THE EFFECTS OF DISORDERED EATING, ANGER, AND NEGATIVE URGENCY ON ATTENTIONAL BIAS AND SUBSEQUENT FOOD CRAVINGS AND FOOD CONSUMPTION

by

KENDRA ROSAMOND DAVIS

(Under the Direction of Sarah Fischer)

ABSTRACT

Attentional bias to food cues, negative affect, and negative urgency have all been linked to loss of control eating. However, few studies have examined the joint effects of cognitive bias, mood, and personality on food consumption. In the current study, 190 undergraduate women were randomly assigned to either an anger or neutral mood condition. Women in both conditions then completed the Food Stroop, in which the presentation of food and neutral words were counterbalanced. After the task, participants were exposed to bowls of mandarins and candy while the experimenter left the room. The type and quantity of food consumed was calculated after the participant departed. Contrary to hypotheses, increases in arousal and negative mood did not influence attentional bias to food cues. However, arousal, a food attentional bias, and negative urgency all had significant main effects on food consumption.

Index Words: emotional eating, negative urgency, Stroop effect, arousal, food consumption

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B.A., Purdue University, 2007

A Thesis Submitted to the Graduate Faculty of the University of Georgia in Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2013

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DEDICATION

As is common knowledge, any project is the result of collaboration and extensive support. This thesis is no exception, in that I have been expertly guided by my advisors and continuously encouraged by my loving family and friends. Specifically I want to dedicate this manuscript and project to my major professor Dr. Sarah Fischer who was instrumental in its design and management from conceptualization to manuscript preparation. Dr. Joshua D. Miller's suggestions and advice expanded the scope of this project, and his mentorship ensured the success of the project. This study would have been impossible without John Acker, who graciously provided his time and expertise concerning attentional bias and the development and data management of Stroop designs. My colleges and lab mates have helpfully discussed ideas, assisted with data collection, and thankfully edited the many versions of this manuscript. In addition to scholastic support and assistance, I am grateful for the many wonderful friends and family members that have verbally encouraged me along this process and made it easier for me tackle this challenge. Thus, I would also like to dedicate this work to my parents, who always answer my anxious late-night phone calls with reassurance, and my husband, who's care and support have given me the fortitude to complete this study.

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Chapter 1

INTRODUCTION

Overview

Disordered eating *(*e.g., bulimia nervosa, anorexia nervosa, binge eating disorder and eating disorders not otherwise specified) is one of the most common psychological problems for women (Stice, 2002). The prevalence of anorexia nervosa and bulimia nervosa (BN) in young women is estimated at 0.3% and 1% respectively (Hoek, 2006). Additionally, disordered eating behaviors, especially binge eating, are relatively prevalent even in non-clinical female populations. Bulimic behavior is defined by both binge eating (i.e., consumption of large amounts of food in a relatively short time period) and associated compensatory behaviors such as self-induced vomiting, misuse of laxatives, extreme dietary restriction, and excessive exercise (APA, 1994).

Multiple risk and maintenance factors have been identified for the development of pathological eating patterns. Trait variables, dietary restraint, affect, and cognitive biases are all associated with disordered eating (Stice, 2002; Faunce, 2002). Although extant research has investigated negative affect, negative urgency, and attentional biases as risk factors for the development of biases on bulimic symptoms, such as binge eating, a model that explains the relationships between these constructs and their joint effects on loss of control eating and food cravings has not been tested. The present study aims to integrate personality and cognitive research into a coherent model of how traits interact with mood states to influence attentional bias in individuals with disinhibited eating, and test specific hypotheses from that model. This

study investigates the effects of mood and negative urgency, and their interaction, on attentional biases towards disorder relevant stimuli using a modified version of the Stroop task and further examines the effects of these variables on urges to binge, subjective food cravings, and palatable food consumption.

Negative Affect and Disordered Eating

The affect regulation model of bulimia suggests that binge eating and purging represent coping methods for negative emotions and anxiety due to deficits in adaptive emotion regulation strategies in women with bulimia (Agras & Telch, 1998; Hawkins & Clement, 1984). Negative affect has been identified as a risk factor for loss of control eating, body dissatisfaction, subjective cravings, and caloric intake, as well as a maintenance factor in binge eating (Hepworth, Mogg, Brignell, & Bradley, 2010; Macht, 2008; Stice, 2002). Studies using ecological momentary assessment demonstrate support for this model, such that increases in negative affect were found to correlate with "binge and vomit days" and precede disordered eating (Wegner et al., 2002, Smyth et al., 2007). Additionally, decreases in negative affect occurred after binge and purge episodes, which suggests a negative feedback loop that helps reinforce the continued use of these maladaptive coping strategies (Smyth et al., 2007).

In addition, laboratory-based mood inductions suggest that increased negative affect results in increased cognitive distortions associated with eating pathology as well as urges to binge (Macht, 2008; Hepworth et al. 2010). Furthermore, under emotional stress, emotional eaters are more likely to consume sweet high-fat foods (Macht, 2008). In a binge eating disordered population, increases in negative affect was related to an increased likelihood of both objective and subjective binges (Agras & Telch, 1998). Thus, both chronic and acute negative

affect influence cognitive distortions and behaviors associated with eating pathology and binge eating.

Anger and Disordered Eating

Negative affect is a multi-faceted construct comprised of negative emotions ranging in arousal from anxiety and anger to depression and guilt. The "trade-off" theory purports that binge eating has a unique affect regulation function for highly aversive and arousing negative emotions such as anger, irritability, and anxiety (Haedt-Matt & Keel, 2011). Therefore, general levels of the negative valence of emotionality, as opposed to arousal, would not decrease following binge episodes as negative emotions are simply altered from highly arousing to low arousing negative mood states (Haedt-Matt & Keel, 2011).

Anger may specifically be related to emotional eating as it can be defined as a negatively-valenced, highly arousing, and appetitive emotion. Appetitive emotions may elicit approach, rather than withdrawal, behaviors. Thus, anger represents a motivating emotion despite being consistently grouped under terms such as neuroticism and negative affect with more withdrawing and low arousal emotions (e.g., anxiety and depression; Carver & Harmon-Jones, 2009). As such, anger may be an emotion that increases the likelihood of binge eating. Indeed, several studies suggest that state anger is an antecedent for binge eating (Milligan & Waller, 2000; Smyth et al., 2007). Furthermore, individuals with high levels of impulsivity engage in binge eating when experiencing increasing anger levels, suggesting that impulsive individuals may specifically employ disordered eating to regulate variations in anger (Engel et al., 2007). Accordingly, it seems appropriate to distinctly investigate the influence of anger on the cognitive processing of eating disorder relevant stimuli.

Impulsivity, Negative Urgency, and Disordered Eating

Mixed results regarding the relationship of impulsivity to bulimic pathology and a heterogeneous range of effect sizes make it difficult to determine the relative importance of impulsivity in eating disorder symptoms (Cassin & von Ranson, 2005; Stice, 2002; Wonderlich, Connolly, & Stice, 2004). Individuals who engage in loss of control eating or binge eating are often characterized as being unable to control urges and impulses. Additionally, some data indicates that highly impulsive participants are more strongly affected by negative mood in self-perceived emotional eating than those who were less impulsive (Bekker et al., 2004; Wonderlich et al., 2004). However, many studies on impulsivity and binge eating have null findings, and the lack of consistent findings has reduced the overall association between impulsivity and eating pathology in longitudinal studies to small aggregated effect sizes (r = 0.07; Stice, 2002).

The mixed findings regarding the association of impulsivity to eating pathology may be due to historically imprecise measurements of this trait in self-report personality inventories due to a lack of consensus regarding its operational definition. The term impulsivity has been used to represent constructs as varied as lack of premeditation, sensation seeking, risk taking, boredom, susceptibility, and adventuresomeness. This failure to agree on a unitary definition representing this construct likely has resulted in scales that measure different traits and multiple constructs (Smith et al., 2007). This is problematic because scales that are a combination of items representative of multiple constructs are likely to reduce the predictive variance of one construct by averaging it with another that may lack predictive ability. Thus, real relationships are undetected due to imprecise measurement (Smith et al., 2007). Furthermore, definitions that did consider impulsivity to be an umbrella term (i.e. composed of multiple constructs; e.g., Eysenck & Eysenck, 1977; Barratt, 1995), have failed to consider the importance of negative affect in the

prediction of risky behaviors (Anestis et al., 2007). This omission is particularly relevant for disordered eating, as negative affect is associated with binge eating and purging behaviors.

In order to address the heterogeneous nature of the impulsivity construct, Whiteside and Lynam (2001) identified four distinct personality aspects related to impulsive behavior (i.e., urgency, lack of premeditation, lack of perseverance, and sensation seeking). Sensation seeking represents a tendency to search for novel and stimulating experiences. Lack of planning indicates a pattern of acting without forethought. Lack of perseverance is an inability to handle boredom or remain focused on tasks during distractions and, finally, urgency is defined as a propensity to rash action when distressed. Each trait is associated with broader domains within the Five Factor Model of Personality and has predictive utility for a variety of specific behavior patterns (Whiteside & Lynam, 2001; Smith et al., 2007; Miller, Flory, Lynam, Leukefeld, 2003). Negative urgency (a tendency to act rashly when influenced by a negative mood) has consistently been shown to predict bulimic symptoms, such as binge eating, better than the more broadly defined impulsivity term, and accounts for more variance in these symptoms than other facets, such as sensation seeking or (lack of) deliberation (Miller et al., 2002; Anestis, Selby, & Joiner, 2007; Fischer, Anderson, & Smith, 2004; Fischer, Smith, & Cyders, 2008; Fischer et al., 2005; Fischer, Smith, Anderson, 2002; Smith, Fischer, Cyders, Annus, & Spillane, 2007).

Although data suggest that urgency is associated with bulimic symptoms, the precise mechanism that mediates these relationships remains unknown. Individuals who act rashly while experiencing distress are likely to engage in immediately reinforcing behaviors in negative mood states, and negative affect has been established as a trigger for binge eating and purging behaviors. However, individuals with high levels of urgency could choose any number of negatively reinforcing behaviors. Attentional bias to food cues may be another pathway through

which trait urgency influences increased vulnerability to bulimic symptoms such as loss of control eating or binge eating. Individuals high in trait urgency who are selectively attentive to information regarding weight, shape, and food may be more likely to engage in disordered eating behavior when experiencing negative affect.

Attentional Bias and Eating disorders

Cognitive theory suggests that body image and food information are more salient to individuals with disordered eating due to maladaptive core beliefs that maintain weight and shape concerns. Thus food, weight, and shape cues distort the way information is processed via preferential allocation of attentional resources to these salient stimuli (Fairburn, 2008). A modified Stroop test was developed as an objective measure of attentional bias to food, weight, and shape cues, and has repeatedly shown that eating disordered patients can be objectively differentiated from controls based on interference of emotionally laden words (i.e. food and shape words). However, large differences in effect sizes and results suggest the presence of moderators in this relationship (Bentovim & Walker, 1991; Bentovim, Walker, Fok, & Yap, 1989; Brooks, Prince, Stahl, Campbell, & Treasure, 2011; Cooper, Anastasiades, & Fairburn, 1992; Cooper & Fairburn, 1993, 1994a; Dobson & Dozois, 2004; Fairburn, Cooper, Cooper, McKenna, & Anastasiades, 1991; Faunce, 2002; Formea & Burns, 1996; Green & Rogers, 1993; Johansson, et al. 2004; Jones-Chesters, Monsell, & Cooper, 1998; Long, Hinton, & Gillespie, 1994; Overduin, Jansen, & Louwerse, 1995; Placanica, Faunce, & Job, 2002; Pringle, Harmer, & Cooper, 2009; Rofey, Corcoran, & Tran, 2004).

The Stroop task and emotional salience. The Stroop task was originally developed for the purpose of studying informational and attentional processes by presenting participants with colored shapes or color words printed in incongruent ink (*i.e.*, the word blue printed in red ink).

The challenge of reporting the color name when the word was printed in a competing color creates interference in information processing (Stroop, 1935). Interference of competing pathways in the brain is proposed to delay the naming of the ink color and is measured by the extra time to respond (i.e., latency; MacLeod, 1991). Although the actual reason behind the interference is debated, the task has been shown to be useful when examining cognitive processes in psychopathology and has been used in research involving anxiety, depression, schizophrenia, substance abuse, and eating disorders. The task has usually been modified to include words that are emotionally salient to individuals with the specific disorder under study. Therefore, the modified tasks examine whether disorders cause attentional biases to relevant words such that these words are processed more efficiently than the color (Dobson & Dozois, 2004). However, findings have not revealed if Stroop interference indicates hypervigilance to salient words or avoidance away from threatening words (Brooks et al., 2011; Faunce, 2002).

