BINGE EATING ANTECEDENTS AMONG FEMALE COLLEGE STUDENTS: AN ECOLOGICAL MOMENTARY ASSESSMENT STUDY

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A Dissertation

Submitted to the Graduate College of Bowling Green State University in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2007

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ABSTRACT

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Using ecological momentary assessment with female binge eaters, this investigation compared binge eating episodes, regular meals, and non-eating episodes (i.e., random prompts) on mood, dietary restraint, stress, and body dissatisfaction. This study also examined whether binge episodes were greater in total calories than regular meals and whether weight status or size of a binge were associated with the psychological antecedents. It was hypothesized that participants would report greater depression, dietary restraint, stress, and body dissatisfaction immediately prior to binge episodes compared to regular meals and random prompts. Also, it was hypothesized that binges would contain greater calories than regular meals and that overweight/obese bingers would report larger binges than normal weight bingers. Eighteen normal weight and 20 overweight/obese female college students meeting the criteria for binge eating disorder or subthreshold binge eating disorder participated in this study. They completed a 3-day food diary and an 11-day binge eating diary. Participants recorded mood, dietary restraint, stress, and body dissatisfaction in response to binges, regular meals, and random prompts for two weeks. Generalized estimating equations (GEE) examined the differences among binge episodes, regular meals, and random prompts on the psychological antecedents. GEE also examined the association between weight status and psychological antecedents during binge episodes, regular meals, and random prompts as well as the association between calorie content of the binge and psychological antecedents. Results showed that depression, stress, and body dissatisfaction were greater prior to binge episodes than regular meals and random prompts. Dietary restraint was
greater prior to binge episodes than regular meals. Being normal weight was associated with
greater dietary restraint prior to binge episodes. Binge episodes also contained greater caloric
totals than regular meals; however binges with greater caloric intake were not preceded by
greater depression, dietary restraint, stress, and body dissatisfaction. The caloric total of a binge
eating episode did not differ between overweight/obese and normal weight bingers. Interventions
that help participants increase their understanding of binge antecedents as well as teach coping
strategies to reduce high risk situations are likely to be successful at helping binge eaters reduce
the occurrence of binge eating episodes. Also, due to the increased prevalence rates of
overweight and obesity, and the prevalence of binge eating among these groups, weight
management will be an essential component for binge eating interventions. Future studies could
examine more closely how dietary restraint differs between normal weight and overweight/obese
binge eaters.
To my husband, Brian, for inspiring me to keep writing, and to my son, William, for inspiring me to finish!
ACKNOWLEDGMENTS

I would like to extend a thank you to all people involved in this process, especially my advisor, Dr. Robert Carels, for all his invaluable assistance in providing prompt feedback on my drafts, teaching me about complex methodology and statistics, and for being available for help at any time. Since the day I arrived in Bowling Green he has provided me with many great opportunities to become involved in behavioral medicine interventions and to write up papers for publication. I also want to thank my other committee members: Drs. William O’Brien, Steve Jex, and Viktoria Ekstrand for their constructive feedback and valuable contributions to this process.

I would also like to thank my research assistant, Molly Biglin, who spent many hours reading over and entering data from all participants’ food diaries. Moreover, I am grateful to my participants who shared so much personal information and devoted their time to this research project. Also, thank you, Shanna for being such a great friend and colleague during graduate school – it would not have been as fun without having you there to share my accomplishments (and at times, my frustrations) and frozen meals at placement.

Finally, I would like to thank my family who has encouraged me to focus on the big picture when I was caught up in details. In particular, I would like to thank my husband, Brian, whose great passion for statistical analyses helped to keep my motivation high on many late nights of work. My sincere thanks also go to my parents Bodil and Lars, who always remind me that I can do whatever I set my mind to, and to my sister, Maria, who has spent many hours on the phone with me when I needed someone to talk to. Despite the geographical distance my parents and sister are always close to my heart. Last, but not least, another person that has been influential and inspiring during the past year is my son, William, who was born between dissertation proposal and defense.
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CHAPTER I. INTRODUCTION

Binge Eating Defined

Binge eating has been recognized as a maladaptive eating pattern and is a term that is commonly used in the eating disorder literature to indicate someone who struggles with eating a large amount of food in a discrete period of time accompanied with a loss of control (Marcus, 1993). Binge eating disorder (BED), a chronic and severe form of binge eating, is listed in the Diagnostic and Statistical Manual of Mental Disorders-IV ([DSM-IV-TR] American Psychiatric Association, 2000). In order to meet the diagnostic criteria for binge eating disorder, the binge eating episodes must be associated with (1) eating, in a discrete period of time (e.g., within a 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances, (2) a sense of loss of control during these episodes of overeating, and (3) at least three of the following symptoms must be present: (a) eating much more rapidly than normal; (b) eating until feeling uncomfortably full; (c) eating large amounts of food when not feeling physically hungry; (d) eating alone because of feeling embarrassed about the quantity of food one is eating; or (e) feeling disgusted with oneself, depressed, or guilty after a binge eating episode. Significant psychological distress must also accompany the binge eating. Compensatory behaviors, such as purging or excessive exercise, must not accompany the binge eating episode (APA, 1994).

Researchers have found the criterion “eating an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances” to be difficult to operationalize. While some researchers have used a cutpoint of 500 calories to determine binge eating episodes (e.g., Grilo, Shiffman, & Carter-Campbell, 1994) others have
not reported the calorie intake of the binge episodes (e.g., Le Grange, Gorin, Catley, & Stone, 2001).

Correlates of Binge Eating

Researchers have identified a number of psychological correlates of binge eating disorder (Lloyd-Richardson, King, Forsyth, & Clark, 2000; Marcus, 1993; Striegel-Moore, Wilson, Wilfley, Elder & Brownell, 1998; Telch & Stice, 1998). For example, Striegel-Moore et al. (1998) found that women with BED were more depressed, had lower self-esteem, and reported greater body dissatisfaction than non-binge eaters. Subthreshold binge eaters (i.e., they do not meet the twice per week DSM-IV frequency criterion, but they report binges once per week) also reported higher levels of these traits than non-bingers (but lower than individuals with BED), indicating a continuum of increasing psychological disturbance and poor body image with increasing binge eating. Similarly, in a community sample, lifetime prevalence rates for major depression and any Axis I or Axis II disorders were higher in women with BED compared to non-bingers (Telch & Stice, 1998). An extensive literature linking psychological distress with binge eating underscores the importance of increasing the understanding of the development, maintenance, and treatment of this disorder.

Prevalence of Binge Eating

It is estimated that binge eating disorder affects 2% to 5% of all adults, or about 1 million to 2 million Americans (Hagan, Shuman, Oswald, Corcoran, Profitt, Blackburn, et al., 2002). Substantial data indicates that many normal weight college students engage in binge eating (Striegel-Moore, Silberstein, Frensch, & Rodin, 1989; Schwinzer, Bergholtz, Dore, & Salimi, 1998). While there is a lack of research on the prevalence of binge eating disorder among college women the estimated prevalence of subthreshold eating disorders (i.e., binging once per week as
opposed to twice per week) in college females is between 23% and 30% (Mintz, O'Halloran, Mulholland, & Schneider, 1997). As mentioned earlier, prospective studies assessing eating patterns in normal-weight female college students suggest that a significant number of women evidence increased eating pathology over the course of an academic year (Cooley & Toray, 2001; Striegel-Moore et al., 1989).

**Binge Eating Etiology**

The etiology of binge eating has received considerable attention among researchers (Heatherton & Baumeister, 1991; Polivy & Herman, 1993). It has been theorized that binge eating disorder, bulimia, and anorexia represent a class of maladaptive eating patterns that appear to be influenced by similar distal and proximal factors (Smyth, Wonderlich, Crosby, Miltenberger, Mitchell, & Rorty, 2001). Distal factors, such as body dissatisfaction and strict dieting are believed to be the result of Western society’s emphasis on thinness and weight loss (Polivy & Herman, 1993). Chronic dieting appears to make a person more vulnerable to binge eating as one’s body becomes food deprived and overeating occurs (Polivy & Herman, 1993). In addition, both body dissatisfaction and dieting have been associated with low self-esteem (Polivy & Herman, 1993), another distal correlate of eating pathology. However, it is difficult to accurately determine how these distal factors directly influence acute binge eating episodes (Polivy & Herman, 1993). Therefore, the study of proximal antecedents to binge eating episodes has gained attention in the binge eating literature. The search for proximal antecedents of binge eating episodes has begun by examining whether binge eating is preceded by acute exacerbations of many common distal factors. For example, researchers have begun to examine whether acute exacerbations of negative mood, dietary restraint, stress, and body dissatisfaction are common precursors of binge eating episodes. While considerable research has been conducted to examine
binge antecedents, much research has been hindered by methodological limitations. Most researchers have used self-report questionnaires and retrospective interviews, each of which has methodological limitations (e.g., inaccurate recall, social desirability, limited external validity, and lack of information on the caloric content of a binge). While researchers have also examined correlates of binge eating using daily diaries, these studies are limited in making conclusions about the immediate antecedents of binge episodes.

Another limitation is that many studies only assess antecedents to binge eating episodes while not assessing antecedents of non-binge meals and non-meal episodes, hindering important comparisons. Finally, several studies on binge antecedents fail to report the caloric intake of binges, making it difficult to conclude whether large quantities of food are being consumed during a reported binge. With these limitations in mind, the following literature review examines studies on binge antecedents (i.e., negative mood, dietary restraint, stress, and body dissatisfaction) among binge eaters in the general population and in the college population, noting the respective methodological strengths and weaknesses.
CHAPTER II. LITERATURE REVIEW

_Binge Eating Antecedents_

As noted above, previous research suggests that plausible binge eating antecedents are negative mood, dietary restraint, stress, and body dissatisfaction (Greeno, Wing, & Shiffman, 2000; Heatherton & Baumeister, 1991; Polivy & Herman, 1993). Past studies have commonly examined these binge antecedents using retrospective interviews, questionnaires, daily diaries, and ecological momentary assessment. The following section will review previous research investigating each of these antecedents.

Negative Mood and Binge Eating

Negative mood is a generic term for a variety of more specific negative emotional states that have been studied in the binge eating literature. For example, depression, anxiety, and boredom frequently appear in the literature. The variety of operational definitions of negative affect presents interpretive challenges to any researcher attempting to understand binge eating antecedents.

Operational definitions aside, Escape Theory (Heatherton & Baumeister, 1991) stands as a prominent theoretical explanation for how negative mood can trigger binge eating. According to escape theory, binge eating represents an effort to escape negative affect caused by maladaptive cognitions about the self (e.g., “I’m worthless”). These maladaptive cognitions often include condemnation over body shape and size. As the binge eater becomes more focused on the immediate and pleasurable characteristics of the food (e.g., taste, texture, smell), she becomes less focused on her more threatening negative self cognitions. The attention toward food represents a shift from the more upsetting and threatening internal stimuli to more comforting environmental stimuli. While the binge eating provides short-term relief from the
negative thoughts (i.e., eating is reinforcing), it can exacerbate the negative and maladaptive self cognitions following the binge. Following the binge, the binge eater is likely to feel guilty, self-contemptuous, and depressed due to the loss of control over dietary restraint, which is often secondary to a desire to be thin. In the end, guilt about the uncontrolled eating may intensify negative emotions, resulting in further binge-eating episodes (Heatherton & Baumeister, 1991). Escape theory has evolved as a plausible explanation of initiation and maintenance of binge eating episodes. Negative mood has been studied using a variety of methods, such as retrospective interviews, questionnaires, and ecological momentary assessment.

Negative Mood, Binge Eating, and Retrospective Interviews. Interviews have been used to examine whether negative mood is an antecedent to binge eating. For example, utilizing a telephone interviewing methodology approximately 2.5 days after a binge, Grilo et al., (1994) examined negative affect prior to binging among 50 normal weight college women. The inclusion criterion for the investigation was an average binge frequency of more than once every two weeks but not more than once every two days. Binging was defined as the consumption of greater than 500 calories in a discrete period of time while experiencing a subjective sense of loss of control. Grilo et al. (1994) found that 87% of binges among their sample were preceded by negative moods. Despite the many strengths of this investigation, a prominent limitation is that a phone interview assessing a distant past event may provide biased estimates of self-reported antecedents and caloric intake.

Negative Mood, Binge Eating, and Questionnaires. Studies have also relied on questionnaires to examine the relationship between negative mood and binge eating. For example, Lynch, Everingham, Dubitzky, Hartman, and Kasser (2000) assessed binge antecedents among male and female college students. Using self-report questionnaires, participants were
asked to recall past binge eating episodes and to report their emotions ten minutes prior to a typical binge episode. Depression and anxiety were the most common antecedents of binge eating episodes. However, Lynch et al.’s (2000) study relied entirely on participants’ self-reports of binge episodes and retrospective reports of emotional antecedents of these episodes. It is quite plausible that a participant’s idiosyncratic definition of a binge may have been quite different than the DSM-IV criteria for a binge, and self-reported mood immediately prior to a binge is susceptible to retrospective recall bias. In addition, their methodology did not allow for comparisons between binge- and non-binge episodes.

