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Predicting Obesity from Four Eating Behaviors

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Predicting Obesity from Four Eating Behaviors

by

Tovah Yanover

A thesis submitted in partial fulfillment
Of the requirements for the degree of
Master of Arts
Department of Psychology
College of Arts and Sciences
University of South Florida

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Keywords: hunger, eating beyond satiety, snacking, night eating, eating expectancies, cue reactivity

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Dedication

I dedicate this thesis to my family: to my mother and father who have supported me tirelessly and always encouraged me to value learning and education, and to my husband who is a constant source of encouragement and comfort. I would also like to thank my lab mates, Christine Vaughan, M.Sc. and Kristi Wells, MPH, who have helped me adjust to life as a graduate student and who have shared the wealth of their experience with me.

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Predicting Obesity from Four Eating Behaviors

Tovah Yanover

ABSTRACT

Obesity is a growing problem in the United States. Research into the causes, treatment, and prevention of obesity is vital. One past study examined four eating behaviors in relation to obesity: eating beyond satiety, snacking, night eating, and feeling hungry within three hours of eating. Only eating beyond satiety was associated with obesity. The present study examined these same eating behaviors while correcting some of the flaws of the previous study. Using a cross-sectional design, university undergraduates reported on the frequency of the above-named eating behaviors. Current weight and height were collected. Multiple regression analyses determined that eating beyond satiety and hunger predicted body mass index (BMI). Race/ethnicity moderated the relationship between hunger and BMI. These findings have important implications for obesity treatment as well as suggesting important avenues for future research.

Introduction

Obesity is a growing problem. Recent statistics from the Centers for Disease Control and Prevention's National Center of Health Statistics (2004a) indicate that in 2000, 64% of Americans over the age of 20 were overweight and 30% were obese. In 1962, these figures were 44.8% and 13.3% respectively. There has been a huge increase in the prevalence of obesity and overweight in recent decades, and these figures continue to rise. Obese individuals are also at higher risk for a multitude of health problems including diabetes mellitus, cardiovascular disease, and all-cause mortality (National Heart, Lung and Blood Institute, 1998). Research into the causes, treatment, and prevention of obesity is vital in order to reduce the toll this condition takes on people's lives.

Obesity is the result of a positive energy balance wherein individuals take in more calories than they expend (Yanovski & Yanovski, 1999). A great deal of funding for recent research focusing on the energy out or physical activity side of the equation has been made available, with the goal of getting people to increase their activity. But the energy in or food intake side of the equation deserves just as much attention (Lavizzo-Mourey, 2004). Many past studies have examined diet composition to determine whether certain macronutrients contribute to the development of obesity (e.g. Nicklas, Baranowski, Cullen, & Berenson, 2001; Ortega, Redondo, Zamora, Lopez-Sobaler, & Andres, 1995). However, results from these studies have failed to identify macronutrient intake patterns that lead to obesity (Togo, Osler, Sorenson, & Heitmann, 2001). Other approaches are required to determine the mechanisms by which individuals take in so much more food than they need, and the determinants thereof.

In a recent article, Brewer, Kolotkin, and Baird (2003) investigated whether specific eating behaviors were associated with obesity in premenopausal African American and Caucasian women. They examined four behaviors: eating before bedtime,

feeling hungry within three hours of eating, eating between meals, and eating past the point of feeling full or the point of satiety. In their study, only eating beyond satiety was associated with obesity. This finding is important. If a specific eating behavior can be shown to be associated with obesity, this is an important first step in encouraging investigators to look into the causal role of eating behaviors. If eating beyond satiety does indeed play a causal role in the development of obesity, there are major implications for treatment and prevention programs. Teaching people to recognize internal signals of satiety and then to stop eating when they feel those signals could help prevent obesity, and help those who are obese to lose weight.

There were, however, some problems with the Brewer et al. (2003) study that lead to the need for new studies to reexamine these variables. Only one question assessed the frequency of each eating behavior, leading to questionable reliability of the measures. In addition, their measure of overweight was artificially dichotomized, forcing them to use nonparametric analyses and leading to a loss of power in the analyses. Furthermore, Brewer et al. (2003) did not control for physical activity. If individuals take in extra calories via one of the eating behaviors under study but then compensate by exercising, they could maintain a constant weight. Therefore, physical activity might mask relationships that exist between obesity and eating behaviors. Physical activity was controlled in the present study, to remove its effects from the relationship between eating behaviors and obesity. Reexamination of the variables set out in the study by Brewer et al. (2003), while removing these flaws, would strengthen the level of confidence in its findings. If the findings do, in fact, hold up, there are implications for the treatment of obesity. Correlation between eating beyond satiety and obesity does not imply a causal role for the eating behavior. However, establishing a correlation is a prerequisite to establishing causality. If future research can establish a causal role for eating beyond satiety or other eating behaviors, then weight management programs can incorporate strategies that teach individuals to recognize internal cues that signal satiety, and then to stop eating when they sense those cues. Research could also examine environmental or situational factors that are predictive of maladaptive eating behaviors. Weight

management programs could also teach individuals how to avoid these situations or deal with them more adaptively.

In the present study, the four eating behaviors investigated by Brewer et al. (2003) were once again examined to determine their relative contributions to obesity. These behaviors include snacking, eating beyond satiety, night eating, and hunger. Although hunger is not an eating behavior, it is included in order to re-examine all four of the variables proposed by Brewer et al. (2003). In the current study, explanatory mechanisms were also explored. Both expectancy theory and learning theory could potentially explain why some individuals engage in maladaptive eating behaviors while others do not.

Snacking

Concern has been raised about snacking because snack foods are commonly thought to be high-fat foods like chocolate or potato chips. Estimates of the contribution of snacking to the overall caloric intake of Americans range from 16% to 29% in various age groups (Summerbell, Moody, Shanks, Stock, & Geissler, 1995). Basdevant, Craplet, and Guy-Grand (1993) observed that the total daily energy intake of snackers was higher than that of non-snackers. Findings relating snacking to obesity have been mixed (Brewer et al., 2003). For example, Bertus Forslund, Lindroos, Sjoström, and Lissner (2002) found that obese women consumed more meals per day than a group of reference women. On the other hand, Fabry and Tepperman (1970) concluded that eating frequent meals is not necessarily pathological and may have positive benefits on weight. It is hypothesized that snacking will predict obesity.

Eating Beyond Satiety

Many now agree that environmental influences contribute to the problem of obesity (Hill, 1998). Large portions of tasty, high energy-density foods are readily available (DeAngelis, 2004). And people tend to eat until their plate is empty. In a study by Tuomisto, Tuomisto, Hetherington, and Lappalainen (1998), 39% of obese participants reported that they stopped eating because they had had enough, but 10% reported that they stopped eating because no food was left. The phenomenon of eating

beyond satiety has been linked to disinhibition (Brewer et al., 2003), described as the tendency to eat because of the availability of palatable foods, because others are eating, or because of emotional distress (Lowe & Maycock, 1988). Disinhibition has been associated with body mass index (BMI), an indicator of overweight, in several studies (e.g. Boschi, Iorio, Margiotta, D'Orsi, & Falconi, 2001; Hays et al., 2002)

Eating past the feeling of satiety was the only eating behavior associated with obesity in the study by Brewer et al. (2003). It is hypothesized that this relationship will once again be found in the present study. Furthermore, Brewer et al. (2003) found that eating beyond satiety was a stronger predictor of obesity in African American women than in Caucasian women. It is expected that, in the present study, race/ethnicity will once again moderate the relationship between eating behaviors and obesity.

Eating beyond satiety falls on a continuum, which at very high levels is likely represented by Binge Eating Disorder (BED). BED is defined as regular eating binges wherein the individual eats a large amount of food and perceives a loss of control over eating. These binges are accompanied by distress but not compensatory behaviors such as vomiting, fasting, or excessive exercise (Stice et al., 2000). Binges are often accompanied by feelings of being overfull or uncomfortably full. They are characterized by the consumption of large amounts of food. Eating beyond satiety is characterized by these same symptoms. BED is commonly found in overweight and obese individuals. Thus, it is possible that the association between eating beyond satiety and obesity is accounted for by BED. The present study therefore examined whether eating beyond satiety adds to the prediction of obesity, over and above the effect of BED.

Night Eating

Night eating may be informally referred to as bedtime snacking. Popular lore would have us believe that eating before bed will have a negative effect on one's weight. Empirical data does not support this position. Kant, Balfard-Barbash, and Schatzkin (1995) conducted a diary study of eating patterns and had women report what they ate during several periods of the day. Despite the fact that one third of the women consumed

more than 50% of their calories after 8 p.m., they found that night eating had no relationship to BMI. Brewer et al. (2003) also failed to find that night eating was a significant predictor of obesity. However, reliability of the measures in these studies could not be established because the number of items was too small. The present study used a scale designed to assess the construct of night eating in a more reliable manner. It is hypothesized that night eating will predict obesity in the present study¹.

Hunger

Research has been inconsistent in determining whether or not feeling hungry within three hours of eating is associated with obesity. Boschi et al. (2001) surveyed normal-weight and overweight women at the same Italian outpatient weight clinic and found that overweight women had higher hunger scores on Stunkard and Messick's (1985) Three-Factor Eating Questionnaire. On the other hand, Hays et al. (2002) found that hunger did not predict weight gain or current BMI. Feeling hungry is not, however, an eating behavior. Rather, it is a sensation that may lead to eating. Feeling hungry before a meal is adaptive and normative. However, feeling constantly hungry and unable to refrain from eating because of that hunger could be maladaptive. Hunger is expected to be correlated with snacking and night eating. Hunger is expected to predict obesity in the present study.

Expectancies

Expectancies have been defined as long-term memory structures that have an impact on cognitive processes governing behavior, both current and future (Jones, Corbin, & Fromme, 2001). Based on their learning history, individuals come to expect a given behavior will lead to a given outcome. If that outcome is desirable, the probability of the behavior is higher. If the outcome is negative, the probability of the behavior is

¹ Stunkard (1955 as cited in Napolitano, Head, Babyak, & Blumenthal, 2001) postulated a disorder known as night eating syndrome (NES) characterized by a lack of appetite in the morning, overeating in the evening, emotional distress, and insomnia. It could be that night eating also falls along a continuum, the extreme represented by NES. The present study did not, however, assess for the presence of NES.

lower. When an individual is given the opportunity to engage in some behavior, expectancies may act as cognitive mediators in the decision-making process. Expectancy theory has been extensively investigated in the substance abuse literature, especially in the domain of alcohol. Individuals with more positive alcohol expectancies engage in heavier drinking than individuals with less positive alcohol expectancies. Additionally, alcohol expectancies have been found to play a causal role in alcohol consumption in that manipulation of expectancies can reduce drinking (Darkes & Goldman, 1993). Recently, investigators have begun to examine food-related expectancies and their relationships to eating disorders such as anorexia and bulimia (Hohlstein, Smith, & Atlas, 1998). Hohlstein et al. (1998) claim that expectancy theory has been successfully applied in numerous other areas of psychology and that “expectancy operations appear implicit in a number of current eating disorder constructs” (p. 49). They found that bulimic individuals held expectancies that food would reduce negative affect and that anorexic individuals tended not to expect positive reinforcement from food. Expectancy theory has not, however, been applied in the context of obesity. This theory has much to offer in the investigation of the relationship between eating behaviors and obesity. What an individual comes to expect from food could then predict his or her intake. If an individual expects food to provide relief from negative affect, he or she would be more likely to engage in maladaptive eating behaviors in stressful situations. If individuals have more positive food- or eating-related expectancies, they would be expected to consume larger amounts of food and to do so more frequently, thus increasing their chances of being overweight or obese. The present study investigated whether those individuals who engage in the eating behaviors of interest are those who hold more positive eating or food-related expectancies. It is hypothesized that more positive expectancies about eating will be related to BMI and eating behaviors. Furthermore, the present study tested the hypothesis that eating behaviors mediate the effects of expectancies on BMI.