Specificity of the Stroop effect to eating pathology. Several studies have been conducted to investigate if the observed Stroop effect in eating disordered populations is reflective of eating pathology or a more general effect of negative mood. Analyses indicate that the frequency of purging, not depression, is the strongest predictor of interference during the modified Stroop task, thus supporting hypotheses that the task is more closely related to symptoms of bulimia than to general pathology (Cooper & Fairburn, 1993). Similarly, Formea and Burns (1996) reported latencies for weight, shape, and food related words similar to those of participants with bulimia when using a population of undiagnosed participants with self-reports of binge eating, purging, and body dissatisfaction. However, no difference in response times was found between depressed but non-bulimic and control participants in response times on disorder relevant words. Nevertheless, participants who reported bulimic behavior also had the highest

scores on depressive measures. This could confound the differentiation between depressive and eating disorder symptoms, but also stresses the importance of studying mood and loss of control eating (Formea & Burns, 1996).

The modified Stroop effect in diagnosed and at risk populations. The Food and Shape Stroop also has demonstrated the ability to differentiate between participants with eating pathology and those who are highly concerned with their weight and body image but do not exhibit disordered eating, again suggesting that the modified Stroop is a reliable measure of pathology (Bentovim & Walker, 1991). Furthermore, Cooper and Fairburn (1992) demonstrated that latency times for food and shape words was lower in patients with less severe pathology than those with severe eating pathology. A subsequent study suggested that treatment reduced the latency for eating, shape, and weight words in patients with bulimia (Cooper & Fairburn, 1992). Food and shape word latencies do not seem to simply reflect "normative" concerns regarding weight and shape because neither female control non-symptomatic participants nor male participants, showed the latency effects for food and shape words when compared to participants with bulimia (Fairburn et al., 1991), unless these participants received food or were presented with food pictures before the task (Johansson et al. 2004). Furthermore, Pringle et al. (2009) reported that negative self-beliefs and attentional biases to food, weight, and shape stimuli predicted eating disorder symptom development in a group of extreme dieters. Thus, these biases in emotional processing seem to be present in a group at risk for developing eating disorder symptoms as well as those meeting full diagnostic criteria for bulimia (Brooks et al., 2011; Johansson et al., 2004; Pringle et al., 2009).

Alternate explanations of the Stroop effect in eating disordered populations. Research suggests that the higher interference scores found in disordered eating populations with

the modified Stroop task cannot be explained based on artifacts of methodology. Participant fatigue or boredom does not seem to affect results because counterbalanced studies report that neither controls nor eating disorder populations demonstrated increased latencies relative to fatigue levels (Cooper et al., 1992; Faunce, 2002; Jones-Chesters et al., 1998). There is little support for the hypothesis that individuals with bulimic pathology may simply have slower cognitive performance, because response times on control words are comparable between participants with bulimia and controls (Dobson & Dozois, 2004). Furthermore, Stroop scores, as well as differentiating between control and symptomatic populations, are positively correlated with self-report measures of symptoms, such as the Eating Attitudes Test (Cooper et al., 1992; Brooks et al., 2011), the Dutch Eating Behavior Questionnaire (Hepworth et al., 2010) and Restrained Eating scores (Brooks et al., 2011). Regarding the design of the task, participants with eating pathology have longer latencies for both mixed and blocked presentation types, and are significantly more likely to make mistakes in naming disorder relevant words than in color-naming control words (Jones-Chesters et al., 1998). In addition, semantic priming (latency caused by the presentation of multiple words that reflect the same meaning) did not seem to create latencies in color-naming when using groups of thematically related control words (Jones-Chesters et al., 1998).

Theoretical rationale for the Stroop effect with disordered eating. Restraint theory offers a framework for understanding the Stroop effect in disordered eating populations. Loss of restraint in restrictive dieters has been associated with binge eating and overeating, termed "counterregulation." Restraint is also conceptualized as representing cognitive attempts to control eating behavior. Negative affect, alcohol, and eating a 'preload' of food all disrupt

cognitive control and lead to counterregulation in restrained eaters (Herman and Polivy, 1980; Runderman, 1986).

Additionally, thoughts surrounding forbidden foods are distressing to disordered eating individuals, thus, these thoughts are avoided and suppressed. Thought suppression results in attentional biases, craving, increased food thoughts, and food cue reactivity (Brooks et al., 2011). Cognitive avoidance of thoughts related to sweets has been shown to increase attentional bias to sweet words (Dejonckheere, Braet , & Soetens, 2003) and cognitive food cues predict increased food consumption in restrained eaters (Fedoroff, Polivy, & Herman, 1997). Interestingly, increased latencies for unhealthy food words during the Food Stroop predicted increases in body mass index (BMI) over a year's time (Calitri, Pothos, Tapper, Brunstrom, Rogers, 2010). Thus, external food cues *(*i.e., consciously perceived food words) may evoke similar disinhibition of mental self-control as does food preloading, alcohol, and negative emotions.

Furthermore, recent findings suggest that impulsivity is also related to both external eating (i.e., consumption driven by external cues) and attentional biases to the extent that impulsive individuals are more apt to direct attention towards reward stimuli, such as food cues (Hou, Mogg, Bradley, Moss-Morris, Peveler, & Roefs, 2011). In summary, selective attention may be a key factor in eating pathology (Faunce, 2002), and one study to date suggests that impulsivity may increase attentional bias to food words.

Attentional Bias and Negative Mood

In anxiety research, acute negative moods have been induced prior to the assessment of attentional bias, thus establishing support for a causal relationship between negative mood states and attentional biases to threat stimuli (Green, Rogers, & Elliman, 1995; Green, Rogers, & Hedderley, 1996). Previous work with mood induction techniques has demonstrated increased

attentional biases to salient threat words in non-clinically anxious participants (Green et al., 1995; Green et al., 1996).

Although negative mood has been argued to be essential to the maintenance of eating disorders, few studies have utilized a Stroop paradigm to study its effect on the cognitive processes that lead to loss of control over eating. Rofey et al. (2004) reported that negative affect increases reaction time for women with disordered eating behaviors and attitudes on food-related cues, suggesting that the combination of negative affect and eating pathology leads to hyper-attentiveness towards emotional stimuli (Rofey et al., 2004). Additionally, according to the limited resource model of self-control, cognitive resources may be exhausted in negative moods preventing behavioral and attentional control. Thus, limitations on regulatory abilities may give way to enhanced attentional biases and loss of control eating (Baumeister, Bratslavsky, Muraven , & Tice, 1998; Muraven, Tice, & Baumeister, 1998). Furthermore, a depressed mood has been shown to increase the saliency of food cues such that these cues are attended to longer, presumably due to a heighted incentive value (Hepworth, et al., 2010). In light of the paucity of research investigating causal relationships between unique negative moods and subsequent alternations in cognitive processes related to eating behavior, experimental studies of the effect of mood on attentional shifts are needed.

Attentional Bias, Food Cravings, and Food Consumption

Because attentional bias may reflect an increase in saliency to cues with heightened reward values particularly under stress (e.g., strain on cognitive resources such as negative mood), it is proposed that directed attention to those cues reflects increased activation of the reward system (Forestell et al., 2012; Hepwroth, et al. 2010). Individuals who engage in emotional eating form positive expectancies (Hohlstein, Smith, & Atlas, 1998) that palatable

foods relieve negative affect, and, thus, act as rewards. Further, incentive salient theory asserts that, over time, relevant cues activate the same motivation systems as rewards themselves, engendering cravings (Robinson & Berridge, 1993). Evidence from the substance abuse literature supports that cravings and attentional biases most likely act in a reciprocal relationship such that increased attention to cues elicits higher subjective cravings and heightened cravings enhance attentional biases (Field & Cox, 2008). Consequently, craving may motivate actual food consumption, especially for those under emotional stress and with high levels of negative urgency. However, causal relationships between attentional bias, craving, food consumption, mood and negative urgency have not yet been tested in a comprehensive model.

Proposed Model

We propose that negative affect, trait urgency, and attentional biases interact in the following ways to influence loss of control over eating. The presentation of food stimuli disrupts the cognitive control that individuals attempt to maintain over their eating patterns. In individuals who already exhibit disordered eating, this cognitive control may be more vulnerable to disruption. These stimuli are thought to elicit attentional biases as greater attempts are made to suppress food related thoughts and cravings. This process may strain cognitive resources, leaving inadequate control for the management of other stimuli, such as negative mood states. Therefore, during highly arousing emotional states, such as anger, cognitive control is further impaired, leading to an even more increased attentional bias to previously suppressed and rewarding stimuli. Highly urgent individuals may have more difficulty than low urgent individuals with the regulation of stimuli in a negative mood state. This may lead to intense motivation to reduce distressing emotions by engagement in maladaptive regulation strategies such as binge eating, exhibited by increased cravings and palatable food consumption.

Hypotheses

There are two primary goals of the present study. The first is to test hypotheses regarding the influence of valence, arousal, individual differences in eating pathology, and individual differences in negative urgency on attentional bias to food words. The second goal is to examine the influence of valence, arousal, negative urgency, attentional bias to food words, and their interaction on craving for food and actual food consumption.

Accordingly, we hypothesize that induction of an angry mood, compared to a neutral mood, will lead to increased attentional biases, operationalized as increased interference scores for food and neutral items during the Food Stroop task. Second, we hypothesize that bulimic symptoms will be associated with attentional bias to food items during the Food Stroop task, replicating previous studies, which demonstrate that individuals with eating pathology have increased attentional bias to food words. Third, it is hypothesized that, the interaction between eating pathology and condition (negative mood vs. neutral) will be significant and positive, such that individuals with higher bulimic symptoms in the negative affect condition will have the greatest attentional bias to food cues on the Food Stroop task. Fourth, the interaction between bulimic symptoms and mood on attentional bias to food cues will be moderated by negative urgency such that individuals who report more bulimic symptoms, are in the angry condition, and endorse higher levels of trait negative urgency will have the largest interference scores on the Food Stroop.

The next set of analyses examines hypotheses regarding the influence of attentional bias to food words, in conjunction with condition, and negative urgency, on craving and actual food consumption. Several main effects are hypothesized. First, that attentional bias on the Stroop task will be significantly associated with craving and food consumption. Second, that individuals in

the angry group will have increased craving for food and will consume more food following the Food Stroop than the control individuals. We will also examine the main effects of urgency on craving and food consumption. However, no published study has yet examined the influence of individual differences in this trait on actual food consumption in a lab setting. Thus, the current study builds on previous literature by proposing that negative urgency will influence food consumption and craving in a laboratory setting. Several interaction effects are also hypothesized. We hypothesize that the effects of mood on food craving and consumption will be stronger for those who also endorse higher levels of negative urgency. However, it is also anticipated that the disruption of cognitive resources, as measured by attentional bias, will interact with mood condition to increase craving and food consumption. We will also test a three-way interaction of negative urgency, mood condition, and attentional bias to food cues on craving and consumption (see Figure 1).

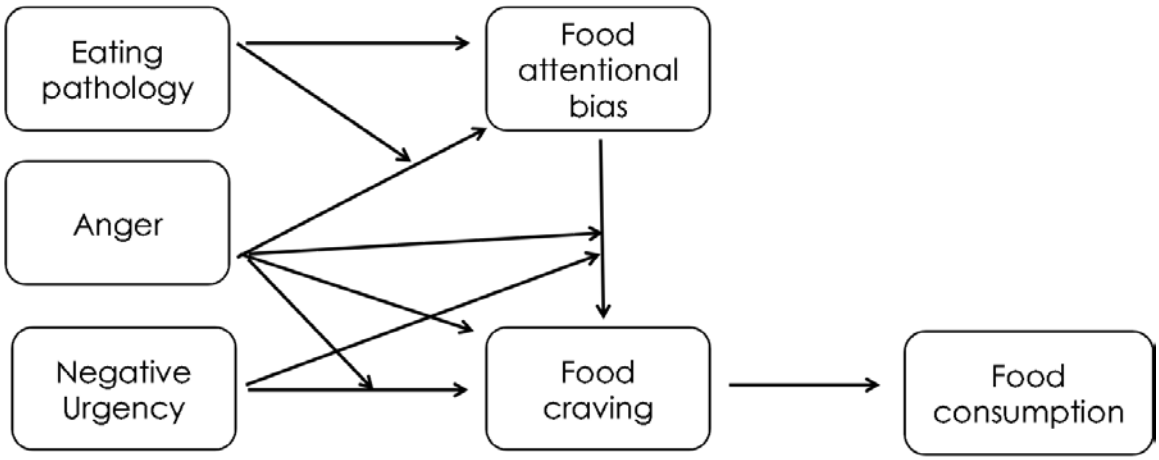

Figure 1. Model of Proposed Hypotheses

Chapter 2

METHODS

Participants

The study population consists of female undergraduate college students from a large university because this age group has been identified as an at-risk population for the development of loss of control eating, (Berg, Frazier, & Sherr, 2009), and the occurrence of this disorder in men is one-tenth that in females (APA, 2000). Participants received partial credit in introductory psychology classes for their completion of the study. Most participants chose to participate in this study by signing up for a timeslot on the university's research pool website, SONA. However, certain participants were contacted for participation based on their responses to a previous lab study (i.e., "Personality and Health Risks for College Women") as described below. In order to qualify for the study, participants were assessed for color blindness (as this would interfere with their ability to perform the Stroop task), and low body mass index (BMI) before beginning the protocol (for participants who signed up via SONA) or during a phone screen (for participants contacted based on their BULIT-R scores). Exclusionary criteria also included a BMI of 17.5, as this is an indicator of anorexia nervosa. Participants with anorexia often exhibit different responses to food cues than individuals with bulimia and healthy weight controls (Dobson & Dozois, 2004) and, therefore, were not included in the study.