Negative Mood, Binge Eating, and EMA studies. Researchers have also examined binge eating antecedents using ecological momentary assessment (EMA). EMA is a methodological technique used to collect repeated measurements of phenomena as they occur in naturalistic settings (Stone & Shiffman, 1994). It has been argued that EMA is superior to self-report questionnaires which can be unreliable or biased in ways that can distort causal inference. Specifically, mood, past behaviors, preconceived notions, and self-image can bias these retrospective self-reports (e.g., see Stone & Shiffman, 1994).

Some studies have examined binge antecedents among obese bingers using EMA. Greeno et al. (2000) examined binge antecedents among 41 obese women diagnosed with binge eating disorder. Individuals were classified as bingers according to self-reported scores on the Binge Eating Scale (score > 17 = bingers) and scores on the Eating Disorder Inventory. Greeno et al. (2000) combined random prompts and event contingent measures (responses to both regular eating episodes and binge eating episodes) in order to compare binge episodes to non-binge episodes. Participants were instructed to record their mood prior to each eating episode in an electronic diary as well as to report food intake in a food diary for six days. After each meal,
individuals reported whether they perceived the meal to be a binge. Bingers reported greater negative mood and less alertness prior to binges than prior to non-binge episodes. Despite the strengths of this study, one limitation was that the participants were not given a definition of what constitutes a binge and therefore it is unknown whether their perceived binges would be consistent with the DSM-IV criteria (e.g., a perceived loss of control while eating).

Another study using EMA to examine binge antecedents among 18 obese bingers during a 2-week period found results similar to those reported by Greeno et al. (2000) (Le Grange et al., 2001). Following a brief phone screening interview, the Structured Clinical Interview for the DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1995), the Questionnaire on Eating and Weight Patterns (Spitzer, Devlin, Walsh, Hasin, Wing, Marcus, et al., 1992), and the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Cooper, 1993) were used to establish a diagnosis of BED. Participants initiated diary entries prior to eating any meal, prior to a binge, and in response to five to six daily random prompts throughout the day. In contrast to Greeno et al. (2000), all participants were provided a detailed definition of BED criteria, exactly as it is presented in the DSM-IV (see page 1 of this paper). Again, Le Grange et al. (2001) found that negative affect was more likely to be reported prior to binge episodes compared to regular meals and random prompts. Le Grange et al. (2001) did not report the caloric intake of a binge precluding a comparison of caloric intake between a binge and a non-binge episode.

In two different EMA studies, Stickney and Miltenberger (1999) and Stickney, Miltenberger, and Wolff (1999) examined antecedents of binge eating in 23 college women of varying BMI’s who reported binges at least twice per week. Participants recorded their binges and the antecedents over four weeks in paper diaries. Again, negative mood (depression and boredom) was the most common antecedent of binge eating. However, Stickney and
Miltenberger (1999) and Stickney et al.’s (1999) relied exclusively on event contingent data (only binge episodes) precluding an important comparison of binge episodes and non-binge episodes. Despite the limitations of these studies, results again suggest that negative mood is a precursor of binge episodes.

Using food and mood records for a 2-week period, Lingswiler, Crowther, and Stephens (1987) assessed mood during binge episodes in a sample of college students with binge eating problems. Subjects completed the Multiple Affect Adjective Checklist each morning and continuously recorded their mood and the type and quantity of food eaten during each regular eating and binge eating episode. Compared to non-binge episodes, significantly more binge episodes were associated with negative moods (depression and anxiety). However, Lingswiler et al. (1987) asked participants to record how they felt during and not immediately prior to binge episodes. Therefore, it is unclear whether negative moods were an antecedent or a response to the binge eating episode. Moreover, they failed to examine mood associated with random prompts (i.e., non-eating episodes) and to report the caloric intake of binge episodes.

Utilizing EMA, Wegner, Smyth, Crosby, Wittrock, Wonderlich, and Mitchell (2002) assessed the relationship between mood and binge eating among 27 normal weight college women with subthreshold binge eating behaviors (i.e., binges once per week as opposed to twice per week). Participants self-monitored their mood on a handheld computer in response to random prompts (i.e., non-eating events) seven times daily and in response to binge episodes for two weeks. While participants reported greater negative mood on binge days compared to non-binge days based on the random prompts, negative mood appeared to remain stable throughout the binge day. In other words, negative mood was not reported to be significantly greater immediately prior to a binge episode. Wegner et al. (2002) did not examine mood prior to non-
binges (i.e., regular meals), making a comparison between binge- and non-binge episodes impossible. It is possible that participants experienced greater negative affect prior to a binge compared to a regular meal. Although Wegner et al. (2002) stated that participants recorded type of food eaten during binges, caloric content of each binge was not reported. While it is unclear whether negative mood was an immediate antecedent, these findings suggest that negative mood was associated with greater binge eating.

Methodological Limitations of Studies Assessing Negative Mood and Binge Eating. In most studies discussed above, negative mood appeared to be a significant trigger of binge episodes. However, many past studies utilizing questionnaires and interviews are seriously limited by their reliance on retrospective reports and failing to compare binge episodes to non-binge episodes. Despite EMA’s reduction in retrospective self-report bias, several studies utilizing EMA still evidence a number of methodological limitations. For example, Stickney and Miltenberger (1999) and Lynch et al. (2000) failed to assess mood associated with non-binge and non-eating episodes, precluding important comparisons of mood during binges versus mood during non-binges. Other studies utilizing EMA did not report the caloric intake of binge episodes nor did they define a binge episode for the participants. Not reporting the caloric intake of binges and not clearly defining binge episodes make it difficult to compare binges across studies. Future EMA studies would benefit from a comparison of binge, non-binge, and non-eating episodes, while providing a detailed definition of a binge for participants, and assessing caloric intake of binge and non-binge eating episodes.

Dietary Restraint and Binge Eating

Beyond negative mood, dietary restraint theory has also emerged as a probable explanation of the binge eating cycle (Polivy & Herman, 1993). Dietary restraint is defined as a
self-initiated attempt to restrict caloric intake in order to control one’s body weight (Polivy & Herman, 1993). In addition, individuals who are high in dietary restraint attempt to adhere to extreme and specific dietary rules rather than more flexible dietary guidelines (Polivy & Herman, 1993). Dietary restraint theory suggests that dietary restriction increases the likelihood of a binge episode because these strict dietary rules are difficult to maintain (Polivy & Herman, 1993). Violations of dietary rules may result in disinhibited eating secondary to abstinence-violation effects (Stice, Agras, Telch, Halmi, Mitchell, & Wilson, 2001). In other words, self-condemnation following binge eating episodes may perpetuate the binge cycle. Past research has found that bingers alternate between restrictive dieting and binging in a cyclical pattern (Heatherton & Polivy, 1992). It has been suggested that restrained eaters become physiologically and psychologically deprived, ultimately resulting in overeating. In support of this theory, past studies have found high rates of binge eating among highly restrained individuals and high levels of dietary restraint among binge eaters (Wardle, 1980). Studies on dietary restraint and binge eating will be discussed in the following sections.

**Dietary Restraint, Binge Eating, and Retrospective Interviews.** Hagan et al. (2002) relied on retrospective interviews in examining dietary restraint among 54 normal weight college women seeking treatment for BED and 29 normal weight non-BED women. Binge eaters were asked to recall times when they had binged and then, based on questions reflecting DSM-IV criteria, binges were classified as binges or overeating episodes (i.e., loss of control is not reported). All participants were administered the Dutch Eating Behavioral Questionnaire to assess dietary restraint prior to their binge episodes. Hagan et al. (2002) found that dietary restraint did not differ between the BED group and the non-BED group. However, this study relied on retrospective self-reports of binges. It is possible that bingers did not accurately recall
their binge episodes or their level of dietary restraint. Another limitation of Hagan et al.’s (2002) study is that only between-group differences (i.e., bingers vs. non-bingers) were assessed. Bingers were not asked to recall non-binge (i.e., normal eating episodes) episodes. Thus, while binge eaters and non-binge eaters did not differ in global dietary restraint, it is unknown whether among binge eaters, binge episodes and non-binge episodes differed in regards to dietary restraint.

**Dietary Restraint, Binge Eating, and Questionnaires.** Several studies have used questionnaires to examine the relationship between binge eating and dietary restraint. However, these studies do not provide evidence that greater dietary restraint directly precedes binge eating. Rather, these studies merely indicate a positive correlation between binge eating and dietary restraint.

Kirkley, Burge, and Ammerman (1988) found a positive relationship between dietary restraint and binge eating among 39 normal weight women seeking treatment for binge eating. Participants completed the Dietary Restraint Scale and they were then asked to monitor their food intake for four days and indicate whether the meal was a binge or a non-binge. A binge was defined for the participants as “eating a large amount of food accompanied by a loss of control while eating”. There was a positive relationship between number of binge episodes and dietary restraint. This finding is consistent with Polivy and Herman’s (1993) theory which suggests that dieting places an individual in a state of real or perceived food deprivation that results in overeating and feelings of loss of control. However, the daily caloric intake was similar among bingers high and low in dietary restraint, suggesting that dietary restraint was more perceptual than behavioral. These findings highlight the importance of having binge eaters keep a food diary to examine differences in the antecedents of perceived binges and to determine whether
they are truly high in calories. Similarly, using questionnaires to assess dietary restraint, another study examined the relationship between dietary restraint and binge eating among 444 female college students (Womble, Williamson, Martin, Zucker, Thaw, Netemeyer, et al., 2001). They found that dietary restraint was significantly and positively associated with binge eating. Kirkley et al.’s (1988) and Womble et al.’s (2001) studies suggests that dietary restraint is associated with binge eating. However, the extent to which greater dietary restraint is a proximal antecedent to binge eating episodes remains unknown.

Eldredge and Agras (1994) examined fluctuations in dietary restraint on binge days and non-binge days among 47 obese women participating in a weight loss intervention. Participants were required to complete the Three Factor Eating Questionnaire at the end of one binge eating day and one non-binge eating day. Dietary restraint was significantly lower on binge days compared to non-binge days. Again, Eldredge and Agras (1994) did not assess dietary restraint immediately prior to binges. Also, because they relied on participants’ recall of dietary restraint at the end of the day, it can not be ruled out that the occurrence of binge eating influenced later reporting of dietary restraint. Moreover, because the results relied entirely on only one binge day and one non-binge day the representativeness of these episodes may be questionable.

Despite these positive findings between dietary restraint and binge eating, it is important to note that several correlational studies have failed to find a positive relationship between dietary restraint and binge eating. For example, Kensinger, Murtaugh, Reichmann, and Tangney (1998) used questionnaires to examine restrained eating associated with binge eating behaviors in 36 overweight female binge eaters. Individuals with more severe binge eating behavior actually reported less dietary restraint than those with moderate binge eating problems. It is possible that among overweight binge eaters, the absence of dietary restraint may contribute to
more severe binge eating. Similarly, using questionnaires, Wardle, Waller, and Rapoport (2001) examined dietary restraint among obese bingers participating in a weight loss intervention. While they did not assess dietary restraint immediately prior to binges they found that obese women high in dietary restraint did not have higher binge eating scores than those with low dietary restraint scores. Again, all participants were obese binge eaters. Findings from Kensinger et al.’s (1998) and Wardle et al.’s (2001) studies suggest that high dietary restraint is not associated with greater binge eating among bingers, particularly among the overweight or obese. Similarly, Masheb and Grilo (2000) and Lawson et al. (1995) failed to find a positive relationship among dietary restraint and binge eating in obese treatment seeking binge eaters. These findings, based exclusively on self-report questionnaires, suggest that dietary restraint may not play an important role in triggering binge eating among overweight and obese bingers. However, these non-significant results may be due to methodological limitations.

**Dietary Restraint, Binge Eating, and Daily Diaries.** Using a 7-day food diary, Lingswiler, Crowther, and Stephens (1989) examined dietary restraint prior to regular eating and binge episodes in 15 binging college women. Dietary restraint was assessed by calculating the caloric intake 24 hours prior to the participants’ eating episodes. However, Lingswiler et al. (1989) did not report how dietary restraint was defined. In contrast to Le Grange et al.’s (2001) findings, Lingswiler et al. (1989) did not find a relationship between dietary restraint and subsequent binging (on average 3.9 binges in one week). A limitation of this study was that Lingswiler et al. (1989) did not report the caloric intake of a binge, the caloric intake during the previous 24 hours that established dietary restraint status, or whether differences in participant BMI (necessary for determining daily caloric needs) were controlled for when establishing dietary restraint status.
Dietary Restraint, Binge Eating, and EMA studies. To date, only one study investigated dietary restraint using EMA. Le Grange et al. (2001) examined dietary restraint using EMA in an obese sample of binge eaters. Level of dietary restraint was assessed on a 6-point Likert scale (0 = not at all to 6 = extremely). Compared to non-binge episodes and random prompts, greater dietary restraint was reported as an immediate precursor to binge eating episodes. Because participants were not required to keep a food diary, the actual calorie content of a binge is unknown. Also, as mentioned above, it is not known whether the findings with an obese sample would generalize to a normal weight sample. Despite these limitations, findings suggest that dietary restraint played a role in triggering binge eating.