Learning Theory

Jansen (1998) compares food intake to the use of drugs in that both initiate physiological responses. Exposure to the sight, smell or taste of food sends the body into

preparations for consumption (Mattes, 1997). The body's cephalic phase responses, those processes that prepare it for food intake, include salivation, the release of gastric juices and insulin as well as preparations by the pancreas, kidneys, and heart (Mattes, 1997). The whole body gears up in preparation for food intake. The fact that the body can prepare for ingestion upon the mere sight of food suggests a role for conditioning processes. The learning or cue-reactivity model proposes that the cephalic phase responses are experienced as craving for food. They increase food intake and increase the likelihood of maladaptive eating patterns (Nederkoorn, Smulders, & Jansen, 2000).

Learning theory applies to obesity as well and has been researched in this context. According to Jansen et al. (2003), learning theory predicts that overeating is due to learned associations between appetitive food cues like smell and taste on the one hand, and food intake on the other. Jansen et al. (2003) found that normal weight children regulate their eating by eating less following a preload of tasty foods, whereas overweight children do not. Epstein, Paluch, and Coleman (1996) found that obese women did not habituate their salivation in response to repeated presentation of the same food, whereas normal weight women did habituate their salivation response. The women had food placed on their tongues, but were not permitted to consume it. The obese women's response to the food remained strong, while that of normal weight women weakened over time. One could argue that the obese women had stronger and more enduring responses to food stimuli in that the salivation response, which prepares them for food intake, does not diminish over time in response to the same food stimulus. Because the responses last longer, it may be more difficult for an obese individual to resist the urge to eat. Their bodies are preparing for food intake and signaling readiness, and they may give in when the signals do not dissipate, resulting in more frequent and long-lasting eating episodes. Further support for this proposal comes from a study comparing cue-exposure treatment to self-control treatment of binge eating. Cue-exposure treatment was more effective in reducing the frequency of binges (Jansen, Broekmate, & Heymans, 1992). In the cue exposure treatment, participants were exposed to cues that signaled a binge. These cues included binge clothing, location, and foods. Participants were encouraged to touch, smell, and even taste small amounts of the binge foods, but they were not permitted to

engage in a binge. The goal of this treatment was to break the bond between cues that signal a binge and the binge response. The self-control treatment taught participants to identify high-risk situations for a binge and to learn alternative ways to deal with these difficult situations. Role-playing and self-efficacy exercises were used in the cognitive restructuring portion of the treatment where participants learned and practiced the alternative behaviors. Jansen et al. (1992) found that individuals in the self-control treatment group had a 33% relapse rate while those in the cue-exposure treatment group were able to abstain totally from bingeing over the one-year follow-up period. These findings are consistent with the idea that responses to food stimuli can be powerful motivators for food consumption. It is hypothesized, therefore, that stronger and more enduring responses to food cues, in the form of self-reported cue reactivity, will be positively related to BMI and the eating behaviors of interest in the present study: eating beyond satiety, snacking, night eating, and hunger. Further, this study tested the hypothesis that these eating behaviors mediate the relationship between self-reported cue reactivity to food and BMI.

Present Study

Previous research (Brewer et al., 2003) examined only African-American and Caucasian women. The present study also included Hispanic women. Statistics show that rates of obesity are high in all three of these groups (National Center for Health Statistics, 2004b). Between 1999 and 2000, approximately 62% of Caucasian females aged 20 years and above were overweight and 33% were obese. The figures for African American women are 77% overweight and 49% obese. For Hispanic women of Mexican origin, 69% were overweight and 38% were obese. These figures indicate that obesity and overweight are problematic in all of these groups and that all three of these groups merit inclusion in a study of this nature.

Previous research (Brewer et al., 2003) has also focused on older populations; specifically premenopausal women aged 35 to 49 in their sample. With the rapid increase in obesity at all ages, it is important to understand obesity in younger individuals and to target interventions at those individuals. In the present study, the population of interest

was undergraduate students, a population younger than that studied by Brewer et al. (2003). The prevalence of overweight among individuals between the ages of 12 and 19 was 6.1% between 1971 and 1974 and it rose to 15.5% between 1999 and 2000 (National Center for Health Statistics, 2004c). Overweight and obesity has more than doubled in this age group in the last 30 years making this group an important one to study. Targeting undergraduates captures individuals who fall in this age group as well as the older age group, individuals 20 years and older among whom 30% are obese and 64% are overweight, (National Center for Health Statistics, 2004a).

The present study aimed to pull all of the above threads together to begin to better understand which eating behaviors predict obesity and whether expectancy theory or learning theory can help explain why certain individuals develop maladaptive eating patterns while others do not. The present study hopes to initiate and stimulate research in an area that, if fruitful, could help reduce the disease burden and lives lost due to obesity.

Hypotheses

1. Of the four eating behaviors assessed in the present study, eating beyond satiety will be the best predictor of BMI when the effects of the others are controlled.
2. Race/ethnicity will moderate the relationship between the eating behaviors and BMI.
3. Positive food expectancies will correlate positively with BMI and with the eating behaviors. Further, the eating behaviors will mediate the relationship between expectancies and BMI.
4. Strong, enduring self-reported cue reactivity to food stimuli will be associated with BMI and with the eating behaviors. Further, the eating behaviors will mediate the relationship between self-reported cue reactivity and BMI.
5. Eating beyond satiety will account for additional variance in BMI over and above the presence of a diagnosis of Binge Eating Disorder.

Method

Participants

Participants were recruited through the University of South Florida's Experimentrack system, which allows researchers to recruit students and reward their research participation with extra course credit. Inclusion criteria required participants to be female, able to read English, over the age of 18, and to belong to one of three racial/ethnic groups (African-American Non-Hispanic, Caucasian Non-Hispanic or Hispanic). For the purposes of this study, participants must self-identify as belonging to only one racial/ethnic group.

Six hundred and twenty-four individuals participated in the present study. Of these, 191 were eliminated either because they were male or because they did not belong to one of the racial/ethnic groups of interest. The remaining 45 individuals were eliminated because they answered one or more of the five attention items incorrectly. These were items scattered throughout the survey to detect careless responding. The final sample consisted of 388 female undergraduates at the University of South Florida. The mean age of the sample was 21.8 years ($SD = 4.66$) with a range of 18 to 53 years. The majority of the sample was in their junior (32.0%) or senior (31.2%) year. The sample was predominantly Caucasian Non-Hispanic (74.0%) with 14.4% of the participants self-identifying as Hispanic and 11.6% of the sample self-identifying as African-American Non-Hispanic. The largest proportion of the sample reported being single (29.6%) followed closely by being in a serious dating relationship (26.5%). Less than one quarter of the sample (23.2%) endorsed current dieting efforts. Of these, 36.4% reported being on "other" diet plans, with the second most popular choice being counting calories (23.2%). The mean BMI of the sample was 24.3 ($SD = 5.29$), which falls at the high end of the normal weight range (see Table 1 for racial/ethnic breakdown). Mean weight was 146.7

pounds ($SD = 34.27$) and mean height was 65.1 inches ($SD = 2.66$). Five individuals (1.3%) had subclinical BED according to the Eating Disorder Diagnostic Scale and fourteen individuals (3.6%) met criteria for BED.

Table 1. Demographic characteristics

| Group | Variable | | | |
|-------------------------------|----------|-----------|-------------------|-----------|
| | Age | | BMI | |
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> |
| Total Sample | 21.8 | 4.66 | 24.3 | 5.29 |
| Caucasian Non-Hispanic | 21.8 | 4.83 | 23.9 | 5.06 |
| African-American Non-Hispanic | 22.5 | 4.37 | 27.3 ^a | 5.99 |
| Hispanic | 21.6 | 3.96 | 23.5 | 5.11 |

^aMean is higher than the other two, $p < .05$

Measures

Measures can be found in Appendices A-J. Five items will be interspersed throughout the measures to detect careless responding.

Body Mass Index

Body Mass Index (BMI) is a common index of overweight calculated by [(weight in pounds) / (height in inches)²] x 703. Current BMI was calculated from height and weight information provided by participants.

Paffenbarger Physical Activity Questionnaire

Physical activity was assessed using the Paffenbarger Physical Activity Questionnaire (Paffenbarger, Wing, & Hyde, 1978). The questionnaire consists of eight items asking individuals their typical level of activity. Key items ask participants to report the number of flights of stairs they climb up each day and the number of blocks they walk each day. Participants also report the various types of physical activity in which they participate, the number of times a year they do so, and the duration of each

episode. The types of activity are then multiplied by their estimated intensity in METS, “a unit that represents the metabolic equivalent of an activity in multiples of the resting rate of oxygen consumption” (Courneya & Hellsten, p. 627). The MET values were obtained primarily from Lee, Paffenbarger, and Hsieh (1992). The scale score is calculated by multiplying the activity by the MET score and then by the duration per episode in minutes and the number of episodes per week. The number of kilocalories expended on stairs weekly is calculated by multiplying the number of flights of stairs climbed daily by 7 and then by 8. The number of kilocalories expended walking is calculated by multiplying the number of blocks walked daily by 7 and then 4. The sports, stairs, and blocks scores are then summed. The Paffenbarger thus yields a weekly kilocalorie expenditure for each participant.

The Paffenbarger has one-month test-retest reliability ranging from .63 for the number of blocks walked daily to .78 for the number of flights of stairs climbed daily. It has been shown to have convergent validity in that it correlates .31 with a four-week history of physical activity and .52 with a physical fitness workload test. The Paffenbarger scores are related to risk of first heart attack and hypertension, and to HDL cholesterol (Paffenbarger et al., 1978). Alpha was not calculated for the current sample, as one would not expect the items to hold together well.