Screening. The Bulimia Test-Revised (BULIT-R; described below) was used to screen participants for eating pathology in order to oversample individuals who have higher disordered eating attitudes and beliefs. Previous studies indicate that a score of 104 is associated with a

clinical level of bulimic pathology (Thalen, Farmer, Wonderlich, & Smith, 1991**).** However, bulimia is a low base rate disorder and, therefore, it is unlikely that enough participants would meet a strict diagnostic cut-off for inclusion. Furthermore, the clinical severity of those with currently diagnosed with subthreshold bulimia has recently been shown to be equivalent to those meeting current diagnostic criteria (Wilson & Sysko, 2009). Thus, a cut-off score of one standard deviation above mean was used to identify individuals to contact for participation in the current study.

Statistical Power Analysis

An a priori power analysis indicated that the minimum number of participants required to detect a moderate effect size (0.1) using a 0.8 power level was 150 participants. However, given the number of analyses and multiple predicted interactions, we chose to recruit 190. (Faul, Erdfelder, Lang, & Buchner, 2007).

Measures

The Bulimia Test- Revised (BULIT-R; Thalen, Farmer, Wonderlich, & Smith, 1991). The BULIT-R is a self-report measure designed to assess diagnostic criteria for bulimia nervosa. It consists of 28 items with 5 multiple choice responses scored from 1 to 5 where 5 represents severe pathology and 1 indicates the absence of pathology. The total score ranges from 28 to 140, and 104 has been established as a diagnostic cut-off because it affords the highest sensitivity and specificity. The authors evaluated the measure in both a bulimic sample and a control sample consisting of college students in introductory psychology classes. A cross validation study confirmed that the BULIT-R was able to differentiate between controls and participants with bulimia. Furthermore, the internal consistency was extremely high ($\alpha = .97$) in this sample (Thalen et al., 1991). Test retest reliability has also been shown to be higher, .95,

over two months in a college sample (Thalen et al. 1991). In this sample the internal consistency for the total score was $\alpha = .93$.

Demographics questionnaire. This measure is a general measure of demographics including: age, gender, education level, ethnicity, sexual orientation, and BMI.

Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994). The EDE-Q represents a 41 item self-report version of the Eating Disorder Examination (EDE), which is a structured interview designed to assess eating disorder symptoms. It is used to assess the frequency of binge eating and purging as well as the distorted cognitions surrounding eating, weight, and shape that are characteristic of eating disorders. Studies suggest that the questionnaire performs comparably to the interview for assessment of disordered behaviors such as self-induced vomiting. Multiple studies have shown that the scale is capable of differentiating between frequent and non-frequent binge eaters and assessing weight and shape concerns (e.g., Fairburn, 2008). In general, the EDE-Q is a psychometrically sound instrument for the assessment of eating disorders (Luce & Crowther, 1999). The EDE-Q is comprised of 4 subscales, Restraint, Shape Concern, Weight Concern, and Eating Concern. Internal consistencies of the four scales were measured at two separate times points (2-weeks apart) and results indicated high values for all subscales ranging from Cronbach alphas of .78 (Eating Concern) to .93 (Shape Concern). In addition, the test-retest (at 2 weeks) values for each subscale were also high with values ranging from .81 (Restraint) to .94 (Shape Concern). The EDE-Q will be used to confirm that individuals with low BULIT-R scores do not endorse binge eating or purging symptoms (Luce & Crowther, 1999). Internal consistency for global score in this sample was $\alpha = .95$, while the subscales had the following reliabilities: .81 (Restraint), .77 (Eating Concern), .89 (Weight Concern), and .89 (Shape Concern).

The Food-Craving Inventory (FCI: White, Whisenhunt, Williamson, Greenway, & Netemeyer, 2002). The FCI was developed as a self-report measure of general and specific food cravings. Twenty-eight food items representative of four food types are rated for frequency of craving using a 5-point Liker scale ranging from "Never" to "Almost every day." Exploratory and confirmatory factor analyses reveal a four- factor structure representing four subscales: high fats, sweets, carbohydrates/starches, and fast-food fats. Each factor is also highly correlated, suggesting that each is a unitary dimension of a higher order factor of food craving. Items comprising the scale were chosen based on consensus ratings of experts who identified food items that were representative of selected food categories and highly specific to only one category. Psychometrics in the development sample revealed moderate to high internal consistency (range of α coefficients. .76 - .93) and test retest reliability (range, .79 - .91) for all subscales and the total score. Additionally, the scale demonstrated concurrent and discriminate validity by correlating highly with the perceived hunger scale of the Three Factor Eating Questionnaire (TFEQ), moderately with the Conceptual Craving Scale, but not with the dietary restraint scale of the TFEQ (White, et al., 2002). Self-reported craving, as measured by the FCI, has been associated with subsequent specific food consumption within a laboratory setting, suggesting that specific cravings are related to corresponding food intake (Martin, O'Neil, Tollefson, Greenway, & White, 2008). Reliability for the total FCI score was $\alpha = .88$ in this sample with the following values for the subscales: .75 (Fats), .85 (Sweets), .69 (Carbohydrates), and .75 (Fast Foods).

Modified version of the Stroop task specific to eating disorders: Food Stroop (Israeli & Stewart, 2001). The modified Stroop is the most widely used measure of attentional biases specific to eating disordered patients and individuals with high levels of thin-ideal internalization

or restraint (Faunce, 2002). Previous literature suggests that the attentional bias reported with food words is a more robust relationship than that with body shape words, and that food word presentation is less susceptible to habituation (Brooks et al., 2011)

The proposed study utilized words from Israeli and Stewart (2001) and Rofey et al. (2004) both studies of attentional bias to food words in women with eating pathology. In one of these studies, mood influenced response times to food–related words (Rofey et al. 2002). Because the proposed study aims to induce a negative mood and test the interaction of mood with levels of trait urgency on attentional bias, it is critical to use words that have been shown to reveal attentional biases to food and show sensitivity to mood. Research also suggests that words which represent high-calorie or fattening foods are better at producing color-naming differences in bulimic populations and in individuals who engage in emotional eating versus low calorie words (Davidson & Wright, 2002; Maalouf & Yeomans, 2010). Thus, the group of target words utilized by Rofey et al. (2004) appears best suited to test the hypotheses of the study. However, a larger variety of words reduces habituation effects to stimuli (Watts, McKenna, Sharrock, & Trezise, 1986; MacLeod, 1991). Therefore, the final word list, incorporates words used in the following studies, Rofey et al. (2004) and Israeli & Stewart (2001) and is attached in Appendix A.

Mood Affect Grid (Russell, Weiss, & Mendelsohn, 1989). This measure is a one-item scale to assess the two continua of emotion: the dimension of arousal and sleepiness and the dimension of pleasure and displeasure. Theory suggests that these two dimensions should be related but distinct (independent) in determining the emotional state of individuals. The scale was developed as an alternative to longer questionnaires, which may be burdensome for participants involved in repeated-measures designs. The Mood Affect Grid also represents an

improvement over categorical scales because participants are not limited to a distinct set of specified moods.

In recognition of the difficulties in establishing internal consistency with this type of measure, the authors established psychometric properties of the Mood Affect Grid by assessing inter-rater reliability and by comparing Mood Affect Grid responses with established scales measuring alike or dissimilar constructs. In general, the Mood Affect Grid showed high correlations with other measures assessing pleasure and arousal even under varied formats. Additionally, the reliability of the Mood Affect Grid has been evaluated via assessment of 28 emotion-related words (Russell, et al., 1989). The sample was split and compared on both pleasure and arousal components for each word as assessed by the affect grid. Reliability between the two groups was high for both dimensions, pleasure = .98 and affect = .97. Furthermore, responses from the Mood Affect Grid were highly correlated with scales previously designed to address arousal and pleasure: direct circular scaling, multidimensional scaling, and unidimensional scaling with correlations of .95, .96, and .96, respectively. Mood Affect Grid responses were compared with ratings using Mehrabian and Russell's (1974) scale of pleasure and arousal to determine facial expressions of emotions (Russell, et al., 1989). The mean correlation across subjects between the two scales on the pleasure dimension was .85 and on the arousal dimension reached an averaged .81. Convergent, discriminate, and predictive validity was established using self-reports of current mood measured by the Mood Affect Grid with other emotional measures (such as the PANAS). The scale has also been successfully used as a manipulation check, changing in response to mood inductions (Russell, et al., 1989).

Negative urgency subscale of the UPPS-P Impulsive Behavioral scale (Whiteside & Lynam, 2001). This measurement scale is a Likert-type scale with possible choices ranging

from 1 (agree strongly) to 4 (disagree strongly). The full scale includes 59 items that assess the 5 aspects of personality that are related to impulsive behavior including: positive urgency negative urgency, lack of planning, lack of persistence, and sensation seeking. Factor analysis indicates the loading of the four constructs on three separate factors, with two constructs (lack of persistence and lack of planning) loading on a common factor. This is consistent with theory that the facets of impulsivity can be explained through the five-factor personality model (Whiteside & Lynam, 2001). This structure has been replicated in subsequent studies with undergraduate college populations (Smith, et al., 2007). The internal consistency of the Urgency subscale has reported Cronbach's alpha of .79 and .89. Multitrait-Multimethod analyses indicate that the association between the various subscales do not represent an overestimation due to similar self-report methods of measurement. Internal consistency for the negative urgency subscale in this sample was $\alpha = .87$.

Probability of Binge Eating Scale (PBS). The PBES is a 3 item self-report measure developed for the proposed study to quickly assess the desire to binge eat following the mood induction and Food Stroop (see Appendix B). The first item assess immediate urges to eat (i.e., "How much do you want to eat your favorite foods right now?"), the second item specifically addresses the likelihood of binge eating (i.e., "How likely is it that you would binge eat right now if your favorite foods were available to you?"), and the third item asses loss of control (i.e., "Do you feel like you would lose control if you could eat right now?"). These items were not correlated highly enough to be considered a unitary scale, so each item was analyzed individually (see Table 4).

Procedure

Because individuals with higher eating pathology were oversampled in order to increase variability in bulimia symptoms, two recruitment methods were used. Most participants elected to sign up for the study via the SONA website where they selected a session (time and date) to attend. During their study session, these participants completed all tasks and measures associated with the study protocol. However, individuals who were invited to participate (based on their responses in a previous study) had already completed a variety of measures, including the BULIT-R, the UPPS-P, EDE-Q and the demographics questionnaire. During that initial data collection, participants were informed of the opportunity to participate in a second study and were given forms to complete that included their email address and names for future contact. Participants with higher BULIT-R scores were selected to participate in the main study and contacted via telephone. Provided that interested individuals met the inclusion criteria (female, at least 18 years of age, not color blind, and a BMI greater than 17.5), they were invited to participate in the main study. Participants who were recruited directly from SONA answered these same screening questions at the beginning of their study session. Upon arriving to the lab, and regardless of recruitment method, all participants met a member of the lab team who described the study as an investigation of the effects of emotional memories on cognitive processes. After participants were deemed eligible and introduced to the study's purpose, protocol, risks, and benefits; consent forms were completed.

Introduction of the Stroop Task. Participants were randomly assigned to either the negative or neutral condition and were introduced to the Color-Stroop task. Participants were told that they would be participating in a cognitive task designed to assess how individuals process word and color information in order to determine which combinations lead to the most

efficient and accurate processing. Participants were instructed to respond to the specific color presentation of color words (Red, Blue, and Green) by pressing a coordinating key on the computer. The words were presented in the middle of the screen in uppercase, 20 point Arial font against a white background and were shown in the following colors: red, blue, and green. Each word was preceded by a black fixation cross which oriented the participants to the location of the stimuli. After each word, an interstimulus interval of 1500 ms was presented during which the participants saw only the white screen. Responding to the color stimuli by pressing a key instead of naming the color is a departure from the original Stroop task, but research has demonstrated that voice-activated computer programs may introduce error in response times due to microphone sensitivity (Davidson & Wright, 2002). Each word was presented on the screen until the participant hit a key, but the program only responded to the specified keys. After each answer, the participant received feedback (i.e. "correct" or "incorrect") based on their response. First, a practice set of 12 congruent and incongruent words was presented to familiarize participants to the task. Next, words were presented in blocks of 120 trials each with 80% of the trials being congruent (i.e. red printed in red) and 20% incongruent (Lansbergen & Kenemans, 2008). A higher number of congruent trails increases interference on incongruent trials, presumably because a learned pattern of responding is interrupted and must be inhibited during an incongruent trial (Macleod, 1991).