Methodological Limitations of Studies Assessing Dietary Restraint and Binge Eating. Despite the popularity of dietary restraint theory in explaining binge eating, few studies have accurately assessed whether dietary restraint immediately precedes binge eating. The inconsistent findings of previous correlational studies and daily diary studies may be due to the methodology of these studies or differing sample characteristics. Moreover, previous studies have infrequently compared dietary restraint in relation to both binge episodes and non-binge episodes. The only EMA study (Le Grange et al., 2001) found a relationship between dietary restraint and binge eating but failed to report important information such as the caloric intake of binges and non-binges. Clearly, more research examining the relationship between dietary restraint and binge eating is needed.

Stress and Binge Eating

Recent research has highlighted the association between perceived stress and binge eating. Bingers have been found to report higher than average levels of stress (Soukup, Beiler, & Terrell, 1990) and greater difficulty managing the emotional effects of stress (Grilo, Shiffman, &
Wing, 1989). For example, laboratory induced stress has been linked to increased urges to binge eat among bulimic women (Tuschen-Caffier & Voge, 1999). Moreover, women with eating disordered behavior have been found to respond to stress with maladaptive coping strategies (e.g., overeating; Koo-Loeb, Costello, Light, & Girdler, 2000). The following sections will review questionnaire and EMA studies examining the relationship between stress and binge eating. To my knowledge, there are no previous studies using retrospective interviews in examining stress and binge eating.

**Stress, Binge Eating, and Questionnaires.** Questionnaire studies on stress and binge eating are limited. Pendleton et al. (2001) examined the relationship between stress and binge eating in 62 obese bingers participating in a 16-month binge eating intervention. Participants who reported high levels of negative stress (e.g., death of a loved one) throughout the intervention (assessed at baseline, 4-months, 10-months, and 16-months) reported a binge eating frequency that was three times greater than that reported by participants experiencing low negative stress. Greater negative stress also predicted the rate at which the frequency of binge eating would be reduced. Although this study did not examine stress as an immediate precursor for binge eating, the findings suggest that level of stress is associated with binge eating.

**Stress, Binge Eating, and Daily Diaries.** Daily diaries have also been used to assess binge antecedents. In diary studies on stress and binge eating, individuals recorded everything they consumed as well as their daily levels of stress. Freeman and Gil (2004) investigated the relationship between stress and binge eating among 46 normal weight bingers in a college population. Participants kept a 30-day record of binge eating episodes and daily stress. Results showed that stress was significantly greater on binge days as opposed to non-binge days. While
Freeman and Gil (2004) found a positive relationship between stress and binge eating they did not examine the immediate impact of stress on binge eating.

Two other studies indicated that while the number of perceived stressors was not greater on binge days than non-binge days, bingers consumed more calories on high stress days and the perceived stressors were reported as more intense and emotionally distressing on binge days compared to non-binge days. For example, Crowther, Sanfter, Bonifazi, and Shepherd (2001) had 17 normal weight binge eating women record for two weeks their level of stress as well as the type of food eaten, whether it was a meal or a snack, and whether they perceived the meal as a binge or a non-binge. Crowther et al. (2001) found that while the participants did not report more binge episodes on high perceived stress days, they did consume more calories during high perceived stress days than on days with less perceived stress. In a similar study, Wolff, Crosby, Roberts, and Wittrock (2000) asked 20 normal weight bingers to self-monitor their daily stress and eating behavior for three weeks. Participants did not report a difference in the number of stressful events on binge days as compared to non-binge days. However, greater binging appeared to occur when the impact of stressors were greater.

While some studies suggest that there is a relationship between overall levels of stress and binge eating, evidence for acute stress as a proximal antecedent of binge episodes is lacking.

*Stress, Binge Eating, and EMA studies.* Using EMA for a 2-week period, Le Grange et al. (2001) examined levels of stress prior to binge episodes and non-binge episodes among 18 obese bingers. They found that bingers reported greater levels of stress prior to both binge episodes and non-binge episodes (i.e., regular meals) compared to random prompts. Because the caloric intake of binge- and non-binge episodes was not reported, it cannot be concluded that caloric intake differed during non-binge episodes and binge episodes. Further research is needed to examine
the effect of perceived stress on subsequent binge eating when reports on caloric intake are included.

**Methodological Limitations in Studies Examining Stress and Binge Eating.** While the relationship between global and daily stress and binge eating has been studied, the relationship between acute stress and binge eating is still unknown. The only EMA study (Le Grange et al., 2001) did find an association between stress and binge eating but failed to report the caloric intake of binge episodes and regular eating episodes. Although Pendleton et al. (2001) found that greater overall stress predicted greater binge eating it cannot be concluded that stress was an immediate precursor of binge eating. Further research using EMA that examines the level of stress immediately prior to binge episodes, regular eating episodes, and non-eating episodes is needed.

**Body Dissatisfaction and Binge Eating**

Body dissatisfaction may be another prominent proximal antecedent to binge eating episodes. Polivy and Herman (1993) proposed that the sociocultural pressures to be thin may encourage people, especially young women, to have high standards for body weight and shape. The inability to meet these high standards often results in body dissatisfaction and strict dieting; strict dieting has been associated with binge eating (Rosen, 1996). Although binge eaters tend to report greater body dissatisfaction than non-bingers (Eldredge & Agras, 1996) body dissatisfaction as an immediate antecedent of binge eating has received limited attention among researchers.

**Body dissatisfaction, Binge Eating, and Questionnaires.** To my knowledge the use of questionnaires to study body dissatisfaction as a precursor to binge eating has been limited. Only one study examined whether body dissatisfaction was an immediate precursor of binge eating
among normal weight bingers. Vanderlinden, Dalle, Vandereycken, and Noorduin (2001) asked 110 normal weight college students with binge eating problems to report on their body image prior to binge episodes using self-report questionnaires. Body dissatisfaction was rarely reported to be an antecedent for binge eating episodes. However, this study’s reliance on retrospective self-report questionnaires with its attendant susceptibility to bias suggests that these findings should be viewed cautiously.

*Body Dissatisfaction, Binge Eating, and EMA Studies.* Only one previous study examined body dissatisfaction and binge eating using EMA methodology. Stickney and Miltenberger (1999) asked female binge eaters in a college population to complete a 4-week binge monitoring form in which they recorded binge antecedents immediately following each binge. Because participants were not required to complete food diaries for each binge, the actual calorie content of the binges is unknown. Stickney and Miltenberger (1999) found that body dissatisfaction was a common antecedent of binge eating episodes.

*Methodological Limitations of Studies Examining Body Dissatisfaction and Binge Eating.* Despite many reports that binge eaters report high levels of body dissatisfaction, studies investigating the immediate impact of body dissatisfaction on binge eating have been limited. Moreover, previous questionnaire studies (Vanderlinden, 2001) are flawed by potential memory bias and/or merely suggest a correlation between body dissatisfaction and binge eating. The only EMA study examining body dissatisfaction and binge eating (Stickney & Miltenberger, 1999) found that body dissatisfaction was greater prior to binge episodes compared to non-binge episodes. Because body dissatisfaction is prominent in women reporting binge eating, it may be important to further examine the immediate effects of body dissatisfaction on binge eating episodes, using a methodology (e.g., EMA) well-suited to capture binge eating antecedents.
Weight Status and Binge Antecedents

Research indicates that both normal weight and overweight/obese individuals binge eat, but the prevalence of binge eating among obese individuals is significantly higher (Spitzer et al., 1992). Therefore, with the increased prevalence of overweight (body mass index [BMI] ≥ 25; approximately 55% of population) and obesity (BMI ≥ 30; approximately 33% of population), binge eating within this population has become a growing public health concern (Flegal, Carroll, Kuczmarski, & Johnson, 1998; Hedley et al., 2004). Among those seeking weight loss treatment, estimates for binge eating disorder range from 20% to 46% (compared to 2% to 5% in the general population; Brewerton, 1999; Faith & Allison, 1996; Henderson & Huon, 2002; Marcus, 1993; Nauta, Hospers, & Jansen, 2001). In addition, studies suggest that obese people with binge eating disorder often became overweight at a younger age, may have more frequent episodes of losing and regaining weight and report greater levels of depression, body dissatisfaction, and lower levels of self-esteem than obese non-bingers (Marcus, 1993).

Although research suggests that binge eating is more commonly reported among the obese, little is known about the how binge eating develops and is maintained in the obese population. Researchers have suggested that studies be conducted that compare overweight/obese and normal weight binge eaters in order to understand the processes involved in the binge eating cycle (e.g., Fairburn & Wilson, 1993; Lingswiler et al., 1989; Lowe, 1993; Marcus, 1993). However, there is a noticeable gap in the literature regarding these comparisons. Studies that examine binge eating either ignore weight status or have only included a weight matched non-BED control group. Therefore, research is needed on the differences and similarities among overweight/obese and normal weight individuals binge eaters, particularly
among college students since these many females make weight loss attempts and are at risk for weight gain and serious eating disorder.

*Literature Review Summary*

Numerous studies examining the possible antecedents of binge eating and non-binge eating episodes among bingers have been performed (Crowther et al., 2001; Greeno et al., 2000; Grilo & Shiffman, 1994; Le Grange et al., 2001; Wolff et al., 2000). The common findings among these studies are that negative mood, dietary restraint, stress, and body dissatisfaction are associated with binge eating. However, there are still some limitations in these studies in that the studies were either correlational, did not compare binge eating episodes to non-binge episodes, or did not define binge eating to the participants. Thus, it is unknown whether mood, dietary restraint, stress, and body dissatisfaction are immediate precursors to binge episodes or whether these psychological factors are associated with individuals identified as binge eaters. It is also unknown whether participants truly experienced binges. Again, many previous studies have been unable to adequately search for this temporal relationship because of the methodological design of the research (e.g., correlational designs, retrospective interviews, self-report measures).

Research indicates that discrepancies between retrospective self-reports and concurrent methods of assessment commonly exist (Rossiter, Agras, Telch & Bruce, 1992). Moreover, tempting situations are especially subject to retrospective bias (Shiffman, Hufford, Hickcox, Paty, Gnys, & Kassell, 1997). Therefore, conclusions based on measures that exclusively rely on retrospective recall and questionnaires should be examined cautiously. EMA is a valuable method of collecting data from participants in the moment, in their natural environment, and its data can be used to determine situational variables, such as mood, that influence a behavior. EMA has been used in previous studies examining alcohol, smoking, and anorexia nervosa and
participants’ compliance with responding to random prompts and to events was high (e.g., Engel et al., 2005; Litt, Cooney, & Morse, 1998; O’Connell, et al., 1998).

Other shortcomings of prior research are the inconsistent definition of a binge episode as well as the frequent failure to report the caloric intake of the reported binges. As noted earlier, several researchers have reported difficulty in interpreting the meaning of the DSM-IV BED diagnostic criterion, “a large amount of food” (Kerzhnerman & Lowe, 2002; Niego, Pratt, & Agras, 1997). Over the years researchers have neglected to report the caloric value of binges and so it is difficult for current studies to compare binge and non-binge episodes or to compare perceived binges that differ in calorie totals. Although some studies suggest that the objective size of a binge is less important than the reported loss of control during a binge (Kerzhnerman & Lowe, 2002; Niego et al., 1997), the calorie totals of binges can be easily measured and amount of caloric intake may prove vitally important to the understanding of BED.

Despite exhortation by researchers to examine differences in binge eating by weight status (Fairburn & Wilson, 1993; Lingswiler et al., 1989; Lowe, 1993; Marcus, 1993), it is unknown whether overweight/obese and normal weight bingers differ on negative mood, dietary restraint, stress, and body dissatisfaction. While past research has examined these antecedents within normal weight binge eaters and within obese bingers, it has typically not examined these antecedents between the two groups. Determining whether these two groups differ in respect to these antecedents may help health psychologists develop more effective BED treatments.

A thorough examination of the immediate triggers for binge eating episodes may provide a fuller, more accurate picture of what leads a person to engage in binge eating. Understanding the immediate precursors for binge eating may improve treatment outcomes as these triggers can be directly targeted. The purpose of this study is to examine negative mood, dietary restraint,
stress, and body dissatisfaction and their immediate effects on subsequent binge eating episodes among bingers using ecological momentary assessment in a female college population. Another purpose is to examine whether negative mood, dietary restraint, stress, and body dissatisfaction, including the caloric intake of binges, differ among overweight/obese and normal weight bingers. The last intent of the study is to contribute to the developing understanding of caloric content of binge episodes. For example, do binges contain greater calorie totals than non-binges and does a perceived binge that is high in calories differ in its antecedents from a perceived binge that is low in calories?