Eating Disorder Diagnostic Scale

Binge eating was assessed using the Eating Disorder Diagnostic Scale (EDDS: Stice et al., 2000). The EDDS is a brief, self-report measure of eating pathology that provides separate diagnostic information on Anorexia, Bulimia, and Binge-Eating Disorder. Test-retest reliability of the EDDS is .87 and Cronbach’s alpha is .91. The EDDS discriminates among the different eating disorder diagnoses (Stice et al., 2000). The EDDS has also been shown to agree with the Eating Disorder Examination, a structured interview of eating pathology (Kappa = .78; Stice et al., 2004). The final four items of the EDDS collect height, weight, and menstrual cycle information. These items were omitted. Height and weight were collected later and menstrual status was not of interest in the present study. The EDDS yields a diagnosis of Binge Eating Disorder

(BED) if an individual gives a response of “yes” to items 5, 6, 14, and at least three of 9, 10, 11, 12 and 13. An individual must also give a response greater than two on item 7 and zero on items 15, 16, 17, and 18. The EDDS provides an eating disorder diagnosis of clinical and subclinical bulimia nervosa and binge eating disorder. In the present sample the full EDDS showed good internal consistency (Alpha = .85).

Eating Beyond Satiety Questionnaire

Eating beyond satiety was assessed using 10 items. Four items were taken from the Disinhibition scale of the Three-Factor Eating Questionnaire (TFEQ; Stunkard & Messick, 1985), either directly or in modified form. The TFEQ is a commonly used measure of eating behaviors that has been employed extensively in a wide variety of populations. It has been shown to discriminate between dieters and free eaters (Stunkard & Messick, 1985). The disinhibition scale was not used in its entirety in the present study because it is not a pure measure of eating beyond satiety. Some items also assess eating in response to mood cues such as anxiety or feeling “blue”. Therefore, items that assessed the construct of eating beyond satiety were pulled from the disinhibition scale for use in the present study. These are items 2, 3, 7, and 11. The response options were also changed from true or false to a 5-point Likert-type scale, which is preferable because it increases the potential variability of the responses. Words that refer to frequency of behavior such as “usually,” “sometimes,” and “always” were removed from the items because these ideas are now included in the response options. Leaving them in the items themselves leads to redundancy. Additionally, item 9 was modified to read “Even though I am full” from the original “I am always hungry so” in order to put the focus on satiety rather than hunger. The words “not difficult” were removed from item 7.

The remaining items were experimenter-generated to measure the construct of eating beyond satiety and were created to be face-valid and construct valid questions. An expert panel rated the items as a good measure of eating beyond satiety. Items 7 and 10 were reverse-coded. Responses were summed to create a total score for eating beyond satiety (possible total = 50). The measure showed good internal consistency in the present sample (Alpha = .85).

Snacking Questionnaire

A thorough literature search failed to generate an existing, validated measure of snacking. Snacking was, therefore, assessed with six experimenter-generated items. These items were designed to assess frequency of snacking during the day. An expert panel rated the items as a good measure of snacking. Item 1 was reverse-coded and the responses were summed to create a total score for snacking (possible total = 30). The full scale showed reasonable internal consistency in the present sample (Alpha = .63), however an item analysis revealed that the first five items produced a scale with a more acceptable alpha. Therefore, the final scale consists of the first five items, which showed good internal consistency (Alpha = .77), with a possible scale total of 25.

Hunger Questionnaire

Hunger was assessed using seven items. Two of these items were modified from the Hunger scale of the TFEQ (Stunkard & Messick, 1985). The hunger scale of the TFEQ was not used in its entirety because several items confound the sensation of hunger with the behavior of eating. Unconfounded items were pulled from the scale for use in the present study. These are items 1 and 5. The response options for these two items were changed from true or false to a 5-point Likert-type scale. The word “always” was removed from both of these items because it became redundant with the new response format.

The remaining items were experimenter-generated to measure the construct of hunger. Items 2, 3, and 4 were designed to extend the question asked in the study by Brewer et al. (2003), which asked how often after eating an individual is likely to feel hungry. The likelihood of feeling hungry may vary depending on the meal eaten previously, so the present study has three items; one each for breakfast, lunch, and dinner. These three items were reverse coded so that higher scores reflected greater hunger sensations. Item 6 was designed to be a face-valid measure of hunger. An expert panel rated the items as a good measure of hunger. Responses were summed to create a total

hunger score (possible total = 35). Internal consistency for the scale was good in the present sample (Alpha = .74).

Night Eating Scale

Night eating was assessed using seven items, several of which were from the Night Eating Questionnaire (NEQ; Marshall et al., 2004). The NEQ is a 14-item screening instrument designed to assess Night Eating Syndrome. The construct of interest in the current study is the frequency with which individuals engage in nighttime eating. Therefore, items addressing this construct were pulled from the scale. The remaining items were experimenter-generated. An expert panel rated the items as a good measure of night eating. Responses were summed to yield a total night eating score (possible total = 35). Internal consistency for the scale was good in the current sample (Alpha = .78).

Brewer et al. (2003) Measures

To explore the possibility that the findings from Brewer et al. (2003), were due to poor measurement, the original four questions used in their study were included as a separate measure for the sake of comparison. No reliability information is available for these items. The four items assessed eating before bedtime (“How often do you eat during the two hours before your bedtime?”), eating between meals (“How often do you eat between meals?”) feeling hungry within three hours of eating (“How often do you feel really hungry even though you have eaten adequately in the last three hours?”) and eating beyond satiation (“How often do you keep eating at meals even though you are not hungry anymore?”). These items were all rated on a 5-point Likert-type scale from “rarely or never” to “nearly everyday.”

Eating Expectancies Inventory

Expectancies were assessed with the Eating Expectancies Inventory (EEI; Hohlstein et al., 1998). The EEI is a five-subscale measure of learned expectancies related to eating. The scale was originally designed for use with eating disordered populations, but has applications to the problem of obesity. The five subscales are: Eating

helps manage negative affect (18 items), Eating is pleasurable and useful as a reward (6 items), Eating leads to feeling out of control (4 items), Eating enhances cognitive competence (2 items), and Eating alleviates boredom (4 items). Coefficient alphas for the five factors range from .78 to .94. Various subscales of the EEI have been shown to correlate highly with several other eating measures including the Disinhibition and Restraint scales of the TFEQ. The EEI has also been used to show that expectancies differ across individuals with anorexia, individuals with bulimia, and control individuals. The factor structure of the EEI has been shown to be consistent in samples of African American and Caucasian undergraduate women (Atlas, Smith, Hohlstein, McCarthy, & Kroll, 2002). Negatively worded items were reverse-coded so that a higher total score reflected more positive expectancies toward food. Responses were summed to yield a total expectancies score (possible total = 170). Subscale scores were not calculated. Alpha for the overall scale for the current sample was good (Alpha = .87).

Self-Reported Cue Reactivity Questionnaire

In the present study, individuals' self-reported cue reactivity to food stimuli was assessed using 18 items. These items assess the strength, longevity, and ability to resist responses to external food cues. Three of the situations described in these items, such as "When you see other people eating," have been taken directly from the External Eating scale of the DEBQ (van Strien et al., 1986). The remaining situations were experimenter-generated to cover other situations in which individuals might respond to food-related cues. Each situation is repeated three times, each time assessing one of the three aspects mentioned above. The items assessing how difficult the individual finds resisting the urge to eat were modified from the Food Craving Questionnaire (Lafay et al., 2001). The words "this strong urge to eat a particular food" were changed to "the desire." Responses were summed to create a total score (possible total = 90). Internal consistency for the scale in the present sample was very good. (Alpha = .93).

Procedure

Participants logged on to the University of South Florida Experimentrak system and were directed to a generic informed consent form. Upon providing consent to participate, they were redirected to the study's web page. They were informed that the study posed minimal risk, that all information collected was completely confidential and anonymous, and that participation was voluntary. Participants then completed all of the measures in one of five sequences. The sequence was randomly selected in order to counterbalance across participants and reduce fatigue effects. Demographic information was provided at the end. The final two questions asked for self-reported weight and height. Accuracy of reporting was stressed along with the anonymity of the information being provided. Participants were then provided with a debriefing form. Course credit was awarded via the University of South Florida Experimentrak system after their participation.

Results

Relevant scale means and standard deviations are presented in Table 2.

Table 2. Means and standard deviations for scale scores

| Scale | Score Range | <i>M</i> | <i>SD</i> |
|---|-------------|----------|-----------|
| Eating Beyond Satiety | 10 - 50 | 21.3 | 6.23 |
| Snacking | 5 - 25 | 17.3 | 4.13 |
| Hunger | 7 - 35 | 17.2 | 3.03 |
| Night Eating | 7 - 35 | 11.1 | 3.68 |
| Brewer et al. (2003) Eating Beyond Satiety Item | 1 - 4 | 2.0 | 0.96 |
| Brewer et al. (2003) Snacking Item | 1 - 4 | 2.6 | 0.98 |
| Brewer et al. (2003) Hunger Item | 1 - 4 | 2.0 | 0.86 |
| Brewer et al. (2003) Night Eating Item | 1 - 4 | 2.3 | 1.03 |
| Physical Activity | 0-no limit | 13957.0 | 101867.47 |
| Eating Expectancies | 34 - 238 | 110.5 | 37.06 |
| Self-Reported Cue Reactivity | 18 - 90 | 43.9 | 14.62 |

Hypothesis 1

It was hypothesized that eating beyond satiety would be the best predictor of BMI when the effects of the other eating behaviors were controlled. A preliminary correlation matrix was calculated to examine the relationships between each of the eating behaviors and BMI. Only eating beyond satiety was significantly correlated with BMI ($r = .15, p < .01$). The eating behaviors were all correlated with each other (see Table 3). Correlations among the items from Brewer et al. (2003) and key measures from the present study were examined. The pattern of significant and nonsignificant correlations was identical to that for the present study (see Table 4). Only the Brewer et al. (2003) item asking about eating

beyond satiety was correlated with BMI ($r = .12, p < .05$) and all four of the items were intercorrelated. Correlations between present study eating behavior measures and Brewer et al. (2003) eating behavior measures are presented in Table 5.