Mood Induction Procedure. Following the Color Stroop task, all participants were asked to complete the Mood Affect Grid. Participants in the anger condition were next instructed to create a list of situations in which they became angry and rate each on a scale from 1-10. Participants then chose the situation ranked as the most anger-provoking and explicitly described that experience in a written narrative. Imaginary mood induction procedures have been shown to

be effective at inducing negative mood states across various studies (Gerrards-Hesse, Spies, & Hesse, 1994; Miller, Gaughan, Pryor, & Kamen, 2009; Westermann, Spies, Stahl, & Hesse, 1996) and to sufficiently induce anger (Appelhans, Whited, Schneider, Oleski, & Pagoto, 2010). Participants in the neutral mood condition were asked to describe their performance of a routine household chore (Appelhans et al., 2010). Immediately following the mood induction, participants rated their current affect using the Mood Affect Grid.

Food Stroop. Participants were then instructed to complete the Food Stroop task. They were asked to color-name control and food-relevant words. Although participants should have been aware of the word meaning, they were asked to only respond to the color in which the word was written. Participants were asked to respond as quickly as possible without making mistakes. All of the words were presented in each of the three colors: red, blue, and green, so that each word was shown three times for a total of 45 trials per block. Each participant completed 2 blocks of words, one of neutral animal words and one of emotional food words. The Stroop effect has been reported using both mixed and block designs (Brooks et al., 2011; Faunce, 2002; Johansson et al., 2004) but blocked designs repeatedly report higher effect sizes and take advantage of increased conscious processing of threat stimuli (Bar-Haim et al., 2007; Waters et al., 2007) presumed to be important for engagement in disordered eating behaviors. The order of the blocks was counterbalanced to control for order effects. The design of the task mirrored that of the color Stroop such that participants did not need to be reoriented to the task. Although the computerized version of the Stroop is methodologically different than some previous studies examining the relationship between the Food Stroop and eating pathology, it is believed to be a better assessment of attentional biases. The computerized version is able to measure color-naming times for each word, allows for multiple presentations of the Stroop task to reduce

learning effects (randomized order of words and colors), and reduces experimenter error in measuring response times by reducing unconscious altering of results in the direction of the hypotheses (Davidson & Wright, 2002).

Upon completion of the Food Stroop, all participants were led to another room to complete the questionnaire packets. Participants recruited from SONA were asked to complete all measures (i.e., EDE-Q, FCI, PBS, demographics, BULIT-R) while participants who were invited based on their BULIT-R scores were only asked to complete the FCI and the PBS. The room in which the participants were left alone to complete the packets also contained hand sanitizer, a bowl of mandarin oranges, and a bowl of "fun-sized" chocolate candies (i.e., Snickers, Twix, Milky Way, plain M&Ms, peanut M&Ms, Milk Way Dark, Three Musketeers). Participants were told to "feel free" to use the hand sanitizer after touching the much-used computer and to "help themselves" to any candy or oranges as a "thank you" for their participation. After the experimenter returned, participants were asked to complete a third Mood Affect Grid to ensure that their mood had returned to their pre-mood induction state. Finally participants were debriefed about the main purpose of the experiment. Importantly, participants were not informed at this time (unless the second debriefing form was requested) that the number of candy and oranges was carefully counted before and after the experiment. This information was e-mailed to participants in a separate debriefing form at the end of the semester in order to preserve the integrity of the deception.

Initially a positive mood induction procedure (recollection of happy memories in the same fashion as the angry mood induction) was in place only to improve the mood of participants who remained distressed at the end of the experiment. However, it was decided, upon IRB renewal, that all participants should undergo the positive mood induction. Thus, 44

participants completed a positive mood induction and a fourth Mood Affect Grid before being debriefed.

Chapter 3

RESULTS

Data Preparation

Before analyses were performed, data was examined for any incomplete responses or other missing data. For all behavioral data, the most conservative response replaced missing values. Thus, a value of zero replaced unreported numbers of binge, purge, and exercise episodes and a value of one replaced affirmatively coded responses without the associated frequency of the behavior reported. Furthermore, if a participant indicated two values on a scale item, the least pathological response was recorded in the data. Data was entered twice following these guidelines and then was carefully screened for entry mistakes, inappropriately labeled or coded variables, and inappropriate values. In order to determine if the remaining missing items were "missing completely at random (MCAR)" and, therefore, appropriate for imputation methods, Little's MCAR test was performed. A nonsignificant value was found for this data set (p =.218), indicating that there is no pattern to the missing values and that no relationship exists between the missing values and any other variables in the analysis (Schlomer, Bauman, & Card, 2010). Thus, missing scale values (i.e., values from the UPPS-P, FCI, BULIT-R, EDE-Q) data could be imputed using expectation maximization analysis (EM). EM is considered more appropriate for managing missing data than deletion (either pairwise or listwise), mean substation, or regression substitution as these methods may produce biased means, variances and/or covariances and subsequently underestimate correlations (Schlomer et al., 2010). EM is a maximum likelihood approach consisting of two steps. First available data is used to estimate

parameters (e.g., means, variances, covariances), which are then used with regression imputation methods to calculate the missing values. Following this step, new values for the parameters are calculated from the original data and the newly imputed values. Both steps are repeated over several iterations until the estimated values change very little (e.g., "until the estimates converge") (Schlomer et al., 2010). However, no imputation method was used to replace missing physical data (e.g., height, weight, BMI, demographic characteristics, candies or oranges taken), as these were considered inappropriate for substitution.

Outliers were identified from the Food Stroop data and the original Stroop Data. Consistent with recommendations offered by Dai and Feng (2011) and Johansson, Ghaderi, and Anderson (2004), outliers were identified in the Stroop data both within and between subjects such that particular trials during which a participant preformed outside three standard deviations of their own average performance were removed from that participant's average interference score as were entire participants who's average interference scores were outside the three standard deviation range for the entire sample. This resulted in the removal of several trials from most participants but the loss of only two individuals from subsequent analyses. No outliers were identified for the negative urgency subscale of the UPPS-P, the global EDE-Q scale, the FCI total score or any of the FCI subscales (i.e., Fats, Sweets, Carbohydrates, Fast Food). Although, two individuals fell outside three standard deviations from the mean BULIT-R score, it was decided that their values should be included in the analyses as they represent important variance in eating pathology within this sample. Because this sample is a high functioning college sample, the mean BULIT-R score was relatively low (m = 51.05) and three standard deviations above from this mean (i.e., 101.62) is not considered clinically significant according to the norms published for the BULIT-R (i.e., 104). Importantly, we hypothesized that increased

eating pathology would be related to increased attentional bias, food consumption, and food craving.

Sample Characteristics

A total of 202 female participants completed informed consent for the study. However, only 190 met the qualification criteria for participation in the experimental portion of the study. Specifically, one participant came to the session already in a negative mood, one was too young to participate, the computer malfunctioned during data collection for one participant, and nine had self-reported BMIs that were below 17.5. Of those who did qualify, the range in BMI was 18-41 with a mean of 22.84 (*SD* = 3.55). The sample was composed primarily of individuals who identified themselves as White/Caucasian (68.9%), with the remainder identifying themselves as Black/African American (14.2%), Asian/Asian American (8.9%), Biracial (3.7%), Hispanic/Latino (0.5%), or another ethnicity (e.g., Pacific Islander, Samoan, Persian) (3.2%). The age of the participants ranged from 17 – 34 years, with a mean age of 19.4 (*SD* = 1.64). Although a majority if the sample were first year college students (53.2%), second (16.8%), third (18.4%), and fourth year students (11.6%) also participated. Most participants also self-identified as exclusively heterosexual (91.1%), with less participants reporting their sexual orientation as either predominantly heterosexual and incidentally homosexual (5.8%), predominately heterosexual but more than incidentally homosexual (2.1%), or bisexual (1.1%).

Mean EDE-Q Global scores were 1.66 (*SD* = 1.24) and the mean BULIT-R score was 51.05 (*SD* =16.86) suggesting overall low levels of eating pathology. Furthermore, only 27.4% of the sample endorsed experiencing at least one subjective or objective binge episode in the past 28 days. A range of compensatory behaviors was reported during the previous 28 days with compulsive exercise being the most frequent (34.2%), and a smaller number of participants

endorsing self-induced vomiting (3.7%), inappropriate laxative use (3.2%) and inappropriate diuretic use (0.5%) as purging methods.

Because all outcome variables related to the type and amount of food taken during the experiment were positively skewed (e.g., 43.7% of the sample took no food at all, 73% took no oranges, and 56% took no candy), we created three dichotomous variables indicating whether or not a participant took any food at all by the end of the experiment, whether or not a participant took any candy at by the end of the experiment, and whether or not a participant took any mandarins by the end of the experiment. Additionally, we created a natural log transformed variable for the third item from the PBS (i.e., immediate loss of control) because it was significantly and positively skewed (skewness = 4.37, kurtosis = 20.567; UCLA Statistical Consulting Group). All analyses examining food consumption or item three from the PBS utilized only these variables.

Comparison of participants in the angry vs. neutral condition on baseline variables

Independent samples t-tests indicated that women in the neutral condition obtained significantly higher scores than women in the angry condition women on the first item of the PBS ($t(188) = 2.12$, $p = .035$), suggesting that those in the neutral condition had higher urges to eat their favorite foods. No other in differences in descriptive variables were observed between conditions except the anticipated differences in mood ratings (see Table 1).

Mood manipulation check. As expected, there were no differences between the angry and neutral condition either before the mood induction or twenty minutes after mood induction (see Table 2). However directly after the mood induction, as anticipated, individuals in the anger condition reported significantly higher arousal levels ($t(188) = -3.59$, $p = .001$) and greater negative affect ($t(188) = 9.290$, $p < .000$).

Individuals in the angry condition experienced significantly more negative valence and higher arousal levels after the negative mood induction than before ($t(94) = 11.16$, $p < .000$; $t(94) = -7.01$, $p < .000$) and directly post the mood negative induction than twenty minutes after the mood induction ($t(94) = -9.71$, $p < .000$; $t(94) = 3.10$, $p < .000$) (see Table 3).

Interestingly, individuals in the neutral condition reported no differences in valence before and after the neutral mood induction ($t(94) = -.83$, $p = 4.08$), but individuals endorsed higher arousal levels after the neutral mood induction ($t(94) = -2.584$, $p = .011$). Individuals also felt more positive directly following the neutral mood induction than twenty minutes afterwards ($t(94) = 2.42$, $p = .017$; see Table 4).

Changes in valence and arousal were also assessed in individuals who completed the positive mood induction at the end of the experimental session ($n = 44$). There were no differences between conditions either in valence or arousal after the positive mood induction ($t(42) = .193$, $p = .848$; $t(42) = .239$, $p = .812$ respectively) (see Table 2). Compared to their baseline moods taken before either the neutral or angry mood induction, all participants reported increases in arousal (anger condition: $t(24) = -2.687$, $p = .013$ neutral condition: $t(18) = -2.963$, $p = .008$) and those in the angry condition reported feeling significantly more positively ($t(24) = -2.585$, $p = .016$) after the positive mood induction (see Table 3). Additionally, compared to mood states directly after the angry or neutral mood induction, those in the angry condition reported significantly more positive valence after the positive mood induction ($t(24) = -8.380$, $p = <.000$) and those in the neutral condition reported significantly higher arousal levels after the positive mood induction ($t(18) = -4.435$, $p = <.000$) (see Tables 3 and 4).

Color Stroop Analyses

Comparisons between the Color Stroop and the Food Stroop indicated predicted differences between the two tasks such that interference times ($t(186) = 27.52$, $p < .000$) and reaction times ($t(188) = 10.42$, $p < .000$) were longer for the Color Stroop. Likely this represents the saliency of color-word reading over identifying color ink for all participants, whereas food-word meanings are probably only salient for individuals with a level of eating pathology. Additionally, accuracy was higher for the Food Stroop than for the incongruent trials of the Color Stroop ($t(186) = -6.29$, $p < .000$), further demonstrating the increased difficulty of the Color Stroop for a majority of the participants. Importantly, interference times from the Color Stroop were not related to predictor variables (i.e., negative urgency and total BULIT-R score), thus it does not appear that those individuals who scored higher on these scales are better or worse at Stroop tasks (see Table 5).