**Hypotheses**

Based on this review of the literature the following relationships were examined. First, a within person comparison of binge episodes, regular meals, and random prompts on negative mood, dietary restraint, stress, and body dissatisfaction was examined. It was hypothesized that participants would report greater negative affect, dietary restraint, stress, and body dissatisfaction prior to binge episodes than regular meals and random prompts.

Second, within person comparisons of the caloric content of binge and regular meals were examined. It was hypothesized that binge episodes would have significantly higher caloric totals than regular meals.

Third, within person comparisons evaluated whether the caloric content of the binge was associated with mood, dietary restraint, stress, and body dissatisfaction. It was hypothesized that greater depression, dietary restraint, stress, and body dissatisfaction would be associated with binges of greater caloric intake.

Fourth, a between person comparison evaluated whether weight status moderated the relationship among negative mood, dietary restraint, stress, and body dissatisfaction prior to
binge episodes, regular meals, and random prompts. Previous studies have found that normal weight bingers consistently report greater dietary restraint than non-bingers. However, the relationship between dietary restraint and binge episodes among overweight/obese bingers appears to be questionable. Thus, it was hypothesized that normal weight bingers would report greater dietary restraint prior to binges compared to overweight/obese bingers. Due to the lack of previous studies comparing these groups on depression, stress, and body dissatisfaction exploratory analyses were conducted for these comparisons.

Fifth, a between group comparison examined whether differences in caloric intake of binge episodes varied as a function of weight status. It was hypothesized that overweight/obese bingers would consume more calories during binges than normal weight bingers. Similarly, a between group comparison was used to examine whether the percentage of total daily calorie intake represented by binges varied significantly by weight status. It was hypothesized that the percentage of calories from binges of overweight/obese bingers would be significantly greater than the percentage of calories from binges among normal weight bingers.
CHAPTER III. METHODS

Participants

In this investigation, 38 individuals who met the DSM criteria for binge eating disorder (BED) or subthreshold BED were included. Based on their body mass index (BMI) individuals were classified as overweight/obese (BMI ≥ 25; n = 20) or normal weight (BMI < 25; n = 18). As expected, the BMI of participants classified as overweight/obese (M = 30.0, SD = 3.5) was significantly higher than for participants classified as normal weight (M = 21.3, SD = 1.7), t(1, 36) = 8.2, p = .00. In the total sample, 32 individuals were White and 6 were African American, all were unmarried, 31 were freshmen, 5 were sophomores, and 2 were juniors. Mean age was 18.18 (SD = 0.7), and mean BMI was 25.9 (SD = 5.2). Consistent with previous studies on binge eating (e.g., Greeno et al., 2000), women were included if they: (1) were female, (2) were at least 18 years old, and (3) met the DSM-IV criteria for binge eating disorder. Consistent with previous research on binge eating (Le Grange et al., 2001), women were excluded if they: (1) were pregnant, (2) had a BMI < 18, (3) had been diagnosed with, were currently, or had been in treatment for bulimia or anorexia within the past year, and (4) were in a formal weight loss program (e.g., Weight Watchers) during the study period. As compensation for their participation, the women received three extra credits toward their undergraduate psychology course requirements and $10.

Procedure

Participants were recruited via an announcement on Experimetrix, an electronic recruitment site for psychology students. The announcement invited women to participate in a study on eating patterns, body weight, and psychological well-being. An electronic cover letter explained the voluntary nature of participation and the purpose of the study. Individuals who
were interested were asked to give their consent and complete an initial electronic screening questionnaire. Participants were instructed that upon giving their informed consent and completing the initial questionnaire the principal investigator may contact them for further participation, which would include keeping a detailed 3-day food diary as well as recording their eating patterns for two weeks.

**Binge Eating Disorder Criteria**

A review of the screening instruments was performed to determine participants’ eligibility for participation. Individuals who met the DSM-IV criteria for binge eating disorder and for subthreshold BED were contacted by email and asked to participate in the study. Binge eating disorder was defined as (1) eating, in a discrete period of time (e.g., within a 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances, (2) a sense of loss of control during these episodes, and (3) at least three of the following symptoms must be present: (a) eating much more rapidly than normal; (b) eating until feeling uncomfortably full; (c) eating large amounts of food when not feeling physically hungry; (d) eating alone because of feeling embarrassed about the quantity of food one is eating; or (e) feeling disgusted with oneself, depressed, or guilty after a binge eating episode. There must also be marked distress regarding binge eating and binge eating could not occur exclusively with anorexia or bulimia. The DSM-IV frequency criterion stipulates that these behaviors must occur on a minimum of two days a week for 6 months. Participants that agreed to participate were invited to attend a 30-minute individual training session in which the 3-day food diary, the 11-day binge diary, and the 2-week EMA were explained. They were informed that

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1 Meeting all of the DSM-IV criteria for BED except for the frequency criterion of twice per week is commonly referred to as subthreshold BED (Striegel-Moore et al., 2000).
they were required to complete a demographics questionnaire and questionnaires on mood, eating patterns, stress, and body dissatisfaction during the training session. Individuals also reported their weight and height in the screening questionnaire.

**Measures**

*Questionnaire on Eating and Weight Patterns* (Appendix A; QEWP; Spitzer et al., 1992). To diagnose BED and subthreshold BED participants completed selected items reflecting the DSM-IV criteria from the QEWP (Spitzer et al., 1992). Consistent with previous studies (e.g., Eldredge & Agras, 1996; Le Grange et al., 2001), in order to be eligible for this study, individuals met the criteria for binge eating disorder as indicated on the QEWP. The QEWP was developed exclusively for the identification of BED and includes items regarding frequency and duration of binge eating, compensatory behaviors for weight control, degree of distress regarding binge eating, and the presence of accompanying behavioral indicators of loss of control. All questions about current functioning and eating behavior focused on the previous six months. While the QEWP consists of 27-items, only 12 items are used to determine a diagnosis of BED. Those 12 items were included in the screening questionnaire for this study. For example, items not relevant to a BED diagnosis, such as age at which time the binge eating behavior began, the largest amount of weight they have lost at one point in life, duration of binge episodes, and time of day that binge episodes generally occur were excluded from the screening questionnaire.

To diagnose BED, participants were asked to reflect upon binge eating episodes that occurred during the previous six months. Individuals were asked whether they had eaten an amount of food that was larger than what most people would consume during similar circumstances within a specified period of time (about 2 hours). Participants had to respond “yes” to both of these in order to qualify for this study. They were then asked whether they had
experienced a sense of loss of control during these episodes of overeating. Participants were asked how frequently, on average, these two behaviors had co-occurred and responded “No days”, “Once per week”, or “Twice per week”. Participants had to endorse either the “Once per week” or “Twice per week” frequency criteria to qualify for this study. Moreover, they responded “Yes” or “No” to whether during these episodes they had been (a) eating much more rapidly than normal; (b) eating until feeling uncomfortably full; (c) eating large amounts of food when not feeling physically hungry; (d) eating alone because of feeling embarrassed about the quantity of food one was eating; or (e) feeling disgusted with oneself, depressed, or guilty after a binge eating episode (at least three of these symptoms must be present). They were also asked whether they experienced significant distress regarding these eating episodes. Participants had to endorse at least three of these criteria and report significant distress during these episodes in order to qualify for this investigation. To rule out DSM-IV diagnoses of anorexia nervosa and bulimia nervosa the following questions from the QEWP were asked: (1) Have you made yourself sick (i.e., vomiting) as a means of controlling your shape or weight?; (2) Have you taken laxatives or diuretics as a means of controlling your shape or weight?; (3) Have you exercised in a “driven” or compulsive ways as a means of controlling your weight, shape, or amount of fat, or to burn off calories? Individuals responded “yes” or “no” to items addressing anorexia and bulimia. In order to qualify for this study, and to rule out another eating disorder, participants had to respond “no” to these questions. Individuals who met the criteria for binge eating disorder and subthreshold BED were contacted for further participation. The principal investigator reviewed the DSM-IV BED criteria with each participant to confirm a BED or subthreshold BED diagnosis during the initial meeting.
BED diagnoses based on the QEWP correlate moderately with structured interviews (kappa = .57; de Zwann, Mitchell, Specker, Pyle, Mussel, & Seim, 1993) and differentiate high versus low frequency binge eaters with sufficient predictive efficiency (71-73%; Nangle, Johnson, Carr-Nangle, & Engler, 1994). A BED diagnosis based on the QEWP has been found to be relatively stable over a 3-week interval (Cronbach alpha = .58; Nangle et al., 1994).

*Binge-Eating Scale* (BES). This is a 16-item self-report questionnaire (Gormally, Black, Daston & Rardin, 1982) designed to assess the severity of binge eating problems. The Binge Eating Scale was used as an additional screening measure and during the initial meeting. Consistent with Gormally et al. (1982) and Greeno et al., (2001) individuals in this investigation scoring >17 were considered binge eaters and were offered to participate in the study. The BES measures binge eating symptomatology along behavioral, emotional, and cognitive dimensions. Participants read 3 or 4 statements per question and selected the statement that most accurately described them. More severe binge eating is indicated by higher scores. The BES has been found to have adequate internal consistency (Cronbach’s alpha = .89; Gormally et al., 1982) and 2-week test-retest reliability (kappa = .87; Timmerman, 1999). Alpha coefficient for this investigation was .86.

*Demographics* (Appendix B). Individuals eligible for participation and who agreed to participate completed a demographics questionnaire during the initial meeting. This questionnaire contained questions concerning their age, ethnicity, eating disorder diagnoses in the past year, year in school, and medical conditions.

*The Dutch Eating Behavior Questionnaire Restraint Scale* (DEBQ-R, Van Strien, Frijters, Bergers, & DeFares, 1986). This is a 10-item questionnaire designed to identify dieters that restrain food intake behaviorally and cognitively. Items were answered on a 5-point Likert
scale ranging from “never” to “very often.” A higher score indicates greater dietary restraint. Coefficient alphas for internal reliability and test-retest reliability are generally around .90 (Van Strien et al., 1986). Alpha coefficient for this investigation was .90.

*Beck Depression Inventory* (BDI; Beck & Steer, 1993). The BDI is a 21-item instrument designed to measure depressive symptoms. For each item, participants picked one statement from a group of statements (e.g., “I do not feel sad”; “I feel sad”; “I am sad all the time and can’t snap out of it”; or “I am so sad or unhappy that I can’t stand it”) that described how they felt during the past week. Higher scores reflected greater depressive symptoms. Psychometric evaluations have reported adequate internal consistency (coefficient alpha values generally range from .73 to .95) and acceptable short term test-retest reliability and convergent validity with clinician ratings of depressive symptoms (mean $r = .75$; Beck, Steer, & Garbin, 1988). Alpha coefficient for this investigation was .90.

*Body Shape Questionnaire* (BSQ: Cooper, Taylor, Cooper, & Fairburn 1987). This is a 34-item self report instrument that measures concerns about body shape and weight. Items are based on a 6-point Likert scale and range from “never” to “always.” Scores are summed to create a total score, with higher scores indicating greater body and weight dissatisfaction. The BSQ is a reliable and valid assessment tool for body shape concerns with reliability coefficients that reflect high internal consistency (.97), test-retest reliability (.88), and concurrent validity with alternative measures of body dissatisfaction (.66; Cooper et al., 1987). Alpha coefficient for this investigation was .95.

*Perceived Stress Scale* (PSS; Cohen, Kamarck & Mermelstein,1983; Cohen & Williamson, 1988). The PSS is a measure of the degree to which situations in one’s life are appraised as stressful. Items were designed to tap how unpredictable, uncontrollable, and
overloaded respondents find their lives. There are three versions of the scale, with 4-items, 10-items, or 14-items. The 10-item version is suggested since it has maximum reliability (.91; Cohen & Williamson, 1988). Items are rated on a 5-point Likert scale from 0 (never) to 4 (very often). Higher scores on the PSS-10 represent higher levels of perceived stress. The 4-item scale has been recommended for situations in which time is limited (Cohen et al., 1983) and was therefore used for assessing perceived stress in the moment for the present study. Cronbach's alphas for the PSS range from .85 - .90 (Wilson, Larson, & Stone, 1993). Test-retest reliability of .85 was reported by Cohen et al. (1983). Alpha coefficient for this investigation was .90.

The purpose of the baseline administration of these questionnaires on depression, dietary restraint, stress, and body dissatisfaction, while not the primary aim of this investigation, was to explore relationships between baseline values of these variables and participants’ responses to the acute antecedents during ecological momentary assessments.