Table 3. Correlations among the eating behaviors, BMI, physical activity, eating expectancies and self-reported cue reactivity.

| Variable | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---------------------------------|-------|-------|-------|-------|-------|------|-------|----|
| 1. BMI | - | | | | | | | |
| 2. Eating Beyond Satiety | .15** | - | | | | | | |
| 3. Snacking | -.04 | .20** | - | | | | | |
| 4. Hunger | -.08 | .39** | .45** | - | | | | |
| 5. Night Eating | -.03 | .34** | .44** | .41** | - | | | |
| 6. Physical Activity | -.03 | -.03 | -.10* | -.06 | -.05 | - | | |
| 7. Eating Expectancies | .16** | .59** | .14** | .34** | .23** | -.03 | - | |
| 8. Self-Reported Cue Reactivity | .05 | .48** | .22** | .46** | .29** | -.03 | .42** | - |

* $p < .05$, ** $p < .01$

Table 4. Correlations among the eating behaviors (Brewer et al. (2003) measures), BMI, physical activity, eating expectancies and self-reported cue reactivity

| Variable | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---------------------------------|-------|-------|-------|-------|-------|------|-------|----|
| 1. BMI | - | | | | | | | |
| 2. Eating Beyond Satiety | .12* | - | | | | | | |
| 3. Snacking | -.03 | .28** | - | | | | | |
| 4. Hunger | -.02 | .47** | .43** | - | | | | |
| 5. Night Eating | .03 | .33** | .33** | .30** | - | | | |
| 6. Physical Activity | -.03 | .00 | -.08 | -.05 | -.09 | - | | |
| 7. Eating Expectancies | .16** | .48** | .16** | .32** | .23** | -.03 | - | |
| 8. Self-Reported Cue Reactivity | .05 | .40** | .16** | .39** | .27** | -.03 | .42** | - |

* $p < .05$, ** $p < .01$

Table 5. Correlations among the eating behaviors: Present study measures vs. Brewer et al. (2003) measures

| Variable | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|----|
| 1. Eating Beyond Satiety (EBS) | - | | | | | | | |
| 2. Snacking | .20** | - | | | | | | |
| 3. Hunger | .39** | .45** | - | | | | | |
| 4. Night Eating | .34** | .44** | .41** | - | | | | |
| 5. Brewer et al. EBS | .74** | .21** | .33** | .26** | - | | | |
| 6. Brewer et al. Snacking | .22** | .65** | .37** | .29** | .28** | - | | |
| 7. Brewer et al. Hunger | .43** | .42** | .58** | .39** | .43** | .43** | - | |
| 8. Brewer et al. Night Eating | .32** | .35** | .30** | .51** | .33** | .30** | .30** | - |

* $p < .05$, ** $p < .01$

A multiple regression analysis examined which of the eating behaviors predicts BMI after controlling for the effects of the other behaviors. The independent variables of interest were the four eating behaviors: snacking, eating beyond satiety, night eating, and hunger. All four eating behaviors were entered simultaneously. The overall regression equation was significant ($F(4,383) = 4.90, p < .01$). Eating beyond satiety was a significant predictor of BMI ($\beta = 0.23, p < .001$). Hunger also significantly predicted BMI ($\beta = -0.15, p < .05$). Betas are presented in Table 6. The unadjusted R^2 for the model was .049 ($SE = 5.19$). In addition, a multiple regression analysis examined whether the results from the Brewer et al. (2003) study replicate. BMI was regressed on the responses given by participants in the present study to the four questions from Brewer et al. (2003). The overall regression equation was not significant, although the trend was strong ($F(4,383) = 2.29, p = .059$). Betas are presented in Table 6 for the sake of comparison. The unadjusted R^2 for the model was .023 ($SE = 5.25$).

Table 6. Standardized regression coefficients and p-values for the regression predicting BMI from all four eating behaviors and from the Brewer et al. (2003) items

| Variable | Present Study Measures | | Brewer Measures | |
|-----------------------|----------------------------|-----------------|----------------------------|-----------------|
| | Standardized | | Standardized | |
| | Coefficient (β) | <i>p</i> -value | Coefficient (β) | <i>p</i> -value |
| Eating Beyond Satiety | 0.23 | < .001 | 0.17 | .005 |
| Snacking | 0.01 | .885 | -0.05 | .417 |
| Hunger | -0.15 | .011 | -0.08 | .173 |
| Night Eating | -0.05 | .415 | 0.02 | .759 |

A logistic regression was also performed to predict obesity from all four eating behaviors entered simultaneously. In this analysis, the BMI variable was dichotomized to compare obese (BMI of 30 or above; N = 53) and normal-weight individuals (BMI between 18.5 and 24.9; N = 240). Underweight (BMI 18 and below; N = 22) and overweight (BMI between 25 and 29.9; N = 72) individuals were removed from this analysis. The overall model was not significant ($\chi^2(4) = 6.34, ns$). The logistic regression was repeated using the Brewer et al. (2003) measures. Once again, the overall model was not significant ($\chi^2(4) = 3.71, ns$).

Logistic regressions were conducted comparing only normal weight (N = 240) and overweight individuals (N = 72). In this case, the overall model was significant ($\chi^2(4) = 22.42, p < .001$). Both eating beyond satiety ($OR = 1.22, p < .01$; see Table 7) and night eating ($OR = 0.81, p < .01$) predicted overweight. There was a trend for hunger to predict obesity ($OR = 0.82, p = .069$). The Cox and Snell R^2 for the model was .21. When conducted using the Brewer et al. (2003) measures, the overall model was once again significant ($\chi^2(4) = 14.53, p < .01$). Eating beyond satiety ($OR = 2.89, p < .01$) continued to predict overweight and hunger ($OR = 0.42, p < .05$) also predicted overweight. The Cox and Snell R^2 for the model was .14.

Table 7. Odds ratios for the eating behaviors predicting normal weight versus overweight

| Variable | Present Study Measures | | Brewer Measures | |
|-----------------------|------------------------|----------|-----------------|----------|
| | <i>OR</i> | <i>p</i> | <i>OR</i> | <i>p</i> |
| Eating Beyond Satiety | 1.22 | .004 | 2.89 | .005 |
| Snacking | 1.01 | .936 | 0.79 | .473 |
| Hunger | 0.82 | .069 | 0.42 | .044 |
| Night Eating | 0.81 | .008 | 0.76 | .322 |

All of the above-described linear and logistic regressions were repeated including physical activity as a control variable. The logistic regression comparing normal weight and obese individuals on present study measures of eating behaviors was significant when physical activity was controlled ($\chi^2(5) = 11.56, p < .05$). Only eating beyond satiety was a significant predictor of obesity ($OR = 1.06, p < .05$). No other results differed after controlling for physical activity.

One final set of logistic regressions compared overweight and obese individuals on all four eating behaviors and on the items from Brewer et al. (2003). Neither model was significant.

Hypothesis 2

It was hypothesized that race/ethnicity would moderate the relationship between the eating behaviors and BMI. Race/ethnicity was included in this analysis as a set of two dummy variables. In the first vector, African-American Non-Hispanic was given a value of 1 and the other two groups were coded as 0. In the second vector, Caucasian Non-Hispanic was given a value of 1 and the other groups were coded as 0. Two interaction terms were created for each analysis by multiplying the dummy coded vectors by the eating behavior score. BMI was regressed first on the eating behavior and then race/ethnicity was added to look for a main effect of race/ethnicity. Finally, the interaction terms were added to determine whether race/ethnicity moderates the

relationship between BMI and the eating behavior. At each step of the model, the R^2 -change was examined to determine if there was a significant effect.

There was a main effect of race/ethnicity on BMI in each of the analyses. This main effect was explored with a oneway ANOVA where the independent variable was race/ethnicity and the dependent variable was BMI. Post-hoc Tukey tests revealed that African-American Non-Hispanic ($M = 27.28$, $SD = 5.99$) individuals had higher BMIs than Caucasian Non-Hispanic ($M = 23.93$, $SD = 5.06$) and Hispanic ($M = 23.48$, $SD = 5.11$) individuals. The latter two groups did not differ significantly from each other (see Table 1).

In the first analysis, eating beyond satiety was a significant predictor of BMI ($\beta = 0.18$, $p < .001$) but there was no significant interaction (R^2 -change = .005; F -change(1,2) = .94, ns). There was no main effect for snacking ($\beta = -0.03$, ns), nor was there a significant race/ethnicity by snacking interaction (R^2 -change = .000; F -change(1,2) = 0.59, ns). There was no significant main effect of night eating ($\beta = -0.06$, ns), nor was there a significant interaction (R^2 -change = .001; F -change(1,2) = 0.75, ns). There was no main effect of hunger ($\beta = -0.06$, ns). The interaction terms significantly predicted BMI (R^2 -change = .017; F -change(1,2) = 3.47, $p < .05$).

The hunger by race/ethnicity interaction was examined by calculating a simple regression of BMI on hunger for each race/ethnicity group and then plotting the slopes (see Figure 1). Figure 1 shows a positive association between hunger and BMI for African-American Non-Hispanic individuals. For Hispanic individuals, there was a small negative relationship and there was essentially no relationship between hunger and BMI in Caucasian Non-Hispanic individuals. None of the individual regression models was significant, but Betas will be presented for the sake of interpretation of the interaction effect (see Table 8). In sum, hypothesis 2 was supported only for hunger.

Figure 1. Regression slopes for the simple regression of BMI on hunger for each race/ethnicity group

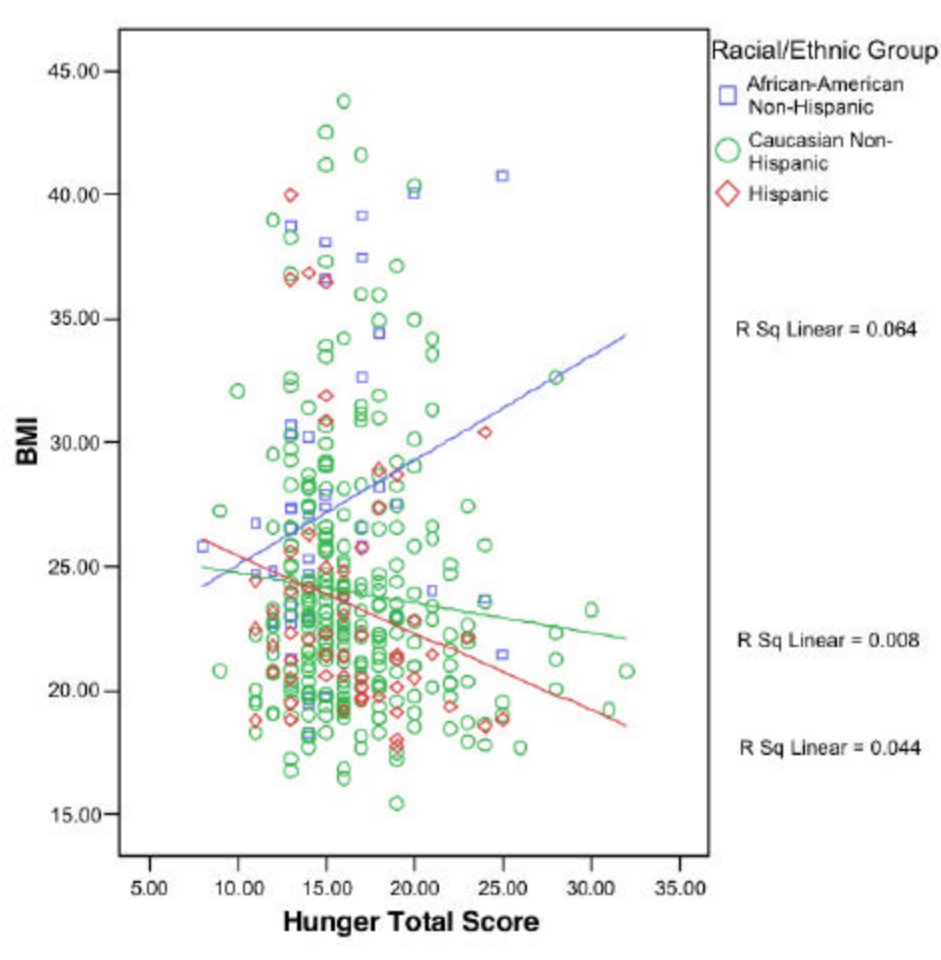


Table 8. Standardized regression coefficients for simple regression of BMI on hunger for each race/ethnicity group

| Group | Standardized Coefficient (β) | <i>F</i> | <i>df</i> | <i>p</i> -value |
|-------------------------------|--------------------------------------|----------|-----------|-----------------|
| African-American Non-Hispanic | 0.25 | 2.93 | 1, 43 | .094 |
| Caucasian Non-Hispanic | -0.09 | 2.23 | 1, 285 | .136 |
| Hispanic | -0.21 | 2.50 | 1, 54 | .120 |