Data Analysis

Before beginning analyses to test our hypotheses, interference scores from the Food Stroop had to first be calculated. Interference scores represent the difference in response time between the food words and the control (i.e., animal) words. Each participant's response time for every trial (i.e., every word presented during the task) is averaged to create a food word average and a control word average. Importantly, trials during which the participant responded incorrectly (i.e., chose the incorrect color) are removed from these averages (Nijs, Franken, & Muris, 2010). Finally, the average control word response time is subtracted from the average food word response time to obtain an interference score for each participant (Calitri et al, 2010; Lansbergen, Kenemans, & van Engeland, 2007; Nijs et al., 2010).

In order to examine the relationships between anger, negative urgency, and eating pathology on attentional biases to food words, hierarchical linear regression was conducted using interference scores from the Food Stroop as the outcome variable. All continuous predictor variables were centered according to recommended guidelines (Aiken & West, 1991) and the angry and neutral conditions were dummy coded as '1' and '0' respectively. Because BMI may be related to attentional bias for food cues (Calitri et al., 2010; Yokum, Ng, & Stice, 2011) this variable was controlled for and entered into the model first. The main effects of negative urgency, eating pathology (i.e., BULIT-R total scores), and condition was entered in the second step of the model. The third step included all two-way interactions, and the final step of the model included the three-way interaction of negative urgency by BULIT-R score by mood condition. Additionally, the Mood Affect Grid provides two values indicative of mood changes, valence and arousal, which more explicitly test our hypotheses regarding the influence of negative moods on eating pathology. Thus, we ran three types of regression models to test our hypotheses. The first set of models included condition (angry vs. neutral) as a dummy coded predictor variable. The next two sets of models were exploratory models and used continuous scores on either valence after the mood induction or arousal after the mood induction as predictor variables.

Linear regression was also used to determine if either attentional bias to food words, negative urgency, negative mood, or any interactions of these variables predicted craving for food and/or urges to eat or binge when controlling for eating pathology. Eight separate models were built for each subscale of the FCI, the FCI total, and each item on the PBS for a total of 24 models predicting food craving or urges to binge (i.e., 8 models for condition, arousal, and valence). In each model, BMI, the total score from the BULIT-R, and ethnicity, dummy coded as either "white" (value of 0) or "other" (value of 1), were controlled for and entered first into the

model. Ethnicity was included in these models because it was correlated with all the food variables (e.g., candy and oranges), the FCI Fats subscale, and items 1 and 2 from the PBS (see Table 5). The second step of these models included, interference scores from the Food Stroop, negative urgency subscale scores, and condition, arousal, or valence. The third step included all two-way interactions and the fourth step included the three-way interaction between mood, attentional bias and negative urgency.

In order to examine the influence of negative urgency, anger, eating pathology, and attentional bias on food consumption, we conducted nine separate logistic regression analyses (three per each condition, arousal, and valence). In each model, we regressed either the dichotomous variable representing any food, candy or oranges taken during the experiment on negative urgency, mood (e.g., either condition, arousal, or valence), attentional bias, all two-way interactions, and the three-way interaction.

Test of Hypotheses

Correlations. Associations between all variables are presented in Table 5 and indicate some expected and unexpected correlations. Importantly attentional bias to food (i.e., interference scores from the Food Stroop) was surprisingly unrelated to all variables (condition, arousal levels, valence levels, eating pathology, negative urgency) with the exception of the consumption of candy. Higher attentional bias to food words was positively associated with consuming candy.

The BULIT-R total score was significantly associated, as expected, with other measures of disordered eating, such as the EDE-Q global score, all subscales of the EDE-Q, and all items of the PBS. Moreover, BULIT-R and the EDE-Q scales were also negatively related to mood valence at all measured time points except directly after the mood induction. Therefore

individuals who rated their initial mood state, their mood twenty minutes after the mood induction, or their mood directly after the positive mood induction as more negative also reported more stable eating pathology (i.e., scores from the EDE-Q and the BULIT-R as opposed to the "immediate" urges measured by the PBS). Valence, however, was unassociated with actual food consumption. In contrast, arousal levels directly following the mood induction were specifically related to food consumption behaviors. Thus, post-mood induction arousal levels were positively correlated the immediate behavior of candy consumption during the experiment but were unassociated with measures of global eating pathology. Notably, condition (anger versus neutral group) did not demonstrate significant relationships with measures of eating pathology or immediate behaviors despite being a proxy variable for affective valence and arousal levels.

Negative urgency was correlated positively with most measures of eating pathology, except immediate urges to eat one's favorite foods (item 1 from the PBS). Negative urgency was also positively correlated with food (i.e., candy and oranges) and specifically candy taken during the experiment. However, negative urgency was not associated with any of the FCI scales or the total FCI score. Furthermore, neither the BULIT-R nor the EDE-Q global were significantly associated with the FCI.

Despite significant relationships between PBS item one and food consumed (positive relationship), condition (i.e., negatively correlated such that those in the neutral condition reported higher cravings for their favorite foods), and all subscales of the FCI; the urge to eat was not correlated with any scale of the EDE-Q. In contrast, items two (likelihood of binge eating) and three (likelihood of losing control if one's favorite foods were available) of the PBS were both positively related to the global EDE-Q score and all EDE-Q subscales and item two

from the PBS was specifically related to the taking of food or candy. PBS item two was also uniquely and positively associated with the FCI Fast Foods subscale. All the FCI scales, except immediate cravings for carbohydrates, were significantly and positively correlated with food consumption.

BMI demonstrated significant negative relationships with the FCI total score and the FCI carbohydrates subscale, but positive correlations the EDE-Q global score and all subscales except "Eating Concern." Of the remaining demographic variables, only sexual orientation and dummy coded ethnicity showed significant correlates with eating and personality variables. Notably ethnicity was significantly and positively associated with items one and two from the PBS, food (both oranges and candy) taken, and the FCI Fats subscale. Finally, sexual orientation showed significant positive correlations with likelihood of losing control (PBS item three), negative urgency, the BULIT-R total score, the EDE-Q global score, and the EDE-Q subscales of eating, weight, and shape concern. However, a partial correlational analysis between sexual orientation (as measured by a scale from 0-7 where 0 is exclusively heterosexual and 7 is asexual) and eating pathology (i.e., PBS items 1 and 2, transformed PBS item 3, the global EDE-Q score, the EDE-Q subscales, and the BULIT-R total score), while controlling for all aspects of impulsivity (i.e., the UPPS-P subscales) revealed no significant correlations. Thus, the relationship between sexual orientation and all disordered eating variables is explained via common relationships with impulsivity.

Main Hypotheses. Tolerance and VIF (variance inflation factor) values were examined for each variable in every model and no evidence of extreme or unacceptable levels of multicollinearity were evident (UCLA Statistical Consulting Group).

Effects of Mood on Attentional Bias. Our first hypothesis, that anger would intensify attentional biases to food words, was not supported (t (186) = -.840, p = .402). Furthermore, neither reaction time (t (188) = .721, p = .472) nor accuracy (t (186) = 1.818, p = .071) was statistically different between the two conditions. However, it is noteworthy that interference times, though nonsignificant, were in the anticipated direction and lower accuracy in the anger condition was at a trend level of significance.

Hypotheses 2-4: Effects of negative urgency, eating pathology, and anger on attentional bias. All hypotheses related to the prediction of attentional bias were unsupported. Thus, eating pathology was not significantly related to attentional bias, the interaction between eating pathology and condition was not significant, and negative urgency did not significantly moderate the interaction between eating pathology and condition. The model regressing attentional bias on negative urgency, eating pathology, mood, and their interactions was not significant (F (8,174) = .606, p = .772**) (**see Table 6). Furthermore, no step of the model reached significance. Correspondingly, neither levels of negative urgency, BULIT-R scores, or condition significantly predicted attentional bias to food words, nor did the interactions between mood and eating pathology or eating pathology and negative urgency. Finally, the three-way interaction between negative urgency, BULIT-R scores, and condition was also not significant (see Table 6). Of note, none of the proposed predictors demonstrated significant correlations with interference from the Food Stroop (see Table 5).

We conducted the same analysis with arousal and valence levels following the mood induction (as assessed by the Mood Affect Grid) to examine if the more specific characteristics of anger (i.e., negative valence and high arousal) predicted attentional bias. The previous pattern of results was replicated regardless of the inclusion of either valence or arousal in the model as

an independent variable in place of condition (arousal model: (F (8,174) = .305, p = .963**);** valence model: (F (8,174) = .469, p = .876**)**. Specifically, the overall models failed to reach significance at any step, there were no significant correlations between attentional bias and the predictors, and no predictor accounted for significant variance in interference scores from the Food Stroop. Thus, attentional bias to food words in this sample was not influenced by arousal, negative valence, or individual differences in eating pathology and urgency.

Hypotheses 5- 10: The effects of mood, attentional bias, and negative urgency on craving. The next set of models tested the hypotheses that higher food cravings and consumption would be significantly predicted by larger attentional biases, angry mood, higher levels of trait negative urgency, the interaction between negative urgency and mood, the interaction between mood and attentional bias, and the three-way interaction between negative urgency, mood, and attentional bias. Three separate models were conducted for each item on the PBS examining the effects of mood (measured either by condition, post-mood induction arousal, or post-mood induction valence), negative urgency, and attentional bias to food words on either urges to eat (PBS item 1) likelihood of binge eating (PBS item 2) or likelihood of losing control (PBS item 3) while controlling for eating pathology, ethnicity, and BMI. For all models including item 1 of the PBS, the only significant variables were BMI, the total BULIT-R score, and ethnicity (ß = -.149, p < .039; ß = .158, p < .029; ß = .221, p < .002 respectively)(see Tables 7, 8, & 9). Thus, all models identified individuals with either a lower BMI, higher total BULIT-R scores, or of an ethnicity other than Caucasian as reporting higher urges to eat. None of the variables of interest, the two-way interactions, or the three-way interaction added significant variance to the any of the models. However, the overall model with demographic

variables accounted for significant variance in scores from item one of the PBS (R = .299, R^2 = .089, p = .001)

Similar results were obtained for the models predicting item 2 of the PBS. The BULIT-R total score was the only significant predictor of urges to binge eat (ß = .437, p < .000) (see Tables 10,11, & 12) and no step past the first added significance. Consistently, the overall model significantly predicted scores on item 2 from the PBS (R = .458, R^2 = .210, p < .000). The BULIT-R total score was also the only significant variable (ß = .471, p < .000) in all regression models predicting the third item of the PBS (see Tables 13,14, & 15) and the overall model with BULIT-R total scores, ethnicity, and BMI significantly predicted the likelihood of losing control while eating (R = .472, R^2 = .223, p < .000). Again, no steps beyond the first added significance to the prediction of item three from the PBS. Overall, results indicate that individuals with higher eating pathology were more likely to report urges to binge and a higher probability of losing control while eating.

All hierarchical linear regression models predicting the subscales (i.e., Fats, Sweets, Carbohydrates, and Fast Foods) and the total score of the FCI were structured identically to those for the PBS items. Accordingly, each outcome variable was regressed on three models created to capture the three assessments of affect (i.e., condition, arousal, valence) following the mood induction. None of the three models predicting the total FCI score were significant past the first step. Consequently, all analyses resulted in the same values, as the only variables included in the first step were the demographic covariates. Only BMI and ethnicity were significant predictors (ß = -.185, p = .013; ß = .158, p = .032 respectively) and the first step model only accounted for about 5.4% of the variance in total FCI scores (R = .233, p < .000). Therefore, individuals with lower BMIs and those who reported an ethnicity other than Caucasian reported higher levels of

craving on the FCI. However, none of the models predicting the FCI Fats, Sweets, or Fast Foods subscales were significant. BMI and ethnicity were also significant predictors for all models predicting scores from the FCI Carbohydrates subscale (ß = -.252, p = .001; ß = .150, p = .038 respectively) (see Tables 16,17, & 18). The overall models remained significant until the last step, although no step, in any model, added significant variance above and beyond the first step. Finally, the model with only demographic variables accounted for significant variance in carbohydrate cravings (R = .293, R^2 = .086, p = .001).

Our hypotheses related to food cravings (measured by either the PBS or the FCI) were predominantly not supported. Neither negative urgency, attentional bias, nor mood (measured by either condition, valence, or arousal) demonstrated significant relationships with urges to eat, reported likelihood of binge eating or losing control, overall cravings, or cravings specifically for fatty foods, sweets, carbohydrates, or fast foods. The total BULIT-R score emerged as the only consistent predictor for all PBS items. The main effects of ethnicity and BMI also significantly predicted urges to eat and cravings for carbohydrates and were the only significant predictors of overall craving.