3-Day Food Diary (Appendix C). The purpose of the 3-day food diary was to gather information on daily caloric intake during non-binge episodes. Participants met individually with the principal investigator and received a 3-day paper food diary along with detailed instructions and demonstrations on how to accurately record all food and beverages that they consumed. Participants were asked to record their food and liquid intake on two weekdays and one weekend day. Also, they were asked to indicate the type of meal (e.g., breakfast, snack, dinner) after each food and liquid consumption and whether they perceived the eating episode as a binge. Estimates for total calories per meal and snack, were derived using Nutribase 2001 Professional Nutrition software (Phoenix, Arizona).

During the training session, each participant received a detailed explanation of the DSM-IV definition of a binge episode. They were asked to identify as a binge only those eating
episodes that met the following criteria: 1) eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstance, and 2) a sense of loss of control during these episodes of overeating. Also, they were asked to identify as a binge those episodes that were associated with any of the following five factors: a) eating faster than usual, b) eating when not feeling hungry, c) eating until feeling uncomfortably full, d) eating alone because of embarrassment about the amount of food, and e) feeling disgusted, depressed, or guilty after overeating. Identifying any binges that occurred during the 3-day food diary which is primarily designed to assess non-binge meals was important.

11-Day Binge Eating Episode Diary (Appendix D). After completing a detailed 3-day food diary, participants continued to complete an 11-day binge eating food diary. The extended monitoring period was designed to increase the likelihood of capturing one or more binge episodes. Again, estimates for calorie intake of binge episodes were also derived using NutriBase 2001 Professional Nutrition software (Phoenix, Arizona).

Ecological Momentary Assessment (EMA). Palm Visor personal digital assistants (PDA; Palm Inc, Milpitas, CA) outfitted with Pendragon Forms Software (Pendragon Software Inc., Libertyville, IL) were employed to assess pre-binging/pre-eating mood, dietary restriction, stress, and body dissatisfaction during the 3-day food diary as well as the 11-day binge monitoring period. Also, random prompts were programmed to occur once per day. The random prompts occurred between 8 a.m. to 10 p.m.

Training on how to use the handheld computers was provided to participants during the food diary training session. They received detailed instructions and demonstrations of how to record their responses on the handheld computer. Participants made several practice diary
entries. Research personnel were available to answer questions throughout the 14-day recording period. The importance of completing entries “in the moment” was stressed throughout training to reduce retrospective recall bias.

Participants were asked to record their responses to EMA items immediately after a binge or a regular eating episode in order to not interfere with the eating event. Participants answered questions on mood, dietary restriction, stress, and body dissatisfaction during the 3-day food diary, the 11-day binge eating diary, and following random prompts. If a random prompt occurred during a binge episode participants responded to the binge instead of the random prompt. If the random prompt occurred during a regular eating episode participants responded to the regular eating episode.

To summarize, while completing the 3-day food diary, participants recorded their mood, dietary restraint, stress, and body image responses to binge episodes, regular eating episodes, and random prompts on the handheld computer. During the 11-day extended monitoring period, participants only responded to binge episodes and random prompts. Upon initiation of any assessment, participants indicated what type of event they were responding to: a binge, a regular eating episode, or random prompt. All questions were identical for binge episodes, regular eating episodes, and random prompts. Participants responded to four items for each of the following constructs: (1) mood, (2) dietary restraint, (3) stress, and (4) body dissatisfaction. Each question was rated on a 5-point Likert scale (0 = “definitely not” to 4 = “definitely”). Mood, dietary restraint, stress, and body dissatisfaction were chosen from the following questionnaires, respectively: The Beck Depression Inventory (Beck & Steer, 1993), The Dutch Eating Behavior Questionnaire Restraint Scale (Van Strien et al., 1986), The Perceived Stress Scale (Cohen et al., 1983), and The Body Shape Questionnaire (Cooper et al., 1987). The EMA items utilized in this
investigation were selected by choosing items with the highest correlation with the total scale score in a previous study of binge eating among college women (Rydin & Carels, 2005).

From the Beck Depression Inventory, the following items had the highest correlation with the total scale score: (1) Do you feel sad? \( (r = .75) \), (2) Have you lost confidence in yourself? \( (r = .77) \), (3) Do you consider yourself worthless? \( (r = .76) \), and (4) Do you feel that you have failed more than you should have? \( (r = .74) \).

Four items from the Dutch Eating Behavior Questionnaire Restraint Scale (Van Strien et al., 1986) were included with minor changes. For example “Do you deliberately eat less in order not to become heavier” was changed to “Since your last meal/binge, have you deliberately eaten less in order not to become heavier.” The following four items measuring dietary restraint and their correlation with the total scale score were: (1) Since your last meal/binge, have you refused food or drinks offered because you are concerned about your weight? \( (r = .77) \), (2) Since your last meal/binge, have you tried not to eat because you are watching your weight? \( (r = .73) \), (3) Since your last meal/binge, have you deliberately eaten less in order not to become heavier? \( (r = .84) \), and (4) Have you tried to eat less because you ate too much earlier today? \( (r = .83) \).

As noted earlier, the 4-item Perceived Stress Scale (Cohen et al., 1983) was used in this investigation: (1) At this moment, do you feel that you are unable to control the important things in your life?, (2) At this moment, do you feel confident about your ability to handle your personal problems?, (3) At this moment, do you feel that things are going your way?, and (4) At this moment, do you feel that difficulties are piling up so high that you can not overcome them? “At this moment”, was added to each question to capture acute stress antecedents.

The following items from the Body Shape Questionnaire (Cooper et al., 1987) and their correlation with the total scale score were: (1) Do you feel ashamed of your body? \( (r = .86) \), (2)
Does seeing your reflection (e.g., in a mirror) make you feel bad about your shape? \( (r = .82) \), (3) Have you noticed the shape of other women and felt that your own shape compared unfavorably? \( (r = .85) \), and (4) Has eating sweets, cakes, or other high calorie food made you feel fat? \( (r = .85) \).

In addition to the questions about the four psychological antecedents, several “yes/no” questions were asked to further determine the validity of binge eating episodes: (1) Did you eat an unusually large amount of food?, (2) Did you experience a loss of control during eating?, (3) Did you eat much more rapidly than normal?, (4) Did you eat until feeling uncomfortably full?, (5) Did you eat large amounts of food when not feeling physically hungry?, (6) Did you eating alone because of feeling embarrassed about the quantity of food you were eating?, and (7) Do you feel disgusted with yourself, depressed, or guilty after the binge eating episode? Thus, in total there were a total of 23 items for responses to eating and binge episodes.

Participants received contact information for the principal investigator should they have any difficulty during the monitoring period. After the 2-week EMA monitoring period, participants returned the PDAs and their food diaries to the principal investigator and they were also debriefed. Participants were asked whether they missed any random prompts and if so, asked to report the main reasons for missing them.

**Body Mass Index (BMI):** Self-reported weight and height was obtained from all participants to determine their body mass index (i.e., weight in kilograms divided by height in meters\(^2\)).

**Data Analyses**

Independent samples \( t \)-tests and chi-square analyses were conducted to determine whether normal and overweight/obese participants differed significantly on demographic variables (e.g., age, gender, race, marital status) and binge episodes.
Generalized estimating equations (GEE; SAS Institute, 1997) were used to compare whether depression, dietary restraint, stress, and body dissatisfaction differed significantly between binge episodes, non-binge eating episodes, and random prompts. GEE was introduced by Liang and Zeger (1986) as an extension of general linear models and is used to take into account the correlation among successive observations within individuals (Zeger, Liang, & Albert, 1988). Because EMA observations from the same individual are collected sequentially, autocorrelation among the residuals occurs. Failure to control for such autocorrelation results in overestimating the between-subject variability in the outcome variables, underestimating the within-subject variability, and underestimating the standard errors of the coefficients of within-subject factors. GEE estimates more efficient and unbiased regression parameters than more commonly used least squares regression by permitting specification of a working correlation matrix. This matrix accounts for the form of within-subject correlation of responses on dependent variables of many different distributions. Binge episodes, regular meals, and random prompts were included as three dichotomous (i.e., “yes/no”) independent variables. Mood, dietary restraint, stress, and body dissatisfaction were included as interval dependent variables. Data for each of these variables were person centered before analyses were conducted.

To examine whether binge episodes had a significantly higher calorie total than non-binge episodes paired (within person) samples $t$-tests were conducted.

GEE were conducted to examine whether within-and between-person mood, dietary restraint, stress, and body dissatisfaction were significantly related to the caloric totals of binge episodes. GEE analyses were also conducted to determine whether the relationships between mood, dietary restraint, stress, and body dissatisfaction prior to binge episodes, regular meals, and random prompts varied as a function of weight status. The interaction of weight status by
binge episode, weight status by regular meals, and weight status by random prompts was examined.

Independent samples $t$-tests were used to compare whether caloric content of binge eating and regular meals were related to weight status. Independent samples $t$-tests were also used to examine whether the percentage of daily calories from binges differed between overweight/obese and normal weight participants. Percentage of binge calories was calculated by dividing the caloric total of binge(s) on any given binge day by the sum of all calories consumed on the same binge day.
CHAPTER IV: RESULTS

Demographic, Baseline Characteristics, and Descriptive Data

There were no significant differences between overweight and normal weight participants on any of the demographic variables or on baseline body dissatisfaction, stress, depression, dietary restraint, and binge eating. Means and standard deviations for baseline demographic data are shown in Table 1. Means and standard deviations for baseline body dissatisfaction, stress, depression, dietary restraint, and binge eating are shown in Table 2.

A total of 933 EMA observations were recorded. The number of observations per person in the sample ranged from 18 to 32 ($M = 24.6$, $SD = 7.7$). A total of 179 binges were reported (11 binges had no corresponding food diary entry; 90 binges among normal weight participants and 89 binges among overweight/obese participants). The number of binges in the sample ranged from 1 to 12 ($M = 4.8$, $SD = 2.9$). The number of binges among the normal weight participants ranged from 1 to 12 ($M = 5.1$, $SD = 3.2$) and among the overweight/obese participants they ranged from 1 to 12 ($M = 4.5$, $SD = 2.7$). There was no significant difference in number of binges between the groups.

A total of 433 random prompts were reported (239 random prompts among overweight/obese and 194 random prompts among normal weight). The number of random prompts in the sample ranged from 3 to 14 ($M = 11.4$, $SD = 2.2$). The number of random prompts among overweight/obese participants ranged from 10 to 14 ($M = 12.0$, $SD = 1.4$) and the number of random prompts among normal weight participants ranged from 3 to 14 ($M = 10.8$, $SD = 2.8$). There was not a significant difference in the number of random prompts reported between the normal weight and overweight/obese participants.
A total of 321 regular meals were reported (176 among overweight/obese and 145 among normal weight). The number of regular meals in the sample ranged from 3 to 14 ($M = 8.2$, $SD = 2.7$). The number of regular meals among overweight/obese participants ranged from 6 to 12 ($M = 8.8$, $SD = 1.8$) and the number of regular meals among normal weight participants ranged from 3 to 14 ($M = 8.1$, $SD = 2.9$). There was no significant difference in number of regular meals reported between normal weight and overweight/obese participants. Descriptives for binge episodes, regular meals, and random prompts for overweight/obese binge eaters (OBE), normal weight binge eaters (NBE) and for total sample (data reported for 2-week study period) are shown in Table 3.

**Compliance Data**

One normal weight participant did not complete the food diary and the EMA due to time constraints and was excluded from the study. The average number of binges reported in the two weeks prior to the study (backwards timeline method, question 15 in Appendix C) was 4.2 ($SD = 3.1$). The average number of binges reported in the backwards timeline did not differ significantly from the average number of binges reported during the 2-week study period ($M = 4.8$, $SD = 2.9$).

Ninety three percent of the reported binges met the DSM-IV BED criterion “A large amount of food” and 91% percent met the DSM-IV BED criterion “Loss of control.” One hundred percent of the reported binge eating episodes met at least 3 of the 5 DSM-IV criteria for BED (a minimum of 3 out of 5 are required to meet a BED diagnosis; see page 1 of this paper for the diagnostic criteria). Eighty seven percent of the reported binges met both the “Large amount of food” and “Loss of control” criteria and at least 3 of the 5 DSM-IV criteria for BED.
There were a total of 99 (18%) missed random prompts in the sample with a range of 1 to 11 missed random prompts ($M = 3.0$, $SD = 2.2$). Normal weight participants missed a total of 57 (23%) random prompts with a range of 1 to 11 missing random prompts ($M = 3.8$, $SD = 2.7$). Overweight/obese participants missed a total of 41 random prompts (15%) with a range of 1 to 4 ($M = 2.3$, $SD = 1.3$). There was no significant difference in number of missed random prompts between the normal weight overweight/obese individuals.

