch at a place other than room, campus, or restaurant (e.g. vending machine)? _____
24. Where? _____
25. The average number of people you ate lunch with? _____

Dinner

26. What was the average size of your dinner?
___ light ___moderate ___large ___skipped or did not

27. Did the number of people you ate dinner with increase, decrease or stay the same compared to high school?
____increase ____decrease ____same

28. How many more or less people did you usually eat with? ____
29. Number of times per week you prepared yourself dinner (in room, kitchen, etc.)?
_____
30a. Number of times per week you ate your dinner in an all-you-can-eat dining hall?
_____
30b. Number of times per week you ate your dinner at a fast food restaurant? _____
31. Number of times per week you ate your dinner at a restaurant (off campus)?
_____
32. Number of times per week you ate your dinner at a place other than room, campus, or restaurant (e.g. vending machine)? _____
33. Where? _____
34. With regards to your meals at college, did the duration of your meals
____increase ____decrease ____same amount of time

If increased or decreased, by how much? _____

35.Did you eat your meals as compared to high school:
___later ___earlier ___same time

36. Did the average size of your meal as compared to high school:
____increased ____decreased ____stayed the same

37. The average number of people you ate a meal with:
___increased ____decreased ____stayed the same

38. The number of meals you ate per day:
___increased ____decreased ____stayed the same

39. The number of snacks you ate per day:
___increased ____decreased ____stayed the same

40a. Do you think your weight has changed since entering VCU?
___increased ____decreased ____stayed the same

40b.If you experienced weight change, why do you think this occurred?

_____

_____

41. What was the biggest change that occurred in your dietary habits since starting school at VCU?

_____

_____

42. Has the amount of time you spend exercising each week:
___increased ____decreased ____stayed the same

Appendix G

Demographic Questionnaire

(Reminder, your scores will be aggregated with all other scores and this information will not be used to identify you in any way).

1. Age:_____
2. Year in school (please circle):

   Freshman (first-year) Sophomore Junior Senior Grad
3. Race/ethnicity:_____
4. Sex (please circle): M F
5. Height:_____
6. Weight:_____
7. What was your **highest** weight at your current height? _____
8. What was your **lowest** weight at your current height? _____
9. Do you feel dissatisfied with your body? yes no
10. What is your current living situation?

___ dormitory with roommates
___ dormitory without roommates
___ off campus with family
___ in an apartment with roommates
___ in an apartment without roommates
___ other (specify)_____

12. How much time each week do you spend:
    watching television? _____
    using the internet/computer? ____
    exercising (days per week) ___

THANK YOU FOR YOUR PARTICIPATION!!!!

If you have any comments about this study, please write them here:

Vita

Rachel Leigh Walker was born on February 18, 1980 in Charlotte, North Carolina and is an American citizen. She graduated from Charles B. Aycock High School, Pikeville, North Carolina, in 1998. She enrolled at Wake Forest University in the fall of 1998 and received her Bachelor of Art in Psychology with a minor in Spanish in 2002. During her undergraduate years, she worked as a research assistant for Dr. Batja Mesquita. After graduating, she enrolled in the Psychological Studies Institute and received her Master of Art in Professional Counseling in 2004. She worked for a year as a research assistant for Dr. Elinore McCance-Katz in the Addiction Psychiatry Division at Virginia Commonwealth University on a multidisciplinary NIDA/NIH funded research team which involved the daily clinical and research tasks for two drug interaction studies for the treatment of cocaine dependence. Rachel also worked as the project coordinator on a Center for Substance Abuse Treatment (CSAT) funded research team which developed and evaluated a state-based program of education on office-based buprenorphine treatment for opioid dependence. She enrolled in Virginia Commonwealth University's Doctoral program in the fall of 2005. Since that time, Rachel has worked with her advisor, Dr. Suzanne Mazzeo, on eating disorder and obesity research. She is also a behavior specialist on a multidisciplinary team addressing adolescent overweight in a severely overweight adolescent population, ages 11-18.