Hypotheses 5- 10: The effects of mood, attentional bias, and negative urgency on food consumption. We expected that greater attentional bias, an angry mood, and higher levels of trait negative urgency would all significantly predict food consumption, as would the interactions between negative urgency and mood, attentional bias and mood, and the three-way interaction between negative urgency, mood, and attentional bias. All models for food consumption utilized logistic regression to identify whether or not individuals took food. We developed three sets of models (i.e., three models per outcome variable utilizing either condition, post-mood induction arousal, or post-mood induction valence to measure mood) to determine if any food (candy or

oranges), any candy, or any oranges were taken. Every model significantly predicted whether or not candy, oranges, or both were taken. Overall the models correctly identified between 68% to 81.1% of individuals as consuming food or not (either candy and oranges, only oranges, or only candy) and both the "total food" and "candy only" models demonstrated relatively comparable sensitivity and specificity. However, because fewer individuals took only oranges, these models had much higher specificity than sensitivity. Importantly, neither mood condition nor any interactions with mood condition were significant in any model. However, ethnicity was found to be a significant predictor in all models (see Tables 19-27) and a chi square analysis indicated that individuals who self-identified as an ethnicity other than Caucasian consistently took food more frequently (for any food at all taken: X^2 (1, N = 182) = 17.39, p < .000; for any candy taken: X^2 (1, N = 186) = 13.25, p < .000; for any oranges taken: X^2 (1, N = 182) = 6.74, p = .009).

Negative urgency (OR = 1.073, 95% CI [1.017, 1.132]), and attentional bias (OR = 1.006, 95% CI [1.000, 1.011]), emerged as significant predictors of any food consumed (i.e., candy or oranges), using the model composed of condition, negative urgency, and attentional bias (in addition BMI and ethnicity as covariates)(see Table 19). Consistently, Negative urgency (post-mood induction arousal model: OR = 1.072, 95% CI [1.017, 1.131]; post-mood induction valence model: OR = 1.072, 95% CI [1.016, 1.131]) and attentional bias (post-mood induction arousal model: OR = 1.006, 95% CI [1.000, 1.011]; post-mood induction valence model: OR = 1.006, 95% CI [1.000, 1.011]) were significant predictors, in addition to ethnicity, in the prediction of any food consumed when either post- mood induction arousal levels or post-mood induction valence levels were included in the model (see Tables 22 & 25). A similar pattern of results manifested in the three models predicting if candy was specifically taken during the

experiment (see Tables 20, 23, & 26). Negative urgency and attentional bias were significant predictors regardless of whether condition (OR = 1.056, 95% CI [1.002, 1.113]; OR = 1.009, 95% CI [1.003, 1.014]), post-mood induction arousal levels (OR = 1.059, 95% CI [1.004, 1.116]); OR = 1.009, 95% CI [1.004, 1.015]), or post-mood induction valence levels (OR = 1.054, 95% CI [1.000, 1.112]; OR = 1.009, 95% CI [1.003, 1.014]) were included in the model with negative urgency, attentional bias, and their interactions. Additionally, post-mood induction arousal emerged as a significant predictor in the model including arousal levels (OR = 1.246, 95% CI [1.042, 1.490]), and BMI was a significant predictor in the first step of all models (OR = .903, 95% CI [.821, .994])(see Table 23). Only negative urgency, in addition to ethnicity, was a significantly related to consuming oranges in the condition and valence models (condition model: OR = 1.073, 95% CI [1.009, 1.140]; and post-mood induction valence model: OR = 1.054, 95% CI [1.000, 1.112]) (see Tables, 21, 24, & 27).

There was partial support for our hypotheses regarding the consuming of food during the experiment. The main effect of negative urgency was associated with consuming any food, consuming only candy, or consuming only oranges. Furthermore, an attentional bias to food predicted consuming any food and specifically consuming candy. Additionally, mood (as measured by post-mood induction arousal levels) was also predictive of candy taken during the experiment.

Table 1

Descriptive Statistics of Major Study Variables

Variable	Neutral	Anger condition	*t*	*p*
	N = 95	N = 95		
BMI	22.77 (3.5)	22.93 (3.6)	-.305	.761
Age	19.47 (2.0)	19.33 (1.2)	.575	.566
Ethnicity	.35 (.48)	.26 (.44)	1.259	.210
Sexual Orientation	.13 (.34)	.05 (.22)	1.081	.281
Negative Urgency	27.09 (7.27)	26.41 (6.97)	.662	.509
PBS1*	5.01 (2.82)	4.19 (2.50)	2.121	.035
PBS2	2.26 (2.11)	2.21 (2.11)	.172	.864
PBS3LN	0.18 (0.47)	0.16 (0.46)	.213	.832
FCI Total	59.95 (16.59)	57.98 (15.98)	.878	.381
FCI Fats	14.03 (4.93)	13.87 (5.46)	.195	.845
FCI Sweets	19.63 (7.38)	18.46 (6.66)	1.150	.252
FCI Carbs	16.66 (5.14)	16.22 (5.17)	.599	.550
FCI Fast Foods	9.63 (4.01)	9,33 (3.80)	.539	.591
BULITRtotal	51.32 (16.78)	50.78 (17.02)	.217	.828
EDE-Q Global	1.71 (1.22)	1.61 (1.26)	.550	.583
EDE-Q Restraint	1.64 (1.33)	1.60 (1.35)	.203	.840
EDE-Q Eating Concern	0.78 (1.02)	0.67 (0.94)	.797	.427
EDE-Q Weight	2.21 (1.55)	2.03 (1.66)	.790	.430

Concern				
EDE-Q Shape	2.23 (1.49)	2.16 (1.56)	.270	.787
Concern				
Binge Episodes	0.96 (2.16)	0.94 (1.97)	.035	.972
Purging Episodes	0.29 (1.25)	0.06 (0.62)	1.625	1.06
Exercise Episodes	1.68 (2.41)	1.23 (2.14)	1.357	.176

Note. All values are means (standard deviations). BMI = body mass index, ethnicity = dummy coded (white = 0 and non-white = 1), Sexual Orientation = dummy coded (0 = heterosexual, 1 = at least incidental homosexual experiences), Food Stroop AB = interference from the Food Stroop, Food Stroop RT = reaction time from the Food Stroop, Food Stroop Acc = Accuracy from the Food Stroop, PBS1 = item 1 of the PBS (immediate urges to eat favorite foods), PBS2 = item 2 of the PBS (likelihood of binge eating), PBS3LN = natural log transformation of item 3 of the PBS (likelihood of losing control), FCI Total = total score from the FCI, FCI Fats = Craving for fats subscale from the FCI, FCI Sweets = cravings for sweets subscale from the FCI, FCI Carbs = cravings for carbohydrates from the FCI, FCI Fast Food = cravings for fast food from the FCI, BULITRtotal = total score from the BULIT-R, Binge Episodes = total subjective and objective binge episodes, Purging Episodes = number of reported purging behaviors (i.e., self-induced vomiting, laxative use, diuretic use), Exercise Episodes = number of compensatory exercise episodes, Food taken = any food (yes or no) taken during the experiment, Candy taken = any candy taken (yes or no) during the experiment, Oranges taken = any oranges taken (yes or no) during the experiment.
*$p < .05$.

Table 2

Mood Check Comparisons between Conditions

Variable	Neutral condition N = 95	Anger condition N = 95	*t*	*p*
AG1 Valence	6.43 (1.57)	6.52 (1.43)	-.435	.664
AG1 Arousal	4.25 (1.89)	4.09 (1.64)	.616	.538
AG2 Valence**	6.53 (1.34)	4.40 (1.79)	9.29	<.000
AG2 Arousal*	4.69 (1.80)	5.64 (1.88)	-3.539	.001
AG3 Valence	6.19 (1.54)	6.27 (1.47)	-.386	.700
AG3 Arousal	4.96(2.09)	4.94 (2.12)	.034	.973
AG4 Valence	7.00 (1.29)	6.92 (1.41)	.193	.848
AG4 Arousal	5.89 (1.76)	5.76 (1.92)	.239	.812

Note. All values are means (standard deviations). AG = Mood Affect Grid, 1 = pre-mood induction, 2 = post-mood induction, 3 = 20 minutes post-mood induction, 4 = post-positive mood induction.
AG4 comparisons: N = 44 (19 in the neutral condition and 25 in the anger condition).
*$p < .05$, **$p < .001$

Table 3

Mood Check Comparisons within the Angry Condition

Comparisons	Anger condition N = 95	*t*	*p*
AG1 Valence, AG2 Valence	6.52 (1.43), 4.4 (1.79)**	11.155	<.000
AG1 Valence, AG3 Valence	6.52 (1.43), 6.27 (1.47)	1.656	.101
AG1 Valence, AG4 Valence	6.35 (1.15), 6.92 (1.41)*	-2.585	.016
AG2 Valence, AG3 Valence	4.40 (1.79), 6.27 (1.47)**	-9.710	<.000
AG2 Valence, AG4 Valence	3.88 (1.51), 6.92 (1.41)**	-8.380	<.000
AG3 Valence, AG4 Valence	6.32 (1.44), 6.92 (1.41)*	-3.928	.001
AG1 Arousal, AG2 Arousal	4.09 (1.64), 5.64 (1.88)**	-7.007	<.000
AG1 Arousal, AG3 Arousal	4.09 (1.64), 4.95 (2.12)**	-3.749	<.000
AG1 Arousal, AG4 Arousal	4.40 (1.53), 5.76 (1.92)*	-2.687	.013
AG2 Arousal, AG3 Arousal	5.64 (1.88), 4.95 (2.12)*	3.101	.003
AG2 Arousal, AG4 Arousal	6.08 (1.80), 5.76 (1.92)	.700	.491
AG3 Arousal, AG4 Arousal	5.48 (2.37), 5.76 (1.92)	-1.098	.283

Note. All values are means (standard deviations). AG = Mood Affect Grid, 1 = pre-mood induction, 2 = post-mood induction, 3 = 20 minutes post-mood induction, 4 = post-positive mood induction. AG4 comparisons: N = 44 (19 in the neutral condition and 25 in the anger condition).
*$p < .05$, **$p < .001$

Table 4

Mood Check Comparisons within the Neutral Condition

Comparisons	Neutral condition N = 95	*t*	*p*
AG1 Valence, AG2 Valence	6.43 (1.57), 6.53 (1.34)	-.832	.408
AG1 Valence, AG3 Valence	6.43 (1.57), 6.18 (1.54)	1.524	.131
AG1 Valence, AG4 Valence	6.52 (1.50), 7.00 (1.29)	-1.124	.276
AG2 Valence, AG3 Valence	6.54 (1.34), 6.19 (1.54)*	2.423	.017
AG2 Valence, AG4 Valence	6.37 (1.61), 7.00 (1.29)	-1.613	.124
AG3 Valence, AG4 Valence	6.37 (1.57), 7.00 (1.29)*	-2.585	.019
AG1 Arousal, AG2 Arousal	4.25 (1.88), 4.69 (1.80)*	-2.584	.011
AG1 Arousal, AG3 Arousal	4.25 (1.88), 4.96 (2.09)*	-2.946	.004
AG1 Arousal, AG4 Arousal	4.37 (1.80), 5.89 (1.76)*	-2.963	.008
AG2 Arousal, AG3 Arousal	4.69 (1.80), 4.96 (2.09)	-1.389	.168
AG2 Arousal, AG4 Arousal	4.58 (1.46), 5.89 (1.76)**	-4.435	<.000
AG3 Arousal, AG4 Arousal	5.00 (1.94), 5.89 (1.76)*	-3.392	.003

Note. All values are means (standard deviations). AG = Mood Affect Grid, 1 = pre-mood induction, 2 = post-mood induction, 3 = 20 minutes post-mood induction, 4 = post-positive mood induction. AG4 comparisons: N = 44 (19 in the neutral condition and 25 in the anger condition).
*$p < .05$, **$p < .001$