Participants responded to the random prompts with no delay approximately 25% of the time. Fifty percent of the random prompts were responded to within 15 minutes, 59% within 30 minutes, and 67% within one hour. There was no significant difference between normal weight and overweight/obese participants’ delay in responding to random prompts.

Thirty-three percent of the participants reported that their number one reason for missing the random prompts was due to being in class, 33% said their number one reason was due to being at work, 18% said that they were asleep during the random prompt, and 15% said they forgot the PDA at home when they were out.

**Binge Eating Antecedents**

It was hypothesized that participants would report greater negative affect, dietary restraint, stress, and body dissatisfaction prior to binge episodes than regular meals and random prompts. General estimating equations (GEE; SAS Institute, 1997) were used to compare depression, dietary restraint, body dissatisfaction, and stress prior to binge episodes, regular eating episodes, and random prompts. See Table 4.

**Depression.** Level of depression was significantly greater prior to binge episodes compared to regular meals, $Z(1, 474) = 7.14$, $p \leq .01$. Level of depression was significantly
greater prior to binge episodes compared to random prompts, $Z(1, 598) = 5.88, p \leq .01$. There was no significant difference in level of depression prior to random prompts and regular meals.

*Dietary Restraint.* Dietary restraint was significantly greater prior to binges compared to regular meals, $Z(1, 474) = 3.48, p \leq .01$. Dietary restraint was significantly greater prior to random prompts than regular meals, $Z(1, 737) = 2.72, p \leq .01$. Dietary restraint was not significantly greater prior to binges compared to random prompts.

*Stress.* Stress was significantly greater prior to binges compared to regular meals, $Z(1, 474) = 3.89, p \leq .01$. Stress was significantly greater prior to binge episodes compared to random prompts, $Z(1, 597) = 2.87, p \leq .01$. Stress did not differ between random prompts and regular meals.

*Body Dissatisfaction.* Body dissatisfaction was significantly greater prior to binges compared to regular meals, $Z(1, 474) = 4.86, p \leq .01$. Body dissatisfaction was significantly greater prior to binge episodes compared to random prompts, $Z(1, 597) = 3.92, p \leq .01$. Body dissatisfaction did not differ between random prompts and regular meals.

*Binge Eating Episodes versus Non-Binge Eating Episodes*

It was hypothesized that binge episodes would have higher caloric totals than regular meals. Binge calories ranged from 266 to 3961 calories among individuals ($M = 1324.2, SD = 519.2$). Separate paired samples $t$-tests revealed that the average binge episode ($M = 1324.2, SD = 519.2$) contained significantly greater calories than the average dinner ($M = 773.3, SD = 285.1$), lunch $M = 725.0, SD = 312.1$, snack ($M = 309.9, SD = 338.1$) and breakfast ($M = 404.1, SD = 339.7$), all $p$’s $\leq .01$. See Table 5.
Binge Eating Antecedents and Caloric Content of Binges

It was hypothesized that greater caloric content of binges would be associated with greater depression, dietary restraint, body dissatisfaction, and stress. GEE revealed non-significant relationships between caloric content of binges and depression, dietary restraint, stress, and body dissatisfaction.

Weight Status, Binge Episodes, Non-Binge Episodes, and Random Prompts

It was hypothesized that normal weight bingers would report greater dietary restraint prior to binges, regular meals, and random prompts than overweight/obese individuals. Weight status was not hypothesized to be related to depression, stress, or body dissatisfaction. GEE examined whether depression, dietary restraint, body dissatisfaction, and stress prior to binge episodes and regular meals varied as a function of weight status. Normal weight binge eaters reported greater dietary restraint prior to binge episodes compared to overweight/obese binge eaters, $Z(1, 167) = 2.54, p \leq .01$. There were no significant differences in dietary restraint between normal weight and overweight/obese individuals prior to random prompts and regular meals. There were no significant differences between normal weight and overweight/obese binge eaters on depression, body dissatisfaction, and stress prior to binges, regular meals, and random prompts. See Table 6.

Weight Status and Caloric Content of Binge

It was hypothesized that overweight/obese individuals would report greater average caloric content of binges than normal weight individuals. Independent samples $t$-tests found no significant differences in the caloric content of binges between normal weight and overweight/obese bingers. Average caloric content of binges was $1462.7 (SD = 560.0)$ among
normal weight individuals and $1199.2$ ($SD = 457.9$) among overweight/obese individuals. See Table 5.

It was hypothesized that overweight/obese bingers would report a greater percentage of calories from binges compared to normal weight bingers. This comparison was calculated twice, once with binges included and once with binges excluded from the day’s total calories. When binges were excluded from the calculation (average binge calories/average calories), overweight/obese bingers reported an average of 52.8% ($SD = 25.2$) of calories from binges and normal weight bingers reported an average of 68.0% ($SD = 26.0$) of calories from binges. Independent samples $t$-tests indicated that while there was no significant difference between normal weight and overweight/obese individuals in percentage of calories from binges, there was a trend suggesting that normal weight bingers consumed a greater percentage of calories from binges ($p = .08$). When binges were included in calculation (average binge calories/(average binge calories + average calories), overweight/obese bingers reported an average of 34.6% ($SD = 9.9$) of calories from binges and normal weight bingers reported an average of 40.6% ($SD = 10.8$) of calories from binges. Independent samples $t$-tests showed that while the percentage of calories from binges did not differ significantly between normal weight and overweight/obese individuals, there was a trend suggesting that normal weight bingers consumed greater calories from binges compared to overweight/obese bingers ($p = .08$). See Table 5 for means and standard deviations of caloric content of binges and regular meals and percentage of calories from binges.

*Post hoc Comparison of BED versus Subthreshold BED Individuals*

Individuals classified as subthreshold BED ($n = 30$; as indicated by reporting binging at least once per week on the screening measure Questionnaire on Eating and Weight Patterns;
QEWP) recorded an average of 4.5 (SD = 2.9) binges during the 2-week study period. Individuals who met the full criteria for BED (n = 8; they reported binging at least twice per week on the QEWP) recorded an average of 5.6 (SD = 3.1) binges during the study period. The number of reported binges did not differ significantly between subthreshold BED and BED individuals. Independent samples t-test revealed a non-significant difference in the average caloric content of binges among BED individuals (M = 1635.1, SD = 631.2) and subthreshold BED individuals (M = 1241.1, SD = 462.5). There were 15 normal weight and 15 overweight/obese subthreshold BED, 3 normal weight BED and 5 overweight/obese BED. Chi-square analyses did not reveal a significant weight status by BED status difference.

GEE revealed non-significant differences in depression, dietary restraint, body dissatisfaction, and stress between subthreshold BED and BED individuals prior to binges, regular eating episodes, and random prompts.

Post hoc Analyses of Initial Self-Reports

Depression. Self-reports of depression (as indicated by scores on the initial Beck Depression Inventory) were significantly correlated with reports of depression during random prompts (r = .55), binge episodes (r = .57), and eating episodes (r = .60), all p’s ≤ .01.

Dietary Restraint. Self-reports of dietary restraint (as indicated by scores on the initial Dutch Eating Behavior Questionnaire Restraint Scale) were significantly correlated with reports of dietary restraint during random prompts (r = .46), binge episodes (r = .46), and eating episodes (r = .53), all p’s ≤ .01.

Stress. Self-reports of stress (as indicated by scores on the initial Perceived Stress Scale) were significantly correlated with reports of stress during random prompts (r = .57), binge episodes (r = .60), and eating episodes (r = .64), all p’s ≤ .01.
Body Dissatisfaction. Self-reports of body dissatisfaction (as indicated by scores on the initial Body Dissatisfaction Questionnaire) were significantly correlated with reports of body dissatisfaction during random prompts ($r = .73$), binge episodes ($r = .71$), and eating episodes ($r = .75$), all $p$’s ≤ .01.

Initial Self-Reports, Weight Status, and BED Status. Independent samples $t$-tests revealed non-significant differences between normal weight and overweight/obese binge eaters on initial measures of depression, dietary restraint, stress, and body dissatisfaction. Independent samples $t$-tests revealed non-significant differences between subthreshold and BED participants on initial measures of depression, dietary restraint, stress, and body dissatisfaction.
CHAPTER V: DISCUSSION

The purpose of this study was to examine, using ecological momentary assessment, the immediate effects of negative mood, dietary restraint, body dissatisfaction, and stress on binge eating episodes among binge eaters. Another purpose of this investigation was to examine whether negative mood, dietary restraint, stress, and body dissatisfaction and the caloric intake of binges differed between overweight/obese and normal weight bingers. Finally, this study investigated whether binge eating episodes contained significantly greater calorie totals than regular meals and whether binge antecedents were associated with the caloric content of binge episodes.

To summarize, as hypothesized, depression, body dissatisfaction, and stress were greater prior to binge episodes than prior to regular meals and random prompts. Moreover, as hypothesized, dietary restraint was greater prior to binge episodes than regular meals, and being normal weight was associated with greater dietary restraint prior to binge episodes. Binges also contained greater caloric totals than non-binges.

A few findings were contrary to the hypotheses. Binges with greater caloric totals were not different in regards to binge antecedents than binges with smaller caloric totals. Caloric totals of binges and non-binges did not differ between overweight/obese and normal weight bingers and the percentage of calories from binges did not differ between overweight/obese and normal weight bingers. However, while not significant, the binges of normal weight bingers tended to be larger than the binges of overweight/obese bingers.

Post hoc analyses revealed that binge antecedents, number of binges reported during the study, and caloric totals of binges did not differ between subthreshold bingers (i.e., binge eating
at least once per week) and binge eaters (i.e., binge eating at least twice per week). These findings are discussed in greater detail below.

*Depression as a Binge Antecedent*

As hypothesized, depression was greater prior to binges than regular meals and random prompts. There was no difference in depression during random prompts and regular meals. The results from this investigation are consistent with previous studies that found an association between depression and binge eating episodes. For example, relying exclusively on event contingent data (only binge episodes) several EMA studies (e.g., Stickney and Miltenberger, 1999, Stickney, Miltenberger, & Wolff, 1999, Lingswiler, Crowther, & Stephens, 1987) reported that depression preceded binge eating episodes. Because these studies only asked participants to report on their negative mood prior to binges and not prior to either regular meals or in response to random prompts it could not be concluded from these studies that depressed mood preceded binge episodes. It is possible that participants would have reported greater depression prior to regular meals and random prompts as well. Two additional studies using EMA in normal and obese women diagnosed with BED found that negative mood preceded binge episodes compared to regular meals and random prompts (Greeno et al. 2000; Le Grange et al. 2001). However, Greeno et al. (2000) did not provide participants with a definition of a binge eating episode and Le Grange et al. (2001) did not report the caloric total of binges and regular meals, precluding an important comparison between these two events. The findings from the current study of normal and overweight/obese binge eaters confirm previous findings that depression is indeed a precursor of binge eating episodes.
Dietary Restraint as a Binge Antecedent

As hypothesized, dietary restraint was greater prior to binges than regular meals. While Le Grange et al. (2001) found that greater dietary restraint preceded binge eating episodes, several other studies have failed to find a relationship between dietary restraint and binge eating (Kensinger et al., 1998; Lingswiler et al., 1989). Because operational definitions of dietary restraint were often not provided in previous studies it is challenging to account for non-significant findings. While the results from this study suggest that dietary restraint is greater prior to binges than prior to regular meals, dietary restraint is not significantly greater prior to binges when compared to random prompts. Therefore, it would appear that binge eaters are vigilant in their food intake throughout their waking hours. However, when this vigilance occurs immediately prior to eating, the stage is set, paradoxically, for a binge episode. Interestingly, when moments of lower dietary restraint coincide with eating, there is a decreased likelihood of binge eating.

Stress as a Binge Antecedent

While studies have generally found a positive relationship between stress and binge eating, these studies often examine general levels of stress and binge eating rather than stress immediately preceding a binge eating episode. Only one study using EMA (Le Grange et al., 2001) found that stress was greater prior to both binge episodes and regular meals than prior to random prompts. As hypothesized, in this investigation, stress was greater prior to binges than regular meals and random prompts suggesting that stress may act as an immediate trigger of binge eating.
Body Dissatisfaction as a Binge Antecedent

While few studies have examined the immediate effect of body dissatisfaction on binge eating episodes, previous studies have generally found that greater body dissatisfaction is associated with greater binge eating (e.g., Stickney & Miltenberger, 1999). For example, although participants did not keep a food diary which precluded a conclusion that binges reflected an “amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances,” Stickney and Miltenberger (1999) reported that binge eaters reported greater body dissatisfaction prior to binge episodes than prior to non-binge episodes. As hypothesized, in this investigation, body dissatisfaction was greater prior to binges than regular meals and random prompts. According to Fairburn, Cooper, and Shafran (2003) body dissatisfaction is a core maintaining component of a binge-purge cycle. Although women in the present study did not engage in purging behavior, body dissatisfaction may nevertheless be a maintaining factor for binge eating episodes. For example, Powell and Thelen (1996) suggest that body dissatisfaction precedes behaviors, such as dietary restriction, which increase the likelihood of a binge. As noted earlier, binge eaters in this investigation reported greater dietary restraint prior to binge episodes. Post hoc GEE analyses indicated that there was a significant positive relationship between dietary restraint and body dissatisfaction prior to binges in this investigation (p < .00). As mentioned previously, sociocultural pressures to be thin often encourage young women to have unrealistic standards for body weight and shape (Polivy & Herman, 1993). Difficulty with meeting these high standards often results in body dissatisfaction and excessive dietary restraint, both of which appear to be precursors of binge eating.
Based on the findings of the current investigation, depression, dietary restraint, stress, and body dissatisfaction are significant immediate precursors to binge eating episodes compared to regular meals and random prompts.