The relationship between race/ethnicity and the eating behaviors was explored further. An ANOVA was conducted for each eating behavior wherein race/ethnicity was the independent variable and the eating behavior was the dependent variable. For eating beyond satiety, there was a main effect of race/ethnicity ($F(2,385) = 3.32, p < .05$; see Table 9). Post-hoc Tukey tests revealed that African-American Non-Hispanics ($M = 19.04, SD = 4.80$) had significantly lower eating beyond satiety scores than Caucasian Non-Hispanic ($M = 21.59, SD = 6.45$) individuals but did not differ significantly from Hispanic individuals ($M = 21.46, SD = 5.80$). Caucasian Non-Hispanic and Hispanic individuals also did not differ significantly. There was also a main effect for snacking ($F(2,385) = 3.79, p < .05$). Post-hoc Tukey tests revealed that the only significant difference was that Hispanic ($M = 13.52, SD = 2.73$) individuals had significantly lower snacking scores than Caucasian Non-Hispanic ($M = 15.02, SD = 3.83$) individuals. There was no main effect for hunger ($F(2,385) = 2.78, p = .063$), although the trend was strong. The same was true of night eating ($F(2,385) = 2.88, p = .057$).

Hypothesis 3

It was hypothesized that the eating behaviors would mediate the relationship between eating expectancies and BMI. A prerequisite for mediation analysis is that the independent, dependent and mediator variables all be correlated. Therefore, eating expectancies, BMI, and eating beyond satiety were correlated to determine if this criterion was met (see Table 3). Eating expectancies were significantly correlated with eating beyond satiety ($r = .59, p < .001$) and with BMI ($r = .16, p < .001$). As reported above, eating beyond satiety and BMI were significantly correlated ($r = .15, p < .01$). BMI was regressed on eating beyond satiety and eating expectancies. With both variables in the model, neither eating beyond satiety ($\beta = 0.10, p = .12$), nor eating expectancies ($\beta = 0.10, p = .11$) were significant predictors of BMI. However, there was a fairly substantial drop in the beta weight for eating expectancies when the mediator was added to the regression (from $\beta = 0.155$ to $\beta = 0.099$). A Sobel test (Sobel, 1982) was performed as a check on the mediational model. The Sobel test confirmed that mediation was not significant ($z = 1.55, p = .12$).

No further mediation analyses could be conducted because the remainder of the eating behaviors were not correlated with BMI. Hypothesis 3 was, therefore, not supported.

Table 9. Race/ethnicity differences on the eating behaviors

| Group | M | SD |
|-------------------------------|--------|------|
| Eating Beyond Satiety | | |
| African-American Non-Hispanic | 19.04* | 4.80 |
| Caucasian Non-Hispanic | 21.59* | 6.45 |
| Hispanic | 21.46 | 5.80 |
| Snacking | | |
| African-American Non-Hispanic | 14.44 | 4.76 |
| Caucasian Non-Hispanic | 15.02* | 3.83 |
| Hispanic | 13.52* | 2.73 |
| Hunger ^a | | |
| African-American Non-Hispanic | 15.27 | 3.59 |
| Caucasian Non-Hispanic | 16.64 | 3.71 |
| Hispanic | 16.27 | 3.45 |
| Night Eating ^a | | |
| African-American Non-Hispanic | 12.29* | 4.65 |
| Caucasian Non-Hispanic | 10.89* | 3.51 |
| Hispanic | 10.92 | 3.54 |

*Means differ significantly.

^aANOVA was not significant.

Hypothesis 4

It was hypothesized that the eating behaviors would mediate the relationship between self-reported cue reactivity and BMI. In this case, a mediation analysis could not be conducted because BMI and self-reported cue reactivity were not significantly correlated ($r = .05$, *ns*; see Table 3) precluding the possibility of a mediational analysis. Hypothesis 4 was, therefore, not supported.

Hypothesis 5

It was hypothesized that eating beyond satiety would account for additional variance in BMI beyond that accounted for by a diagnosis of BED. Individuals were categorized by binge eating status. Individuals who, according to the EDDS scoring algorithm, met criteria for BED or subclinical BED were placed in the binge eaters category. These two subgroups were combined due to the small number of these individuals (5 subclinical and 14 clinical). Participants who did not meet these criteria were classified as non-binge eaters. It could be that the effects of compensatory behaviors such as purging would attenuate the effects of binge eating on BMI because purging negates the caloric intake of the binge. Therefore, individuals who engage in compensatory behaviors such as purging, defined as anyone who scored above 0 on any one of EDDS items 15 through 18, were removed from all subsequent analyses. BMI was regressed on binge eating status and then eating beyond satiety was added into the model. In the first step, binge-eating status was a significant predictor of BMI ($\beta = 0.27, p < .001$). Binge eating status continued to predict BMI when eating beyond satiety was added ($\beta = 0.24, p < .001$). Eating beyond satiety did not account for a statistically significant amount of additional variance in BMI although there was a very strong trend in that direction ($\beta = 0.10, p = .05$). An ANOVA was conducted to further examine the relationship between binge eating status and BMI. Binge eaters ($M = 30.36, SD = 7.78$) had a significantly higher mean BMI than non-binge eaters ($M = 23.91, SD = 4.98$; $F(1,375) = 28.30, p < .001$). A second ANOVA examined the relationship between binge eating status and eating beyond satiety scores. Binge eaters ($M = 28.00, SD = 7.01$) had a significantly higher mean eating beyond satiety score than non-binge eaters ($M = 20.87, SD = 6.01$; $F(1,375) = 24.94, p < .001$).

A binge score was created next to examine binge eating as a continuous rather than a categorical phenomenon. This score was created by taking the sum of the items on the EDDS relevant to binge eating. Items 7 and 8 were dichotomized to be on the same metric as the remaining binge items (items 5-6 and 9-14). Items 7 and 8 were recoded to have a value of 0 if the participant scored lower than 2 and a value of 1 if the participant

scored 2 or higher. These values correspond to the cutoff on the EDDS scoring algorithm (Stice et al., 2000). The internal consistency of this binge score was high ($\alpha = .91$). Once again, individuals who engage in compensatory behaviors were left out of all analyses. The mean binge score for all binge eaters was 2.95 ($SD = 3.36$). Possible scores ranged from 0 to 10. The correlation between binge scores and BMI was small ($r = .19, p < .001$) but significant. BMI was regressed on binge scores and eating beyond satiety. With both variables in the model, binge scores predicted BMI ($\beta = 0.15, p < .05$) but eating beyond satiety did not account for a statistically significant amount of additional variance in BMI ($\beta = 0.07, ns$). Hypothesis 5 was, therefore, not supported.

Discussion

The present study asked which eating behaviors predict BMI. Both eating beyond satiety and hunger were identified as significant predictors of BMI. Brewer et al. (2003) also identified eating beyond satiety as a predictor of obesity in a sample of older Caucasian and African American women. There are several studies that have found relationships between binge eating and obesity or overweight (e.g. Picot & Lilenfeld, 2003; Siqueira, Appolinario, & Sichieri, 2004). The present study was the first to examine the less severe, but likely more common phenomenon, of eating beyond satiety in the college population.

Interestingly, Stice, Presnell, Shaw and Rohde (2005) failed to identify a prospective relationship between binge eating and obesity. In contrast, Brewer et al. (2003) did find that eating beyond satiety was related to age of obesity onset. However, their data were retrospective and could be subject to recall bias. It could be that, while binge eating or overeating do not cause obesity, they could act as maintaining factors. Losing weight is difficult when caloric intake is high and, therefore, behaviors such as eating beyond satiety would serve to impede weight loss. Because the current study is cross sectional, examining current weight rather than obesity onset, the results cannot answer this question. Alternatively, some third variable could account for both BMI and eating beyond satiety, thereby precluding a causal link between them. It is difficult to think what such a variable might be, but there could be some genetic factor that predisposes an individual to overeat and to have a high BMI. Future research will be needed to sort out possible alternative explanations and to further clarify the temporal relationships among these variables.

It should be noted that, in the present study, only 5% of the variance in BMI was explained by eating behaviors, indicating that, while these factors do have a role to play,

there are other factors that account for much more variance in the relationship. And, while eating beyond satiety is an important predictor, the correlation between this variable and BMI is still quite low ($r = .15$). This fact does not, however, diminish the importance of the findings in the present study. BMI is determined by a host of genetic and environmental factors and the more of these that can be identified, the more tools there are in the arsenal to prevent and treat obesity and overweight.

One notable finding concerning eating beyond satiety is its ability to predict overweight, specifically when using the single-item measure from Brewer et al. (2003). The odds ratio in this case was 2.89 indicating that individuals had an almost 3 times greater chance of being overweight if they engaged in eating beyond satiety. This is quite a large effect and it is interesting to note that the predictive power of this single-item measure appears to be greater than that of the 10-item questionnaire designed for the present study ($OR = 1.22$). This finding, however, is likely explained by the fact that the Brewer et al. (2003) item has a possible score range of 1-4 while the present study measure had a range of 10-50. The two odds ratios are not directly comparable because they are not on the same metric. The Brewer et al. (2003) measure should, therefore, not be interpreted as a stronger predictor.

The present study apparently stands in contrast to the findings of Hays et al. (2002) who found that hunger did not predict current BMI. The present findings appear compatible with Boschi et al. (2001), who found that obese women obtained higher hunger scores than did normal weight women. However, the results of both Hays et al. (2002) and Boschi et al. (2001) must be interpreted with caution. The hunger scale of the TFEQ, the measure used in both studies, does not provide a pure measure of the hunger sensation, instead confounding the feeling of hunger with the behavior of eating. It is possible that hunger increases the likelihood that maladaptive overeating will take place, but studies have yet to confirm this possibility. Hill (1974) found that when individuals are hungry, they eat more rapidly, have longer meals, and consume more food. The model makes logical sense: increased hunger leads to eating beyond satiety which, in turn, results in increased caloric intake and a higher BMI. Nevertheless, the most likely

reason for the findings related to hunger in the present study is suppression. Hunger acts as a suppressor variable which according to Conger (1974 as cited in Glasnapp, 1984) “is defined to be a variable which increases the predictive validity of another variable by its inclusion in a regression equation” (p. 858).