Table 5

Zero-Order Correlations Among Key Study Variables (n = 190

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1.	ABpostoutlier	*	.07	-.08	.06	-.04	.01	-.04	-.10	-.04	-.02	.01	.05	-.09	.09	.07	.06	.06	.08	.01	.09	.20*	-.12	-.07	.04	-.04	.04	-.04	.09	-.05	.13	-.02
1.	ColorStroop		*	-.09	.07	.07	-.08	-.06	-.04	-.11	-.03	-.06	-.02	.01	-.06	-.01	.03	-.19*	-.07	-.06	-.05	-.04	-.05	-.11	-.12	-.03	-.08	-.07	-.11	-.09	.17	.07
3.	BMI			*	.02	.11	.10	.22*	.18*	.13	.25*	.21*	-.17*	-.07	-.10	-.24*	-.12	-.11	-.02	-.003	.02	-.13	.13	-.04	-.12	-.06	.03	.02	-.11	-.28	-.17	.01
4.	Condition				*	-.09	-.02	-.04	-.02	-.06	-.06	-.02	-.06	-.01	-.08	-.04	-.04	-.15*	-.01	-.02	.001	.04	-.05	.03	-.05	-.56*	.25*	.03	-.003	-.03	-.04	-.05
5.	DCethnicity					*	.08	.06	.02	-.03	.13	.05	.13	.17*	.07	.11	.05	.21*	.16*	.08	.31*	.27*	.19*	.06	-.07	.07	-.07	.10	.02	-.01	.16	.07
6.	BULITRtotal						*	.75*	.54*	.71*	.73*	.73*	-.04	.01	-.05	-.10	.03	.15*	.44*	.44*	.03	.08	-.03	-.16*	-.04	-.13	-.02	-.27*	-.05	-.39*	-.04	.46*
7.	EDE-Oglobal							*	.85*	.88*	.96*	.95*	-.11	-.04	-.10	-.13	-.04	.09	.27*	.35*	.02	-.01	.03	-.16*	-.06	-.08	-.08	-.23*	.01	-.31*	.02	.43*
8.	EDE-								*	.67*	.72*	.69*	-.10	-.003	-.14*	-.09	-.02	.08	.18*	.27*	-.06	-.12	.02	-.10	-.04	-.05	-.09	-.19*	.01	-.21	.08	.24*
9.	EDE-									*	.81*	.79*	-.10	-.07	-.05	-.14	-.05	.05	.25*	.41*	.04	.01	.02	-.19*	.01	-.08	-.08	-.20*	.005	-.34*	-.005	.39*
10.	EDE-										*	.96*	-.10	-.04	-.10	-.12	-.03	.07	.25*	.31*	.05	.02	.05	-.15*	-.06	-.08	-.07	-.20*	.002	-.27	-.04	.46*
11.	EDE-											*	-.10	-.06	-.06	-.13	-.04	.12	.29*	.32*	.04	.04	.02	-.14	-.10	-.08	-.05	-.25*	.01	-.32*	.04	.46*
12.	FCItotal												*	.73*	.75*	.81*	.77*	.40*	.10	.08	.19*	.21*	-.04	-.07	.01	-.04	.05	-.10	.17*	-.13	.13	-.02
13.	FCIfats													*	.25*	.51*	.60*	.29*	-.01	-.01	.16*	.19*	.03	-.03	-.02	-.02	.03	-.02	.08	-.11	.25	.09
14.	FCIsweets														*	.47*	.39*	.32*	.12	.11	.20*	.18*	-.03	-.12	.11	-.06	.14	-.15*	.28*	-.21	.14	-.07
15.	FCIcarbs															*	.54*	.24*	.02	.01	.07	.11	-.08	-.02	-.09	-.02	-.02	-.03	.05	.09	-.18	-.06
16.	FCIfastfood																*	.41*	.17*	.13	.15*	.16*	-.03	-.02	-.03	.00	-.05	-.06	.05	-.11	.13	-.10
17.	PBS1																	*	.47*	.24*	.17*	.19*	.07	-.09	.05	.02	-.08	-.08	.01	-.19	.11	.03
18.	PBS2																		*	.55*	.11	.19*	.03	-.04	.04	-.12	.01	-.19*	-.001	-.34*	.02	.21*
19.	PBS3LN																			*	-.01	.04	-.03	-.05	.07	-.07	.08	-.14	.18*	-.16	.14	.21*
20.	Foodtaken																				*	.79*	.50*	-.12	-.02	-.04	.04	.02	.13	-.06	.27	.19*
21.	Candytaken																					*	.08	-.07	.01	-.09	.15*	.01	.11	.03	.25	.18*
22.	Orangestaken																						*	-.08	-.10	.06	-.02	.03	.11	-.23	.29	.12
23.	AG1Valence																							*	.36*	.38*	-.14	.49*	-.19*	.41*	.01	-.08
24.	AG1Arousal																								*	-.19*	.41*	-.18	.32	-.24	.06	-.07
25.	AG2Valence																									*	-.43*	.34*	-.15*	.23	.09	-.08
26.	AG2Arousal																										*	-.10	.47*	-.001	.35*	-.04

| | | |

Table 6

Hierarchical Multiple Regression Analysis Predicting Interference Scores from the Food Stroop

Model	*R*	R^2	ΔR^2	*β*	*p*
Step 1	.080	.006	.006		.279
BMI				-.080	.279
Step 2	.105	.011	.004		.714
BMI				-.082	.276
Condition				.066	.378
cNU				-.010	.909
cBulitRtotal				.002	.982
Step 3	.152	.023	.012		.765
BMI				-.089	.239
Condition				.070	.354
cNU				.084	.488
cBulitRtotal				-.071	.576
Condition X cNU				-.132	.266
Condtion X cBulitRtotal				.067	.579
cNU X cBulitRtotal				.077	.325
Step 4	.165	.027	.004		.772
BMI				-.093	.222
Condition				.102	.225
cNU				.085	.487
cBulitRtotal				-.089	.487
Condition X cNU				-.129	.275
Condition X cBulitRtotal				.092	.460
cNU X cBulitRtotal				.143	.194
Condition X cNU x cBulitRtotal				-.098	.392

Note. c = centered, BMI = body mass index, Condition = neutral (coded 0) or anger (coded 1) NU = negative urgency, BulitRtotal = total score from the BULIT-R.

Table 7

Hierarchical Multiple Regression Analysis Predicting Item One from the Probability of Binge Eating Scale (Condition)

Model	*R*	R^2	ΔR^2	β	*p*
Step 1	.299*	.089	.089*		.001
BMI				-.149*	.039
BulitRtotal				.158*	.029
DCethnicity				.221*	.002
Step 2	.336*	.113	.024		.002
BMI				-.143*	.048
BulitRtotal				.200*	.015
DCethnicity				.220*	.003
Condition				-.109	.128
cAB				.081	.261
cNU				-.093	.251
Step 3	.349*	.121	.009		.007
BMI				-.145*	.047
cBulirRtotal				.202*	.014
DCethnicity				.213*	.004
Condition				-.115	.111
cAB				.027	.774
cNU				-.118	.271
Condition X cNU				.047	.641
cNU X cAB				-.061	.400
Condition X cAB				.080	.395
Step 4	.355*	.126	.004		.009
BMI				-.145*	.048
cBulitRtotal				.203*	.014
DCethnicity				.206*	.006
Condition				-.118	.103
cAB				.029	.302
cNU				-.124	.250
Condition X cNU				.051	.609
cAB X cNU				-.009	.919
Condition X cAB				.076	.425
Condition X cNU x cAB				-.085	.355

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), Condition = neutral (coded 0) or anger (coded 1), AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.
*$p < .05$.

Table 8

Hierarchical Multiple Regression Analysis Predicting Item One from the Probability of Binge Eating Scale (Arousal)

Model	*R*	R^2	ΔR^2	β	*p*
Step 1	.299*	.089	.089*		.001
BMI				-.149*	.039
cBulitRtotal				.158*	.029
DCethnicity				.221*	.002
Step 2	.323*	.104	.015		.003
BMI				-.145*	.046
cBulitRtotal				.202*	.014
DCethnicity				.228*	.002
cAB				.076	.292
cNU				-.093	.255
cAG2ar				-.055	.446
Step 3	.333*	.111	.007		.014
BMI				-.153*	.037
cBulirRtotal				.203*	.014
DCethnicity				.217*	.003
cAB				.072	.319
cNU				-.093	.260
cAG2ar				-.060	.408
cAB X cNU				-.061	.403
cAG2ar X cNU				-.060	.409
cAG2ar X cAB				.020	.783
Step 4	.342*	.117	.006		.016
BMI				-.159*	.031
cBulitRtotal				.209*	.012
DCethnicity				.224*	.003
cAB				.071	.329
cNU				-.098	.236
cAG2ar				-.056	.438
cAB X cNU				-.088	.255
cAG2ar X cNU				-.057	.435
cAG2ar X cAB				.015	.835
cAG2ar X cNU x cAB				-.081	.291

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2ar = arousal levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.
*$p < .05$.

Table 9

Hierarchical Multiple Regression Analysis Predicting Item One from the Probability of Binge Eating Scale (Valence)

Model	*R*	R^2	ΔR^2	*β*	*p*
Step 1	.299*	.089	.089*		.001
BMI				-.149*	.039
cBulitRtotal				.158*	.029
DCethnicity				.221*	.002
Step 2	.318*	.101	.012		.004
BMI				-.148*	.043
cBulitRtotal				.202*	.015
DCethnicity				.232*	.002
cAB				.074	.307
cNU				-.092	.260
cAG2val				-.006	.929
Step 3	.325*	.106	.004		.020
BMI				-.152*	.040
cBulirRtotal				.202*	.016
DCethnicity				.229*	.002
cAB				.069	.345
cNU				-.087	.291
cAG2val				-.007	.930
cAGval X cNU				-.001	.993
cAG2val X cAB				-.037	.613
cAB X cNU				-.058	.426
Step 4	.325*	.106	.000		.033
BMI				-.152*	.040
cBulitRtotal				.203*	.016
DCethnicity				.228*	.002
cAB				.069	.344
cNU				-.088	.290
cAG2val				-.006	.936
cAG2val X cNU				-.001	.990
cAG2val X cAB				-.039	.600
cAB X cNU				-.059	.423
cAG2val X cAB x cNU				.012	.877

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2val = valence levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.
*$p < .05$.

Table 10

Hierarchical Multiple Regression Analysis Predicting Item Two from the Probability of Binge Eating Scale (Condition)

Model	*R*	R^2	ΔR^2	β	*p*
Step 1	.458*	.210	.210*		<.000
BMI				-.075	.265
cBulitRtotal				.437*	<.000
DCethnicity				.123	.067
Step 2	.470*	.221	.011		<.000
BMI				-.067	.325
cBulitRtotal				.431*	<.000
DCethnicity				.128	.061
Condition				-.001	.989
cAB				.105	.120
cNU				.013	.868
Step 3	.484*	.235	.014		<.000
BMI				-.079	.247
cBulirRtotal				.436*	<.000
DCethnicity				.127	.063
Condition				-.006	.929
cAB				.104	.240
cNU				.074	.459
Condition X cNU				-.085	.365
cNU X cAB				-.105	.122
Condition X cAB				-.014	.872
Step 4	.489*	.239	.005		<.000
BMI				-.078	.249
cBulitRtotal				.436*	<.000
DCethnicity				.120	.081
Condition				-.009	.898
cAB				.106	.233
cNU				.069	.496
Condition X cNU				-.080	.393
cAB X cNU				-.052	.545
Condition X cAB				-.019	.829
Condition X cNU x cAB				-.087	.309

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), Condition = neutral (coded 0) or anger (coded 1), AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.
*$p < .05$,

Table 11

Hierarchical Multiple Regression Analysis Predicting Item Two from the Probability of Binge Eating Scale (Arousal)

Model	*R*	R^2	ΔR^2	β	*p*
Step 1	.458*	.210	.210*		<.000
BMI				-.075	.265
cBulitRtotal				.437*	<.000
DCethnicity				.123	.067
Step 2	.470*	.221	.011		<.000
BMI				-.067	.323
cBulitRtotal				.432*	<.000
DCethnicity				.128	.059
cAB				.104	.121
cNU				.013	.867
cAG2ar				.007	.914
Step 3	.485*	.235	.014		<.000
BMI				-.072	.292
cBulirRtotal				.439*	<.000
DCethnicity				.131	.056
cAB				.096	.155
cNU				.016	.828
cAG2ar				.011	.874
cAB X cNU				-.098	.146
cAG2ar X cNU				.042	.531
cAG2ar X cAB				-.048	.472
Step 4	.500*	.250	.015		<.000
BMI				-.080	.234
cBulitRtotal				.448*	<.000
DCethnicity				.142*	.038
cAB				.094	.162
cNU				.008	.914
cAG2ar				.017	.802
cAB X cNU				-.142*	.046
cAG2ar X cNU				.048	.477
cAG2ar X cAB				-.056	.401
cAG2ar X cAB x cNU				-.133	.062

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2ar = arousal levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.
*$p < .05$.

Table 12

Hierarchical Multiple Regression Analysis Predicting Item Two from the Probability of Binge Eating Scale (Valence)

Model	*R*	R^2	ΔR^2	β	*p*
Step 1	.458*	.210	.210*		<.000
BMI				-.075	.265
cBulitRtotal				.437*	<.000
DCethnicity				.123	.067
Step 2	.475*	.225	.015		<.000
BMI				-.071	.292
cBulitRtotal				.425*	<.000
DCethnicity				.135*	.047
cAB				.103	.125
cNU				.009	.905
cAG2val				-.067	.319
Step 3	.486*	.236	.011		<.000
BMI				-.080	.239
cBulirRtotal				.430*	<.000
DCethnicity				.132	.054
cAB				.095	.159
cNU				.015	.848
cAG2val				-.067	.325
cAG2val X cNU				.025	.715
cAG2val X cAB				-.025	.715
cAB X cNU				-.099	.141
Step 4	.486*	.237	.001		<.000
BMI				-.082	.232
cBulitRtotal				.433*	<.000
DCethnicity				.130	.058
cAB				.096	.156
cNU				.013	.863
cAG2val				-.066	.337
cAGval X cNU				.024	.724
cAG2val X cAB				-.030	.662
cAB X cNU				-.101	.136
cAG2val X cAB x cNU				.029	.675

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2val = valence levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.
*$p < .05$.