*Caloric Content of Binges and Non-Binges*

Previous studies have generally not compared the caloric content of binges and regular meals. Comparing the caloric content of binges and regular meals is important because the operational definition of a binge eating episode in the DSM-IV criteria requires eating a “large amount of food”. Importantly, researchers have questioned whether the amount of a binge is an important criterion (e.g., Kerzhnerman & Lowe, 2002; Niego et al., 1997) or whether psychological distress associated with a binge are more critical for diagnosing BED. As hypothesized and consistent with the DSM-IV criteria the calorie content of the binges for the binge eaters in this investigation were significantly greater than the calorie content of their regular meals. Thus, the findings from this study are consistent with and generalizable to binges as defined in the DSM criteria.

*Binge Antecedents and Caloric Content of Binges*

While binges had significantly greater caloric content than regular meals, contrary to the hypotheses binges with greater caloric intake were not preceded by greater depression, dietary restraint, stress, and body dissatisfaction. These findings suggest that while greater depression, dietary restraint, stress, and body dissatisfaction may precede a binge episode and that during a binge episode greater calories are likely to be consumed (compared to a non-binge meal), the level of depression, dietary restraint, stress and body dissatisfaction had little bearing on the caloric content of the binge itself. Interestingly, researchers have found that individuals who report smaller versus larger binges do not differ in general psychological characteristics (Keel,
Mayer, & Harnden-Fisher, 2001). Findings from the present study suggest that the immediate precursors are similar for both smaller and larger binges.

**Weight status and Binge Eating Antecedents**

Although previous studies have not directly compared normal weight and overweight/obese bingers on dietary restraint, cross study comparisons suggest that normal weight bingers engage in greater dietary restraint than overweight/obese bingers (Kensinger et al., 1998; Wardle et al., 2001). As hypothesized, normal weight bingers reported greater dietary restraint prior to binges than overweight/obese bingers. However, contrary to the hypotheses, there were no significant differences in dietary restraint between normal weight and overweight/obese individuals prior to regular eating episodes and random prompts. Findings from this study suggest that, generally, normal weight and overweight/obese binge eaters exhibit the same level of dietary restraint throughout the day and prior to regular meals, however, when normal weight binge eaters’ dietary restraint begins to rise relative to that of overweight/obese individuals they are more likely to binge. Dietary restraint theory (Polivy & Herman, 1993) suggests that dietary restraint triggers binge eating. Although not a significant difference, normal weight binge eaters in this study tended to report greater dietary restraint on the initial dietary restraint questionnaire (DEBQ-R; Van Strien et al., 1986). Dietary restriction may be a more reliable trigger for normal weight than for overweight/obese binge eaters. While not examined in this investigation, greater disinhibition may be a more reliable trigger for overweight binge eaters. It is plausible that the higher levels of dietary restraint in normal weight binge eaters in this study may prevent them from gaining weight; however, it also appears to increase the risk of binge eating episodes.
Specific hypotheses were not developed for the relationship between weight status and depression, stress, and body dissatisfaction. However, exploratory analyses were conducted to examine these relationships. Weight status was not associated with negative mood, stress, or body dissatisfaction prior to binge episodes. As previously stated, few studies have compared normal weight and overweight/obese binge eaters on binge antecedents. However, previous studies have found that general psychological distress of binge eaters is independent of weight status (Rydin, 2005; Webber, 1993). It is possible that some binge antecedents also are independent of weight status. However, dietary restraint did emerge as an important difference between normal weight and overweight/obese binge eaters. Because normal weight binge eaters exhibit greater dietary restraint compared to overweight/obese binge eaters it may be especially important to target dietary restraint among normal weight binge eaters. Although dietary restraint may act as a protection against obesity, dietary restraint is highly associated with binge eating. As mentioned previously, binge eating is a risk factor for weight gain. Thus, determining the factors that contribute to successful dietary restraint (i.e., weight prevention) versus unsuccessful dietary restraint (i.e., binge eating) will be an important area of future research. Research comparing normal weight and overweight/obese binger on binge antecedents is needed to learn more about these differences and similarities.

**Weight Status and Caloric Content of Binges**

Contrary to the hypothesis, overweight/obese bingers did not report a greater average caloric content of binges compared to normal weight bingers. Although normal weight binge eaters did report larger binges than overweight/obese this finding was non-significant. Moreover, overweight/obese and normal weight bingers did not differ in the percentage of calories from binges even though there was a trend suggesting that normal weight bingers reported a greater
percentage of calories from binges. Although research has found that binge eating is more prevalent among overweight/obese than normal weight (Spitzer et al., 1992) findings from this study suggest that normal weight bingers resemble overweight/obese bingers in terms of caloric content of binges. However, binges comprise a greater percentage of total calorie intake among normal weight binge eaters.

Subthreshold Versus Binge Eating Disorder

Individuals with subthreshold BED (i.e., participants who reported binges at least once per week) were included in this study due to the difficulty in recruiting only individuals with BED (i.e., participants who reported binges at least twice per week). Individuals with BED and with subthreshold BED did not differ in their reports of depression, dietary restraint, stress, and body dissatisfaction prior to binges, regular meals, and random prompts. They also did not differ on their reported frequency of binges and the average caloric content of binges. Of the 30 participants who were classified as subthreshold BED according to the screening measure (i.e., the Questionnaire on Eating and Weight Patterns), four participants recorded only one binge during the study period, but the remaining 24 subthreshold participants recorded three or more binges during the study period. Thus, the screening measure used in this investigation generally underestimated the number of binges reported by subthreshold BED participants in the current study. Alternatively, self-monitoring of binges may increase the frequency of binge episodes, either due to reactivity or because participants may have a better understanding of the definition of a binge. However, as mentioned previously, there was not a significant difference in the frequency of binges recording during the study period and the backwards time line, which suggests that reactivity was not the cause of the discrepancy between the EMA and the screening measure used to diagnose BED.
Overall, findings from the present study are consistent with previous studies that suggest that there are few differences between individuals with subthreshold BED individuals with BED (Striegel-Moore, Dohm, Solomon, Fairburn, Pike & Wilfley, 2000). Findings from this and previous studies suggest that both individuals with BED and subthreshold BED would benefit from binge eating interventions.

Strengths of This Study

A strength of this study is the use of EMA in assessing binge eating behaviors. This methodology measures behaviors and emotions at the moment they occur in the natural settings and maximizes ecological validity while reducing retrospective recall. Moreover, retrospective entries can be detected when handheld computers are used for collecting data, which is important information for the researcher/clinician. Moreover, the participants provided detailed information on the caloric content of binges and regular meals, which allows for a thorough comparison of these two types of eating episodes, and an external validation of binge episodes. Another strength of this study is that the participants were trained in the identification of binge episodes, which has been found to improve accuracy of reports (Carter, Aime, & Mills, 2001; Passi, Bryson, & Lock, 2003). Finally, both event contingent (i.e., binges and regular meals) and signal contingent (i.e., random prompts) assessments allowed for important comparisons.

Limitations of This Study

This study has several limitations. The sample consisted mainly of Caucasian female college students attending a Midwestern university. Thus, the findings of this study may not be representative of other ethnic populations, males, and non-college populations. Moreover, EMA can be burdensome to participants since they are asked to respond to several events and answer questions for an extended period of time. The use of personal digital assistant (PDA) technology
can also be a limitation although only one participant in this study reported having technological difficulties. The extent to which reactivity affects the behaviors and cognitions under observation also needs to be taken into consideration. However, one study using EMA in studying drinking behavior found that reactivity was minimal (Hufford, Shields, Shiffman, Paty, & Balabanis, 2002). Moreover, in this study, the number of binges reported during the 2-week study period was validated against the number of binges reported during the initial interview (there was no significant difference between binges reported during the study period and binges reported during the interview). Another limitation was the delay in responding to random prompts. Participants responded to the random prompts with no delay 25% of the time, 50% had been responded to within 15 minutes, 59% within 30 minutes, and 67% within one hour. Delayed responses are subject to retrospective recall bias and are thus are a threat to the validity of this investigation.

Implications

The findings from this investigation have a number of clinical and research implications. In this and other investigations binge eaters reported depression, dietary restraint, stress, and body dissatisfaction prior to binges (e.g., Lloyd-Richardson et al., 2000; Marcus, 1993; Striegel-Moore et al, 1998; Elder & Brownell, 1998; Telch & Stice, 1998). Thus, it is important that binge eating interventions continue to include education on effective coping skills to prevent the occurrence of binge episodes. The fact that normal weight bingers reported significantly greater dietary restraint than overweight/obese individuals did prior to binges suggests that greater emphasis on dietary restraint should be targeted among normal weight bingers in binge eating interventions. Overweight/obese binge eaters may benefit from additional weight management strategies to prevent further weight gain and to produce weight loss. Moreover, it is well
established that binge eating is a risk factor of obesity (Brewerton, 1999; Faith & Allison, 1996; Henderson & Huon, 2002). Therefore, normal weight bingers may be at increased risk for unhealthy weight gain and are also likely to benefit from weight management skills.

**Future Studies and Conclusion**

This study examined depression, dietary restraint, stress, and body dissatisfaction prior to binges, non-binges, and random prompts among normal weight and overweight/obese binge eaters. The current study is unique in that it examines four binge eating antecedents, provides data on the caloric content of both binges, and regular meals, and compares normal weight and overweight/obese bingers. Depression, stress, and body dissatisfaction were greater prior to binges than non-binges and random prompts, and dietary restraint was greater prior to binges than non-binges. Normal weight bingers reported greater dietary restraint prior to binges than overweight/obese bingers. There was no weight status effect on dietary restraint prior to regular meals and in response to random prompts. Education on these likely binge antecedents and coping strategies to prevent binge episodes should continue to be an essential component of formal binge eating interventions. Equipped with the knowledge of the antecedents and prevention strategies to address them binge eaters will be more likely to decrease the occurrence of binge eating episodes. Also, due to both the increased prevalence of overweight and obesity, that binge eating is more common among overweight/obese, it is crucial that weight loss is a component of binge eating interventions.

Future studies could examine more closely how dietary restraint differs between normal weight and overweight/obese binge eaters. Although dietary restraint may be an immediate trigger of binge eating it has also been associated with successful weight loss and maintenance among obese non-bingers (Sarlio-Lahteenkorva & Rissanen, 1998). Thus, dietary restraint may
protect against weight gain and binge eating interventions could examine how healthy levels of dietary restraint can reduce binge eating episodes while at the same time encourage weight loss and weight maintenance. Moreover, future studies should include a physical activity/exercise diary during the study period in order to make comparisons of normal weight and overweight/obese binge eaters.

Binge eating antecedents, frequency of binges, and the average caloric content of binges appeared to be similar among individuals with subthreshold BED and individuals with BED. Thus, binge eating interventions should include individuals with subthreshold BED and provide them with coping skills to prevent binge eating episodes. Overall, compliance of recording binges and responding to random prompts was acceptable and future studies should consider the use of PDAs in EMA studies. However, it is recommended that future studies decrease the frequency of delays in responding to random prompts. Perhaps being more explicit about explaining to the participants the importance of responding immediately to random prompts would improve timeliness. It is also possible that timeliness would be improved if participants had a trial period for 3 days, returned their PDAs, and received feedback about any delays in responding. Considering that most participants in the current investigation demonstrated a delay in responding to random prompts due to being in class (33%) or at work (33%) some delays may be unavoidable. It is recommended that researchers increase the study duration to four weeks in order to capture more binge eating episodes. In the present study, four participants recorded only one binge episode.

Findings from the current study also demonstrate that binges are significantly larger than regular meals but that the size of a binge is not influenced by depression, dietary restraint, stress, or body dissatisfaction. Few studies have compared normal weight and overweight/obese binge
eaters in the college population. Considering the rapid increase in overweight/obesity (Flegal et al., 1998) and the associated psychological distress of binge eating it is important to learn more about the etiology, immediate precursors, and treatment of these significant public health problems.
REFERENCES


APPENDIX A

Binge Eating Screening Questionnaire

Please answer the following questions as honestly as you can. Keep in mind that these questions refer to the past 6 months. Please circle the one that best describes you.