It is also interesting to note that the beta for hunger is negative indicating that increased hunger is associated with decreased BMI. The same is true of the odds ratio in the logistic regression. Because it is less than one, the odds ratio indicates that odds of being overweight decrease as hunger scores increase. One possible explanation for the direction of this relationship could be that heavier individuals eat so much or so constantly that they do not experience hunger. Normal weight individuals, on the other hand, may eat less frequently or consume smaller portions, thus allowing themselves to experience hunger. Perhaps normal weight individuals use hunger as a cue to signal when it is time to eat, while overweight and obese individuals do not give themselves the chance to experience hunger.

Past research on snacking has not consistently identified it as a predictor of obesity. The current study adds to the null findings in the literature, further strengthening confidence that snacking is not, in and of itself, significantly related to obesity. It could be that individuals who snack still consume an appropriate number of calories in a day, and therefore would not be expected to be overweight or obese. In fact, Fabry and Tepperman (1970) concluded that an infrequent meal pattern was related to a tendency toward obesity. Snackers may spread out their calories over the course of the day rather than eating them all at once, thus engaging in a potentially protective eating pattern. Frequent snacking may serve to reduce hunger, which, according to Hill (1974) results in a more rapid eating rate and greater food consumption. Both of these factors very likely lead to eating beyond satiety. Eating rate could play an important role in the relationships among these eating behaviors and BMI. Sasaki, Katagiri, Tsuji, Shimoda, and Amano (2003) found a positive relationship between BMI and eating rate. This factor was not considered in the present study but its relationship with the eating behaviors is of potential interest in future research.

The present study confirms the previous null results that night eating does not predict obesity (Brewer et al., 2003; Kant et al., 1995). In a logistic regression comparing normal weight and overweight individuals, however, the odds ratio for night eating was significant. The odds ratio was less than one, indicating that the odds of being overweight decrease as night eating increases. Perhaps individuals who engage in night eating eat enough excess calories to become overweight but engage in some sort of compensatory behavior, such as physical activity or purging, that maintains their weight at the normal weight level. Or, it could be that as long as one eats a reasonable amount of calories in a day, weight gain will not occur, regardless of the distribution of those calories over the course of the day. Individuals who are prone to night eating may also be prone to morning anorexia (Stunkard, 1955 as cited in Napolitano, Head, Babyak, & Blumenthal, 2001), thereby simply shifting their patterns of consumption to later in the day, rather than increasing caloric intake. In this case, night eating would not result in a higher BMI.

Of note in the present study are the low correlations between physical activity and BMI, and physical activity and the eating behaviors. The correlations were negative but were all very small in magnitude with the largest being .10 (between the Brewer et al. snacking measure and physical activity). The negative direction of the correlations makes intuitive sense because one would expect greater physical activity to be associated with a lower BMI and, potentially, a healthier lifestyle and thus fewer maladaptive eating patterns. The small magnitude of the correlations suggests that physical activity is a less important determinant of BMI and eating behaviors than other factors.

Brewer et al. (2003) also identified race as a moderator in the relationship between eating beyond satiety and obesity. Race/ethnicity was not found to moderate the relationship between eating beyond satiety and BMI in the present study. It is possible that the relationship does not hold in the college population; Brewer et al. (2003) examined premenopausal women. The discrepancy in findings could also be explained by the difference in the statistical techniques used. Brewer et al. (2003) claimed that the relationship between eating beyond satiety and BMI was stronger in African-American women than in Caucasian women because the odds ratio was larger. They did not,

however, test to see if these ratios were significantly different and, in fact, the confidence intervals did overlap. The present study, on the other hand, looked for interactions with a more sensitive multiple regression technique.

In contrast, race/ethnicity moderated the relationship between hunger and BMI. Regression slopes indicated that little relationship existed between BMI and hunger in Caucasian Non-Hispanic participants and there was a small, negative relationship in Hispanic participants. In African-American Non-Hispanic participants, there was a strong, positive relationship between hunger and BMI. African-Americans have among the highest rates of obesity in the country. Any variable that sheds light on the possible reasons for this should be considered important. Perhaps African Americans are more sensitive to hunger cues or less able to resist the feeling of hunger. It is interesting, however, that while hunger and BMI were more strongly related in African-American Non-Hispanics than in the other two groups, African-Americans also had a lower eating beyond satiety mean than Caucasian Non-Hispanics. Future research must elucidate this relationship further.

Eating expectancies were found to correlate positively with BMI but, contrary to the study hypothesis, eating beyond satiety did not mediate this relationship. Both variables contribute to the prediction of BMI. This is the first study to systematically evaluate the effects of eating expectancies on BMI. Expectancies have long been known to predict behavior in the alcohol arena. Christiansen, Smith, Roehling, and Goldman (1989) found that alcohol expectancies at the age of 12 years predicted problem drinking one year later. Such findings in the obesity literature would extend the applicability of expectancy theory and make more explicit the similarities between unhealthy, addictive behaviors such as alcohol abuse and smoking, and a more necessary behavior like eating. It is important to note that eating is different from smoking or drinking because one cannot just go “cold turkey.” Eating is necessary to sustain life. Individuals, therefore, must be taught to adopt a healthier lifestyle rather than to go without food. Treatment goals in this case would be analogous to controlled drinking as opposed to abstinence. Controlled drinking has been suggested as a treatment goal by some, and may be

effective in some cases (see Cloud, McKiernan, & Cooper, 2003 for a review). However, also important to note is that there are those individuals who have trouble stopping their food consumption when they have had enough. This finding opens the door to the examination of eating as an addictive behavior. Expectancy challenges have been found to be effective in reducing problem drinking in the college population (e.g. Darkes & Goldman, 1993). Challenging an individual's expectancies about the positive effects of food or eating could prove to be an effective treatment for obesity. Helping individuals to realize that food is not an effective coping mechanism and helping them to find more adaptive coping mechanisms is important for those individuals who turn to food for solace or relief from negative affect, for example.

Self-reported cue reactivity was correlated with all four eating behaviors. However, because cue reactivity was not significantly correlated with BMI, a mediation analysis could not be conducted. It is curious that, in this case, self-reported cue reactivity did not predict BMI. It makes sense that self-reported cue reactivity would predict eating beyond satiety. Those individuals who feel stronger, longer, more difficult to resist urges when confronted with food cues or food-related stimuli are also those who are more likely to eat more than they need to. However, these individuals should also be those with higher BMI. It is possible that the self-reported cue reactivity scale was not powerful enough to detect food-related cue reactivity. Studies of cue reactivity tend to use slides or in vivo exposure to cues and then measure physiological and affective reactions to those cues. A self-report scale may not be able to detect these same reactions. In fact, participants may not even realize that these associations exist. Classical and operant conditioning operate outside of conscious realization. Therefore, a more behavioral paradigm may be required to detect such associations.

Another question posed by the present study was whether eating beyond satiety represents a phenomenon distinct from binge eating or whether it represents a form of subclinical binge behavior. The results suggest that, in fact, eating beyond satiety does not account for variance in BMI over and above binge eating, whether considered as a discrete diagnosis or a continuum of symptomatology. These findings suggest that

overeating may best be viewed as a continuum with eating beyond satiety representing a lesser degree of overeating while binge eating represents its clinical manifestation. In this case, the question becomes whether, for some individuals, this subclinical overeating might precede more severe binge episodes. It is likely that, in some individuals, escalation is unlikely. However, for others, there may be a tendency to start small and get bigger. In this case, identification of predictors and risk factors for eating beyond satiety becomes key. Once identified, these predictors can inform treatment and prevention efforts which should lead to two effects. One would be to affect BMI since eating beyond satiety is a significant predictor of BMI. The other would be to prevent future eating disorders, whether bulimia or binge eating disorder, which are both characterized by episodes of binge eating. The hypothesized model is thus: eating beyond satiety represents a subclinical form of binge eating. In some, this subclinical symptom progresses to the point of becoming a clinically significant binge eating episode. By treating and/or preventing eating beyond satiety, we prevent the development of future eating disorders. It should be noted, however, that there was a strong trend for eating beyond satiety to account for additional variance in BMI when binge eating was considered as a categorical variable. This finding is puzzling because it stands in contrast to what is found when binge eating is considered as a continuous variable. It is difficult to explain why this might be.

Limitations

There is a danger that in a sample of undergraduate students, the variability of weight may be limited. However, while the percentages of individuals who fall into each BMI category did not match population values, the sample in the present study had good variability ($SD = 5.29$).

Other limitations include the cross-sectional nature of the data. No causal conclusions can be drawn, but future prospective studies can help clarify causal issues. A self-report bias may also be present in the reporting of height and weight, but research has shown that self-reported weight is, in general, fairly accurate. Rowland (1990) compared actual and self-reported weight and found that men tend to overreport weight

by 0.4 kg and that women tend to underreport weight by 1.0 kg. He also found that men overreport their height by 1.4 cm and that women overreport their height by 0.6 cm. In the present study, participants were anonymous and were reporting from the privacy of their own computers.

Another potential weakness is with the BMI measurement itself. While it is widely used as the standard in obesity research, it can fail to reflect other aspects of body composition such as high levels of muscularity (Stice et al., 2005) or central adiposity, which has been shown to be an independent predictor of cardiovascular reactivity even in adolescents (Goldbacher, Matthews, & Salomon, 2005). Finally, this study examined only college age females in three specific racial/ethnic groups and may not generalize to males and to members of other racial/ethnic groups.

Future Research

The present study raises more questions than it answers. Future research is needed to identify whether or not eating beyond satiety is predictive of obesity onset or, rather, if it acts as a maintaining factor. The role of hunger in the path to obesity also continues to remain unclear. While hunger is predictive of current BMI, it is also possible that it plays a role in a causal path to overweight by encouraging overeating. Future research can also identify whether individuals who show stronger reactions during cue exposure tasks are those with higher BMI. More research is also needed to determine risk factors for and predictors of eating beyond satiety.

Another potentially fruitful path is in the implementation of treatment and prevention strategies. Incorporating training on learning to identify satiety signals and to cease eating when they are recognized may be a fertile avenue in the treatment of obesity. If, in fact, eating beyond satiety is predictive of obesity onset, then prevention efforts focusing on teaching individuals to stop eating when they are full could prove worthwhile.

The present study replicated the finding that eating beyond satiety predicts BMI and has extended this finding to the college age group. It appears, therefore, that this is a

fairly robust phenomenon. Importantly, the present study has opened the field of eating behaviors as a potentially rewarding avenue in the study of the causes, treatments, and prevention of overweight and obesity, considerable problems for contemporary society.