1. During the past 6 months, did you often eat within any 2-hour period what most people would regard as an unusually large amount of food?
   a. Yes b. No

2. When you ate this way, did you often feel you couldn’t stop eating or control what or how much you were eating?
   a. Yes b. No

3. On average, how often did you have times when you ate this way – that is, large amounts of food with the feeling that your eating was out of control?
   a. No days b. At least once per week c. At least twice per week

Did you usually have any of the following experiences during these eating occasions?

4. Eating much more rapidly than normal?
   a. Yes b. No

5. Eating until you felt uncomfortably full?
   a. Yes b. No

6. Eating large amounts of food, even when you didn’t feel hungry?
   a. Yes b. No

7. Eating alone because you were embarrassed by how much you were eating?
   a. Yes b. No

8. Feeling disgusted with yourself, depressed, or feeling very guilty after overeating?
   a. Yes b. No

9. In general, have you experienced distress related to these eating episodes?
   a. Yes b. No

10. Have you made yourself sick (vomit) as a means of controlling your shape or weight after overeating?
    a. Yes b. No

11. Have you taken laxatives as a means of controlling your shape or weight due to overeating?
    a. Yes b. No

12. Have you exercised in a “driven” or compulsive way as a means of controlling your weight, shape, amount of fat, or to burn off calories?
    a. Yes b. No
APPENDIX B

Demographics Questionnaire

1. Subject ID number (to be filled out by research investigator): ______

2. Age: ________________

3. Year in college: ____ Freshman ____ Sophomore ____ Junior ____ Senior

4. Weight (lbs): ____ Height: ___ ft ___ inches

5. Marital Status: ___ Single ___ Married ____ Divorced

6. Race/Ethnicity (check one):  ____ White/Caucasian ____ Asian/Pacific Islander
   ____ Black/African American  ____ Hispanic
   ____ American Indian ............ Other

12. Have you been diagnosed with bulimia or anorexia in the past 12 months?____ Yes ___ No

13. Are you pregnant?
   a. Yes b. No

14. Are you currently involved in any formal weight loss program (for example, Weight Watchers, Jenny Craig)?
   a. Yes b. No

13. Please list any prescribed medications you are currently taking:

   ___________________ ___________________

14. Please list any chronic medical conditions that you have been diagnosed with and/or treated for (e.g., cancer, thyroid condition, hepatic dysfunction, etc.):

   ___________________ ___________________

15. Over the past two weeks, how many times have you experienced a binge eating episode (see definition below):______ times

   (1) Eating, in a discrete period of time (e.g., within a 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances,
   (2) A sense of loss of control during these episodes of overeating, and
   (3) At least three of the following symptoms must be present:
   (a) Eating much more rapidly than normal;
   (b) Eating until feeling uncomfortably full;
   (c) Eating large amounts of food when not feeling physically hungry;
   (d) Eating alone because of feeling embarrassed about the quantity of food one is eating; or
   (e) Feeling disgusted with oneself, depressed, or guilty after a binge eating episode.
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APPENDIX D

Detailed 11-Day Binge Eating Episode Food Diary
Please, record everything you consume during your binges for the next 11 days. Be as honest and accurate as you can. After recording what you consumed during the binge, please record your emotional responses on the hand held computer.

<table>
<thead>
<tr>
<th>Time</th>
<th>Day</th>
<th>Please, describe in detail what you ate during your binge. Also, don’t forget to record your responses on the handheld computer after the binge episode.</th>
</tr>
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<tbody>
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</table>

Table 1.

Demographics for overweight/obese binge eaters (OBE), normal weight binge eaters (NBE) and for total sample.

<table>
<thead>
<tr>
<th>OBE (n = 20)</th>
<th>NBE (n = 18)</th>
<th>Total (N = 38)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>18.8 (0.7)</td>
<td>18.7 (0.8)</td>
</tr>
<tr>
<td>BMI</td>
<td>30.0 (3.5)*</td>
<td>21.3 (1.7)</td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td>178.0 (23.4)*</td>
<td>127.2 (12.7)</td>
</tr>
<tr>
<td>Binges in last 2 weeks (assessed in backwards timeline)</td>
<td>4.4 (3.0)</td>
<td>4.1 (3.2)</td>
</tr>
</tbody>
</table>

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<th>n (%)</th>
<th>n (%)</th>
<th>N (%)</th>
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</thead>
<tbody>
<tr>
<td>Year in College (n)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>16 (80)</td>
<td>15 (83.3)</td>
<td>31 (81.6)</td>
</tr>
<tr>
<td>Sophomore</td>
<td>2 (10)</td>
<td>3 (16.7)</td>
<td>5 (13.2)</td>
</tr>
<tr>
<td>Junior</td>
<td>2 (10)</td>
<td>0 (0)</td>
<td>2 (5.3)</td>
</tr>
<tr>
<td>Marital Status (n)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Single</td>
<td>20 (100)</td>
<td>18 (100)</td>
<td>38 (100)</td>
</tr>
<tr>
<td>Race (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>4 (20)</td>
<td>2 (11.1)</td>
<td>6 (15.8)</td>
</tr>
<tr>
<td>Caucasian</td>
<td>16 (80)</td>
<td>16 (88.9)</td>
<td>32 (84.2)</td>
</tr>
</tbody>
</table>

* = p ≤ .01 (differs significantly between overweight/obese binge eaters and normal weight binge eaters.)
Table 2.

Means and standard deviations of baseline psychological variables (from initial questionnaire) among overweight/obese binge eaters (OBE), normal weight binge eaters (NBE) and for total sample.

<table>
<thead>
<tr>
<th></th>
<th>OBE  ($n = 20$)</th>
<th>NBE  ($n = 18$)</th>
<th>Total ($N = 38$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$  ($SD$)</td>
<td>$M$  ($SD$)</td>
<td>$M$  ($SD$)</td>
</tr>
<tr>
<td>Depression</td>
<td>14.6  (6.6)</td>
<td>19.1  (9.9)</td>
<td>16.7  (8.5)</td>
</tr>
<tr>
<td>Dietary Restraint</td>
<td>18.5  (5.3)</td>
<td>21.2  (9.0)</td>
<td>19.7  (7.3)</td>
</tr>
<tr>
<td>Body Dissatisfaction</td>
<td>130.5 (28.0)</td>
<td>124.1 (31.9)</td>
<td>127.4 (29.7)</td>
</tr>
<tr>
<td>Stress</td>
<td>22.0  (5.7)</td>
<td>23.9  (6.2)</td>
<td>22.9  (6.0)</td>
</tr>
<tr>
<td>Binge Eating Scale</td>
<td>23.0  (6.4)</td>
<td>24.8  (6.8)</td>
<td>23.8  (6.6)</td>
</tr>
</tbody>
</table>
Table 3.

Descriptives for binge episodes, regular meals, and random prompts for overweight/obese binge eaters (OBE), normal weight binge eaters (NBE) and for total sample (data reported for 2-week study period).

<table>
<thead>
<tr>
<th></th>
<th>OBE (n = 20)</th>
<th>NBE (n = 18)</th>
<th>Total (N = 38)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M (SD)</strong></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Number of binges</td>
<td>4.5 (2.7)</td>
<td>5.1 (3.2)</td>
<td>4.8 (2.9)</td>
</tr>
<tr>
<td>Random prompts responded to</td>
<td>12.0 (1.4)</td>
<td>10.8 (2.8)</td>
<td>11.4 (2.2)</td>
</tr>
<tr>
<td>Number of regular meals</td>
<td>8.8 (1.8)</td>
<td>8.1 (2.9)</td>
<td>8.2 (2.7)</td>
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</tbody>
</table>

**Frequencies and Ranges**

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<tr>
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<tbody>
<tr>
<td>Total number of binges</td>
<td>89</td>
<td>90</td>
<td>179</td>
</tr>
<tr>
<td>Total number of meals</td>
<td>176</td>
<td>145</td>
<td>321</td>
</tr>
<tr>
<td>Total random prompts</td>
<td>239</td>
<td>194</td>
<td>433</td>
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<tbody>
<tr>
<td>Range of binges</td>
<td>1-12</td>
<td>1-12</td>
<td>1-12</td>
</tr>
<tr>
<td>Range of binge calories</td>
<td>304-3593</td>
<td>266-3961</td>
<td>266-3961</td>
</tr>
<tr>
<td>Range of meals</td>
<td>6-12</td>
<td>3-14</td>
<td>3-14</td>
</tr>
<tr>
<td>Range of random prompts</td>
<td>10-14</td>
<td>3-14</td>
<td>3-14</td>
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</table>
Table 4.

The association between antecedents and binge episodes, regular eating episodes, and random prompts.

<table>
<thead>
<tr>
<th></th>
<th>Binge vs. Regular Eating</th>
<th>Binge vs. Random Prompts</th>
<th>Random Prompts vs. Regular Eating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>SE</td>
<td>Z</td>
</tr>
<tr>
<td>Depression</td>
<td>3.3</td>
<td>0.45</td>
<td>7.14*</td>
</tr>
<tr>
<td>Dietary Restraint</td>
<td>1.5</td>
<td>0.43</td>
<td>3.48*</td>
</tr>
<tr>
<td>Stress</td>
<td>1.4</td>
<td>0.34</td>
<td>3.89*</td>
</tr>
<tr>
<td>Body Dissatisfaction</td>
<td>1.5</td>
<td>0.30</td>
<td>4.86*</td>
</tr>
</tbody>
</table>

* = $p \leq .01$ (differs significantly between events).
Table 5.

Means and standard deviations for binge episodes and regular meals for overweight/obese and normal weight bingers and total sample.

<table>
<thead>
<tr>
<th></th>
<th>Overweight/Obese</th>
<th>Normal Weight</th>
<th>Total Sample</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>( n = 20 )</td>
<td>( n = 18 )</td>
<td>( N = 38 )</td>
</tr>
<tr>
<td><strong>M ( (SD) )</strong></td>
<td><strong>M ( (SD) )</strong></td>
<td><strong>M ( (SD) )</strong></td>
<td></td>
</tr>
<tr>
<td>Binge Calories</td>
<td>1199.2 (457.9)*</td>
<td>1462.7 (560.0)*</td>
<td>1324.2 (519.2)*</td>
</tr>
<tr>
<td>Regular Meals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakfast</td>
<td>392.0 (243.7)</td>
<td>417.5 (429.5)</td>
<td>404.1 (339.7)</td>
</tr>
<tr>
<td>Snacks</td>
<td>361.9 (367.5)</td>
<td>252.1 (301.7)</td>
<td>309.9 (338.1)</td>
</tr>
<tr>
<td>Lunch</td>
<td>745.3 (312.2)</td>
<td>702.6 (319.5)</td>
<td>725.0 (312.1)</td>
</tr>
<tr>
<td>Dinner</td>
<td>769.8 (263.8)</td>
<td>777.8 (314.7)</td>
<td>773.3 (285.1)</td>
</tr>
<tr>
<td><strong>Total Daily Calories (combined averages)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Binges included</td>
<td>3368.2</td>
<td>3612.7</td>
<td>3536.5</td>
</tr>
<tr>
<td>Binges excluded</td>
<td>2169.0</td>
<td>2150.0</td>
<td>2212.3</td>
</tr>
<tr>
<td><strong>Percentage of calories from binges</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Binges excluded</td>
<td>52.8 (25.2)</td>
<td>68.0 (26.0)</td>
<td>59.8 (25.5)</td>
</tr>
<tr>
<td>Binges included</td>
<td>34.6 (9.9)</td>
<td>40.6 (10.8)</td>
<td>37.4 (10.7)</td>
</tr>
</tbody>
</table>

* = \( p \leq .01 \). Binge episodes were significantly greater in caloric totals than other meals, regardless of weight status.
A comparison of normal weight and overweight binge eaters on binge antecedents by binge episodes, regular eating episodes, and random prompts.

<table>
<thead>
<tr>
<th></th>
<th>Binge Eating Episode</th>
<th>Random Prompts</th>
<th>Regular Eating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>SE</td>
<td>Z</td>
</tr>
<tr>
<td>Depression</td>
<td>.71</td>
<td>.76</td>
<td>.94</td>
</tr>
<tr>
<td>Dietary Restraint</td>
<td>1.61</td>
<td>.63</td>
<td>2.54*</td>
</tr>
<tr>
<td>Body Dissatisfaction</td>
<td>.54</td>
<td>.61</td>
<td>.88</td>
</tr>
<tr>
<td>Stress</td>
<td>.70</td>
<td>.62</td>
<td>1.12</td>
</tr>
</tbody>
</table>

* = $p \leq .01$ (differs significantly by weight status). Normal weight bingers higher. Binge eating episodes, regular eating episodes, and random prompts analyses run separately.