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Appendices

Appendix A: Paffenbarger Physical Activity Questionnaire

1. How many city blocks or their equivalent do you normally walk each day?
 _____blocks/day (Let 12 blocks = 1 mile)
2. What is your usual pace of walking? (Please check one.)
 - a. _____Casual or strolling (less than 2 mph)
 - b. _____Average or normal (2 to 3 mph)
 - c. _____Fairly brisk (3 to 4 mph)
 - d. _____Brisk or striding (4 mph or faster)
3. How many flights of stairs do you climb up each day? _____flights/day (Let 1 flight = 10 steps)
4. List any sports or recreation you have actively participated in during the past year.
 Please remember seasonal sports or events.

| Sport, Recreation, or Other Physical Activity | Number of Times/year | Average Time/Episode | | Years Participation |
|---|----------------------|----------------------|---------|---------------------|
| | | Hours | Minutes | |
| a. | | | | |
| b. | | | | |
| c. | | | | |
| d. | | | | |
| e. | | | | |
| f. | | | | |

5. Which of these statements best expresses your view (Please check one.)
 - a. _____I take enough exercise to keep healthy.
 - b. _____I ought to take more exercise.
 - c. _____Don't know

Appendix A (Continued)

6. At least once a week do you engage in regular activity akin to brisk walking, jogging, bicycling, swimming, etc. long enough to work up a sweat, get your heart thumping, or get out of breath?

____ No Why not? _____

____ Yes How many times per week? ____ Activity: ____

7. When exercising in your usual fashion, how would you rate your usual level of exertion (degree of effort)? (Please circle one number.)

____ 0 Normal

____ 0.5 Very very weak (just noticeable)

____ 1 Very weak

____ 2 Weak

____ 3 Moderate

____ 4 Somewhat Strong

____ 5 Strong (heavy)

____ 6

____ 7 Very strong

____ 8

____ 9

____ 10 Very very strong (almost maximal)

Appendix A (Continued)

8. On a usual weekday and a weekend day, how much time do you spend on the following activities? Total each day should add up to 24 hours.

| | Usual Weekday Hours/day | Usual Weekend Day Hours/day |
|---|----------------------------|--------------------------------|
| a. Vigorous activity (digging in the garden, strenuous sports, jogging, aerobic dancing, sustained swimming, brisk walking, heavy carpentry, bicycling on hills, etc.) | | |
| b. Moderate activity (housework, light sports, regular walking, golf, yard work, lawn mowing, painting, repairing, light carpentry, ballroom dancing, bicycling on level ground, etc.) | | |
| c. Light activity (office work, driving car, strolling, personal care, standing with little motion, etc.) | | |
| d. Sitting activity (eating, reading, desk work, watching TV, listening to radio, etc.) | | |
| e. Sleeping or reclining | | |

Appendix B: Eating Disorder Diagnostic Scale

Please carefully complete all questions.

| Over the past 3 months... | Not at all | | | | | Slightly | | | Moderately | | | Extremely | | | |
|--|------------|---|---|---|---|----------|---|---|------------|---|----|-----------|----|----|----|
| 1. Have you felt fat? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | |
| 2. Have you had a definite fear that you might gain weight or become fat? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | |
| 3. Has your weight influenced how you think about (judge) yourself as a person? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | |
| 4. Has your shape influenced how you think about (judge) yourself as a person? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | |
| 5. During the past 6 months have there been times when you felt you have eaten what other people would regard as an unusually large amount of food (e.g. a quart of ice cream) given the circumstances? YES NO | | | | | | | | | | | | | | | |
| 6. During the times when you ate an unusually large amount of food, did you experience a loss of control (feel you couldn't stop eating or control what or how much you were eating)? YES NO | | | | | | | | | | | | | | | |
| 7. How many DAYS per week on average over the past 6 MONTHS have you eaten an unusually large amount of food and experienced a loss of control? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | | | | | | |
| 8. How many TIMES per week on average over the past 3 MONTHS have you eaten an unusually large amount of food and experienced a loss of control? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |

Appendix B (Continued)

During these episodes of overeating and loss of control did you...

9. Eat much more rapidly than normal? YES NO
10. Eat until you felt uncomfortably full? YES NO
11. Eat large amounts of food when you didn't feel physically hungry? YES NO
12. Eat alone because you were embarrassed by how much you were eating? YES
NO
13. Feel disgusted with yourself, depressed, or very guilty after overeating? YES
NO
14. Feel very upset about your uncontrollable overeating or resulting weight gain?
YES NO
15. How many times per week on average over the past 3 months have you made yourself vomit to prevent weight gain or counteract the effects of eating?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
16. How many times per week on average over the past 3 months have you used laxatives or diuretics to prevent weight gain or counteract the effects of eating?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
17. How many times per week on average over the past 3 months have you fasted (skipped at least 2 meals in a row) to prevent weight gain or counteract the effects of eating?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
18. How many times per week on average over the past three months have you engaged in excessive exercise specifically to counteract the effects of overeating episodes?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Appendix C: Eating Beyond Satiety Questionnaire

1. I continue to eat after I am full.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

2. I keep on eating even though I am no longer hungry.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

3. When I start eating, I just can't seem to stop.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

4. I eat until I feel uncomfortably full.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

5. I eat food even when I am not hungry.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

6. I feel uncomfortably full after eating.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

7. I leave some food on my plate.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

8. Even though I am full, it is hard for me to stop eating before I finish the food on my plate.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

Appendix C (Continued)

9. I have seconds at a meal even though I am full.

| | | | | |
|-------|-------------|-------------------------|-------|-------------------------|
| 1 | 2 | 3 | 4 | 5 |
| never | once a week | several times a week | daily | more than once a day |

10. When I am full, I skip dessert.

| | | | | |
|-------|-----------|-------|------------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

Appendix D: Snacking Questionnaire

1. I eat **ONLY** breakfast, lunch, and dinner – nothing else.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

2. I eat between meals.

| | | | | |
|-------|-------------|-------------------------|-------|-------------------------|
| 1 | 2 | 3 | 4 | 5 |
| never | once a week | several times a week | daily | more than once a day |

3. How often do you have a snack in the morning?

| | | | | |
|--------------------------|-------------------------|-------------------------|-------------------------|-----------|
| 1 | 2 | 3 | 4 | 5 |
| less than once a week | 1 or 2 days per week | 3 or 4 days per week | 5 or 6 days per week | every day |

4. How often do you have a snack in the afternoon?

| | | | | |
|--------------------------|-------------------------|-------------------------|-------------------------|-----------|
| 1 | 2 | 3 | 4 | 5 |
| less than once a week | 1 or 2 days per week | 3 or 4 days per week | 5 or 6 days per week | every day |

5. How often do you have a snack in the evening?

| | | | | |
|--------------------------|-------------------------|-------------------------|-------------------------|-----------|
| 1 | 2 | 3 | 4 | 5 |
| less than once a week | 1 or 2 days per week | 3 or 4 days per week | 5 or 6 days per week | every day |

6. I am the kind of person who eats 3 meals a day: breakfast, lunch and dinner.

| | | | | |
|--------------------------|-------------------------|-------------------------|-------------------------|-----------|
| 1 | 2 | 3 | 4 | 5 |
| less than once a week | 1 or 2 days per week | 3 or 4 days per week | 5 or 6 days per week | every day |

Appendix E: Hunger Questionnaire

1. I get so hungry that my stomach feels like a bottomless pit.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

2. After breakfast, how long is it before you feel hungry enough to eat again?

| | | | | |
|-----------|-----------|-----------|--------------|---------|
| 1 | 2 | 3 | 4 | 5 |
| 0-1 hours | 1-2 hours | 2-3 hours | over 3 hours | I don't |

3. After lunch, how long is it before you feel hungry enough to eat again?

| | | | | |
|-----------|-----------|-----------|--------------|---------|
| 1 | 2 | 3 | 4 | 5 |
| 0-1 hours | 1-2 hours | 2-3 hours | over 3 hours | I don't |

4. After dinner, how long is it before you feel hungry enough to eat again?

| | | | | |
|-----------|-----------|-----------|--------------|---------|
| 1 | 2 | 3 | 4 | 5 |
| 0-1 hours | 1-2 hours | 2-3 hours | over 3 hours | I don't |

5. I am hungry enough to eat at any time.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

6. My stomach rumbles because I am so hungry.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

7. In between meals, I feel hungry.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

Appendix F: Night Eating Scale

1. How often do you eat a lot of food after dinner but before bedtime?

| | | | | |
|--------------------------|-------------------------|-------------------------|-------------------------|-----------|
| 1 | 2 | 3 | 4 | 5 |
| less than once a week | 1 or 2 days per week | 3 or 4 days per week | 5 or 6 days per week | every day |

2. About how much of your daily food intake do you consume *after* dinnertime?

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

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

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

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

| | | | | |
|-------|-----------|------------------------|---------|--------|
| 0 | 1 | 2 | 3 | 4 |
| Never | Sometimes | About half the Time | Usually | Always |

5. 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 |

6. How often do you find yourself eating or drinking (not including water or diet drinks) throughout much of the evening (after dinner)?

| | | | | |
|--------------------------|-------------------------|-------------------------|-------------------------|-----------|
| 1 | 2 | 3 | 4 | 5 |
| less than once a week | 1 or 2 days per week | 3 or 4 days per week | 5 or 6 days per week | every day |

7. When I get up in the middle of the night, I eat a snack.

| | | | | |
|-------|-----------|-------|---------------|--------|
| 1 | 2 | 3 | 4 | 5 |
| never | sometimes | often | almost always | always |

Appendix G: Brewer et al. (2003) Items

1. How often do you eat during the two hours before your bedtime?

| | | | |
|-----------------|-------------------------------------|-----------------------|-----------------|
| 1 | 2 | 3 | 4 |
| rarely or never | occasionally (at least once a week) | more than once a week | nearly everyday |

2. How often do you eat between meals?

| | | | |
|-----------------|-------------------------------------|-----------------------|-----------------|
| 1 | 2 | 3 | 4 |
| rarely or never | occasionally (at least once a week) | more than once a week | nearly everyday |

3. How often do you feel really hungry even though you have eaten adequately within the last three hours?

| | | | |
|-----------------|-------------------------------------|-----------------------|-----------------|
| 1 | 2 | 3 | 4 |
| rarely or never | occasionally (at least once a week) | more than once a week | nearly everyday |

4. How often do you keep eating at meals even though you are not hungry anymore?

| | | | |
|-----------------|-------------------------------------|-----------------------|-----------------|
| 1 | 2 | 3 | 4 |
| rarely or never | occasionally (at least once a week) | more than once a week | nearly everyday |

Appendix H: Eating Expectancies Inventory

Read each statement and circle the number of the response which most closely matches your level of agreement. Please respond to the items in terms of what the word “eating” means to you. There are no right or wrong answers. Choose only one response for each item. Do not leave any items blank.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--|------------------------|--------------------|----------------------|----------------------------------|-------------------|-----------------|---------------------|
| | completely disagree | mostly disagree | slightly disagree | neither agree nor disagree | slightly agree | mostly agree | completely agree |
| 1. Eating makes me feel loved. | | | | | | | 1 2 3 4 5 6 7 |
| 2. When I am feeling depressed or upset, eating can help me take my mind off my problems. | | | | | | | 1 2 3 4 5 6 7 |
| 3. Eating makes me feel out of control. | | | | | | | 1 2 3 4 5 6 7 |
| 4. Eating fills some emotional need. | | | | | | | 1 2 3 4 5 6 7 |
| 5. When I am feeling anxious or tense, eating helps me relax. | | | | | | | 1 2 3 4 5 6 7 |
| 6. I don't see eating as a pleasurable event. | | | | | | | 1 2 3 4 5 6 7 |
| 7. Eating helps me deal with feelings of inadequacy about myself. | | | | | | | 1 2 3 4 5 6 7 |
| 8. Eating doesn't help me deal with boredom. | | | | | | | 1 2 3 4 5 6 7 |
| 9. When I have nothing to do, eating helps relieve the boredom. | | | | | | | 1 2 3 4 5 6 7 |
| 10. When I eat, I often feel I am not in charge of my life. | | | | | | | 1 2 3 4 5 6 7 |

Appendix H (Continued)

- | | |
|--|---------------|
| 11. When I am feeling anxious, eating does not make me feel calmer. | 1 2 3 4 5 6 7 |
| 12. Eating serves as an emotional release. | 1 2 3 4 5 6 7 |
| 13. Eating seems to decrease my level of anxiety if I am feeling tense or stressed. | 1 2 3 4 5 6 7 |
| 14. Eating is a good way to celebrate. | 1 2 3 4 5 6 7 |
| 15. When I do something good, eating is a way to reward myself. | 1 2 3 4 5 6 7 |
| 16. Eating isn't useful as a reward for me. | 1 2 3 4 5 6 7 |
| 17. I don't get a sense of security or safety from eating. | 1 2 3 4 5 6 7 |
| 18. If I have nothing planned to do during the day, eating isn't something that would help me fill the time. | 1 2 3 4 5 6 7 |
| 19. Eating helps me think and study better. | 1 2 3 4 5 6 7 |
| 20. Eating is fun and enjoyable. | 1 2 3 4 5 6 7 |
| 21. My eating behavior often results in a feeling that I am not in control. | 1 2 3 4 5 6 7 |
| 22. When I work hard or accomplish something, eating doesn't serve as a good reward. | 1 2 3 4 5 6 7 |
| 23. Eating is something to do when you feel bored. | 1 2 3 4 5 6 7 |
| 24. Eating is a way to vent my anger. | 1 2 3 4 5 6 7 |

Appendix H (Continued)

- | | |
|--|---------------|
| 25. Eating helps me avoid uncomfortable social situations. | 1 2 3 4 5 6 7 |
| 26. When I am angry at my parents, spouse or friends, eating helps me get back at them. | 1 2 3 4 5 6 7 |
| 27. When I am faced with difficult tasks, eating can help me avoid doing them. | 1 2 3 4 5 6 7 |
| 28. Eating helps me forget or block out negative feelings, like depression, loneliness, or fear. | 1 2 3 4 5 6 7 |
| 29. Eating calms me when I am feeling stressed, anxious, or tense. | 1 2 3 4 5 6 7 |
| 30. Eating can help me bury my emotions when I don't want to feel them. | 1 2 3 4 5 6 7 |
| 31. Eating helps me work better. | 1 2 3 4 5 6 7 |
| 32. Eating helps me cope with negative emotions. | 1 2 3 4 5 6 7 |
| 33. Eating does not make me feel out of control. | 1 2 3 4 5 6 7 |
| 34. Eating helps me deal with sadness or emotional pain. | 1 2 3 4 5 6 7 |

Appendix I: Self-Reported Cue Reactivity Questionnaire

1. If you walk past a bakery, how long do you desire to eat something?

| | | | | |
|------------------------|------------------|----------------|-----------------|----------------------|
| 1 | 2 | 3 | 4 | 5 |
| at most, a few seconds | about 30 seconds | about a minute | several minutes | five minutes or more |

2. If you see or smell something delicious, how strong is your desire to eat it?

| | | | | |
|-------------------|-----------------|-------------------|-------------|------------------|
| 1 | 2 | 3 | 4 | 5 |
| not strong at all | somewhat strong | moderately strong | very strong | extremely strong |

3. When your favorite foods are around the house, how difficult is it to resist eating them?

| | | | | |
|--------------------------------|------------------------------|--------------------------------|--------------------------|-------------------------------|
| 1 | 2 | 3 | 4 | 5 |
| not at all difficult to resist | somewhat difficult to resist | moderately difficult to resist | very difficult to resist | extremely difficult to resist |

4. If you see others eating, how strong is your desire to eat too?

| | | | | |
|-------------------|-----------------|-------------------|-------------|------------------|
| 1 | 2 | 3 | 4 | 5 |
| not strong at all | somewhat strong | moderately strong | very strong | extremely strong |

5. If you walk past a snack bar or café, how difficult is it to resist your desire to eat something?

| | | | | |
|--------------------------------|------------------------------|--------------------------------|--------------------------|-------------------------------|
| 1 | 2 | 3 | 4 | 5 |
| not at all difficult to resist | somewhat difficult to resist | moderately difficult to resist | very difficult to resist | extremely difficult to resist |

6. If you walk past a bakery, how strong is your desire to eat something?

| | | | | |
|-------------------|-----------------|-------------------|-------------|------------------|
| 1 | 2 | 3 | 4 | 5 |
| not strong at all | somewhat strong | moderately strong | very strong | extremely strong |

Appendix I (Continued)

7. When appealing food comes up in conversation or in something you read, how long do you desire to eat something?

| | | | | |
|------------------------|------------------|----------------|-----------------|----------------------|
| 1 | 2 | 3 | 4 | 5 |
| at most, a few seconds | about 30 seconds | about a minute | several minutes | five minutes or more |

8. If you see or smell something delicious, how long do you desire to eat it?

| | | | | |
|------------------------|------------------|----------------|-----------------|----------------------|
| 1 | 2 | 3 | 4 | 5 |
| at most, a few seconds | about 30 seconds | about a minute | several minutes | five minutes or more |

9. If you walk past a bakery, how difficult is it to resist your desire to eat something?

| | | | | |
|--------------------------------|------------------------------|--------------------------------|--------------------------|-------------------------------|
| 1 | 2 | 3 | 4 | 5 |
| not at all difficult to resist | somewhat difficult to resist | moderately difficult to resist | very difficult to resist | extremely difficult to resist |

10. When appealing food comes up in conversation or in something you read, how strong is your desire to eat something?

| | | | | |
|-------------------|-----------------|-------------------|-------------|------------------|
| 1 | 2 | 3 | 4 | 5 |
| not strong at all | somewhat strong | moderately strong | very strong | extremely strong |

11. If you walk past a snack bar or café, how strong is your desire to eat something?

| | | | | |
|-------------------|-----------------|-------------------|-------------|------------------|
| 1 | 2 | 3 | 4 | 5 |
| not strong at all | somewhat strong | moderately strong | very strong | extremely strong |

12. If you see or smell something delicious, how difficult is it to resist your desire to eat it?

| | | | | |
|--------------------------------|------------------------------|--------------------------------|--------------------------|-------------------------------|
| 1 | 2 | 3 | 4 | 5 |
| not at all difficult to resist | somewhat difficult to resist | moderately difficult to resist | very difficult to resist | extremely difficult to resist |

Appendix I (Continued)

13. When your favorite foods are around the house, how strong is your desire to eat them?

| | | | | |
|----------------------|--------------------|----------------------|-------------|---------------------|
| 1 | 2 | 3 | 4 | 5 |
| not strong at all | somewhat strong | moderately strong | very strong | extremely strong |

14. If you see others eating, how long do you desire to eat something?

| | | | | |
|---------------------------|---------------------|-------------------|--------------------|-------------------------|
| 1 | 2 | 3 | 4 | 5 |
| at most, a few seconds | about 30 seconds | about a minute | several minutes | five minutes or more |

15. When appealing food comes up in conversation or in something you read, how difficult is it to resist your desire to eat something?

| | | | | |
|--------------------------------------|------------------------------------|--------------------------------------|-----------------------------|-------------------------------------|
| 1 | 2 | 3 | 4 | 5 |
| not at all difficult to resist | somewhat difficult to resist | moderately difficult to resist | very difficult to resist | extremely difficult to resist |

16. If you walk past a snack bar or café, how long do you desire to eat something?

| | | | | |
|---------------------------|---------------------|-------------------|--------------------|-------------------------|
| 1 | 2 | 3 | 4 | 5 |
| at most, a few seconds | about 30 seconds | about a minute | several minutes | five minutes or more |

17. If you see others eating, how difficult is it to ignore your desire to eat something?

| | | | | |
|--------------------------------------|------------------------------------|--------------------------------------|-----------------------------|-------------------------------------|
| 1 | 2 | 3 | 4 | 5 |
| not at all difficult to resist | somewhat difficult to resist | moderately difficult to resist | very difficult to resist | extremely difficult to resist |

18. When your favorite foods are in the house, how long do you desire to eat something?

| | | | | |
|---------------------------|---------------------|-------------------|--------------------|-------------------------|
| 1 | 2 | 3 | 4 | 5 |
| at most, a few seconds | about 30 seconds | about a minute | several minutes | five minutes or more |

Appendix J: Demographic Information

Please provide the following information accurately and honestly. It is very important that the information is correct. Please remember that this study is anonymous and your name will not appear anywhere on these forms.

Age: _____

Year in school:

_____ Freshman

_____ Sophomore

_____ Junior

_____ Senior

Major: _____

Marital Status:

_____ Single

_____ Casually dating

_____ Serious dating relationship

_____ Living with a partner

_____ Engaged

_____ Married

_____ Separated

_____ Divorced

_____ Widow or widower

_____ Other (Please specify: _____)

Appendix J (Continued)

Are you currently dieting? Yes No

Which diet plan are you following?

_____ Atkins

_____ Low-carb

_____ Low-fat

_____ Counting calories

_____ South Beach

_____ Jenny Craig

_____ Weight Watchers

_____ Other (Please specify: _____)

Race/Ethnicity (circle only one):

African American Non-Hispanic

Caucasian Non-Hispanic

Hispanic

Other

Weight in pounds: _____

Height: _____

About the Author

Tovah Yanover earned a degree in Scholar's Electives: French and Psychology from the University of Western Ontario in June 2003. The following September, she began her graduate studies in Clinical Psychology at the University of South Florida as the recipient of a Presidential Doctoral Scholarship.

Tovah has twice attended the annual meeting of the Society of Behavioral Medicine and was the first author on several posters presented at these meetings. She also has several manuscripts in preparation based on the data from these posters.

In her spare time, Tovah enjoys spending time with her pet rabbit, Edgar. She loves to cook and she is an avid recipe collector. She also loves to travel, especially to New York City and to any European destination.