Table 13

Hierarchical Multiple Regression Analysis Predicting Item Three from the Probability of Binge Eating Scale (Condition)

Model	*R*	R^2	ΔR^2	β	*p*
Step 1	.472*	.223	.223*		<.000
BMI				-.046	.493
cBulitRtotal				.471*	<.000
DCethnicity				.034	.610
Step 2	.474*	.225	.002		<.000
BMI				-.041	.542
cBulitRtotal				.458*	<.000
DCethnicity				.033	.627
Condition				-.013	.851
cAB				.041	.538
cNU				.027	.722
Step 3	.477*	.228	.003		<.000
BMI				-.043	.531
cBulirRtotal				.459*	<.000
DCethnicity				.029	.669
Condition				-.016	.814
cAB				.008	.930
cNU				.021	.836
Condition X cNU				.015	.872
cNU X cAB				-.034	.615
Condition X cAB				.050	.575
Step 4	.478*	.228	.000		<.000
BMI				-.043	.533
cBulitRtotal				.459*	<.000
DCethnicity				.027	.697
Condition				-.017	.805
cAB				.008	.926
cNU				.019	.851
Condition X cNU				.017	.859
cAB X cNU				-.017	.845
Condition X cAB				.048	.589
Condition X cNU x cAB				-.028	.741

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), Condition = neutral (coded 0) or anger (coded 1), AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.
*$p < .05$.

Table 14

Hierarchical Multiple Regression Analysis Predicting Item Three from the Probability of Binge Eating Scale (Arousal)

Model	*R*	R^2	ΔR^2	β	*p*
Step 1	.472*	.223	.223*		<.000
BMI				-.046	.493
cBulitRtotal				.471*	<.000
DCethnicity				.034	.610
Step 2	.478*	.229	.006		<.000
BMI				-.044	.510
cBulitRtotal				.459*	<.000
DCethnicity				.039	.566
cAB				.038	.568
cNU				.028	.709
cAG2ar				.063	.341
Step 3	.480*	.231	.002		<.000
BMI				-.048	.478
cBulirRtotal				.461*	<.000
DCethnicity				.036	.597
cAB				.035	.609
cNU				.028	.710
cAG2ar				.063	.353
cAB X cNU				-.034	.610
cAG2ar X cNU				-.021	.761
cAG2ar X cAB				-.013	.841
Step 4	.489*	.239	.008		<.000
BMI				-.055	.421
cBulitRtotal				.468*	<.000
DCethnicity				.044	.520
cAB				.033	.627
cNU				.022	.770
cAG2ar				.067	.319
cAB X cNU				-.067	.349
cAG2ar X cNU				-.017	.806
cAG2ar X cAB				-.019	.774
cAG2ar X cAB x cNU				-.098	.171

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2ar = arousal levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.
*$p < .05$.

Table 15

Hierarchical Multiple Regression Analysis Predicting Item Three from the Probability of Binge Eating Scale (Valence)

Model	*R*	R^2	ΔR^2	β	*p*
Step 1	.472*	.223	.223*		<.000
BMI				-.046	.493
cBulitRtotal				.471*	<.000
DCethnicity				.034	.610
Step 2	.474*	.225	.002		<.000
BMI				-.041	.542
cBulitRtotal				.459*	<.000
DCethnicity				.034	.620
cAB				.041	.544
cNU				.027	.718
cAG2val				.005	.936
Step 3	.491*	.241	.016		<.000
BMI				-.048	.482
cBulirRtotal				.453*	<.000
DCethnicity				.036	.596
cAB				.031	.644
cNU				.037	.623
cAG2val				-.008	.908
cAG2val X cNU				.044	.511
cAG2val X cAB				-.112	.096
cAB X cNU				-.041	.537
Step 4	.491*	.241	.001		<.000
BMI				-.049	.471
cBulitRtotal				.456*	<.000
DCethnicity				.035	.610
cAB				.032	.634
cNU				.036	.637
cAG2val				-.007	.923
cAG2val X cNU				.044	.520
cAG2val X cAB				-.117	.088
cAB X cNU				-.043	.523
cAG2val X cAB x cNU				.027	.691

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2val = valence levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.
*$p < .05$.

Table 16

Hierarchical Multiple Regression Analysis Predicting FCI Carbohydrate Cravings (Condition)

Model	*R*	R^2	ΔR^2	*β*	*p*
Step 1	.293*	.086	.086*		.001
BMI				-.252*	.001
cBulitRtotal				-.075	.299
DCethnicity				.150*	.038
Step 2	.311*	.097	.011		.006
BMI				-.248*	.001
cBulitRtotal				-.043	.597
DCethnicity				.158*	.031
Condition				-.006	.936
cAB				.088	.226
cNU				-.066	.421
Step 3	.337*	.113	.016		.012
BMI				-.240*	.001
cBulirRtotal				-.043	.597
DCethnicity				.148*	.044
Condition				-.010	.891
cAB				.022	.818
cNU				-.155	.152
Condition X cNU				.138	.170
cNU X cAB				.001	.987
Condition X cAB				.111	.242
Step 4	.337*	.114	.000		.020
BMI				-.240*	.001
cBulitRtotal				-.044	.597
DCethnicity				.149*	.044
Condition				-.009	.897
cAB				.022	.821
cNU				-.154	.157
Condition X cNU				.137	.174
cAB X cNU				-.009	.920
Condition X cAB				.112	.240
Condition X cNU x cAB				.017	.853

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), Condition = neutral (coded 0) or anger (coded 1), AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.
*$p < .05$.

Table 17

Hierarchical Multiple Regression Analysis Predicting FCI Carbohydrate Cravings (Arousal)

Model	*R*	R^2	ΔR^2	*β*	*p*
Step 1	.293*	.086	.086*		.001
BMI				-.252*	.001
cBulitRtotal				-.075	.299
DCethnicity				.150*	.038
Step 2	.312*	.097	.011		.006
BMI				-.247*	.001
cBulitRtotal				-.043	.596
DCethnicity				.158*	.031
cAB				.088	.224
cNU				-.066	.419
cAG2ar				-.018	.807
Step 3	.356*	.127	.030		.004
BMI				-.235*	.001
cBulirRtotal				-.039	.632
DCethnicity				.175*	.017
cAB				.091	.207
cNU				-.061	.457
cAG2ar				-.007	.922
cAB X cNU				.005	.941
cAG2ar X cNU				.174*	.017
cAG2ar X cAB				-.024	.736
Step 4	.356*	.127	.000		.008
BMI				-.235*	.001
cBulitRtotal				-.039	.633
DCethnicity				.175*	.018
cAB				.091	.209
cNU				-.061	.459
cAG2ar				-.007	.922
cAB X cNU				.005	.945
cAG2ar X cNU				.174*	.017
cAG2ar X cAB				-.024	.737
cAG2ar X cNU x cAB				.000	.998

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2ar = arousal levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.
*$p < .05$.

Table 18

Hierarchical Multiple Regression Analysis Predicting FCI Carbohydrate Cravings (Valence)

Model	*R*	R^2	ΔR^2	*β*	*p*
Step 1	.293*	.089	.086*		.001
BMI				-.252*	.001
cBulitRtotal				-.075	.299
DCethnicity				.150*	.038
Step 2	.318*	.101	.015		.004
BMI				-.252*	.001
cBulitRtotal				-.050	.545
DCethnicity				.166*	.024
cAB				.085	.236
cNU				-.069	.396
cAG2val				-.066	.362
Step 3	.350*	.122	.021		.006
BMI				-.242*	.001
cBulirRtotal				-.062	.449
DCethnicity				.154*	.036
cAB				.086	.233
cNU				-.062	.448
cAG2val				-.060	.418
cAGval X cNU				-.116	.110
cAG2val X cAB				-.095	.186
cAB X cNU				-.004	.957
Step 4	.350*	.123	.000		.011
BMI				-.242*	.001
cBulitRtotal				-.064	.437
DCethnicity				.155*	.035
cAB				.085	.239
cNU				-.061	.457
cAG2val				-.060	.412
cAG2val X cNU				-.116	.113
cAG2val X cAB				-.092	.215
cAB X cNU				-.003	.971
cAG2val X cAB x cNU				-.020	.783

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2val = valence levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.
*$p < .05$.

Table 19

Logistic Regression Analysis Predicting Food Consumption (Condition)

Model/Variable	OR	95% C. I.	p
Model 1			<.000
Block 1			<.000
BULITRtotal	1.003	.984-1.022	.785
DCethnicity	4.792*	2.287-10.038	<.000
BMI	.998	.911-1.093	.959
Model 2			<.000
Block 2			.010
BULITRtotal	.990	.968-1.012	.361
DCethnicity	5.204*	2.389-11.339	<.000
BMI	1.009	.921-1.104	.850
Condition	1.110	.575-2.146	.755
cNU	1.073*	1.017-1.132	.010
cAB	1.006*	1.000-1.011	.038
Model 3			<.000
Block 3			.323
BULITRtotal	.988	.966-1.011	.299
DCethnicity	5.448*	2.468-.12.029	<.000
BMI	1.009	.919-1.109	.847
Condition	1.119	.575-2.177	.741
cNU	1.088*	1.011-1.170	.024
cAB	1.003	.996-1.010	.390
Condition X cNU	.975	.884-1.074	.603
cAB X cNU	1.001	1.000-1.001	.151
cAB X Condition	1.005	.995-1.016	.320
Model 4			<.000
Block 4			.106
BULITRtotal	.998	.966-1.010	.287
DCethnicity	5.139*	2.312-11.423	<.000
BMI	1.008	.917-1.108	.870
Condition	1.050	.534-2.065	.888
cNU	1.090*	1.011-1.175	.025
cAB	1.003	.995-1.011	.456
Condition X cNU	.971	.879-1.073	.566
cAB X cNU	1.001*	1.000-1.003	.046
cAB X Condition	1.005	.994-1.017	.335
CAB X cNU X Condtion	.999	.997-1.000	.116

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), Condition = neutral (coded 0) or anger (coded 1), AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.

Table 20

Logistic Regression Analysis Predicting Candy Consumption (Condition)

Model/Variable	OR	95% C. I.	*p*
Model 1			<.000
Block 1			<.000
BULITRtotal	1.009	.990-1.028	.346
DCethnicity	3.605*	1.821-7.137	<.000
BMI	.903*	.821-.994	.036
Model 2			<.000
Block 2			.001
BULITRtotal	.999	.977-1.021	.917
DCethnicity	4.188*	2.006-8.741	<.000
BMI	.913	.825-1.011	.080
Condition	1.399	.720-2.718	.322
cNU	1.056*	1.002-1.113	.042
cAB	1.009*	1.003-1.014	.002
Model 3			<.000
Block 3			.705
BULITRtotal	.998	.976-1.021	.870
DCethnicity	4.323*	2.052-.9.107	<.000
BMI	.916	.828-1.013	.088
Condition	1.425	.728-2.793	.302
cNU	1.058	.985-1.135	.123
cAB	1.008*	1.000-1.015	.037
Condition X cNU	.996	1.000-1.095	.938
cAB X cNU	1.000	1.00-1.001	.275
cAB X Condition	1.002	.991-1.013	.677
Model 4			<.000
Block 4			.359
BULITRtotal	.998	.976-1.021	.887
DCethnicity	4.204*	1.990-8.880	<.000
BMI	.915	.827-1.013	.088
Condition	1.388	.704-2.733	.344
cNU	1.056	.982-1.135	.140
cAB	1.008*	1.000-1.015	.036
Condition X cNU	.997	.906-1.097	.953
cAB X cNU	1.001	1.001-1.002	.163
cAB X Condition	1.002	.991-1.013	.704
CAB X cNU X Condition	.999	.998-1.001	.363

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), Condition = neutral (coded 0) or anger (coded 1), AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.

Table 21

Logistic Regression Analysis Predicting Orange Consumption (Condition)

Model/Variable	OR	95% C. I.	*p*
Model 1			.019
Block 1			.019
BULITRtotal	.991	.969-1.013	.412
DCethnicity	2.672*	1.265-5.648	.010
BMI	1.078	.980-1.186	.124
Model 2			.005
Block 2			.038
BULITRtotal	.974	.946-1.002	.064
DCethnicity	2.493*	1.154-5.386	.020
BMI	1.077	.978-1.185	.130
Condition	.672	.311-1.451	.312
cNU	1.073*	1.009-1.140	.024
cAB	.996	.990-1.002	.167
Model 3			.024
Block 3			.876
BULITRtotal	.973	.945-1.001	.057
DCethnicity	2.516*	1.152-5.495	.021
BMI	1.076	.976-1.186	.141
Condition	.683	.303-1.516	.349
cNU	1.074	.994-1.159	.069
cAB	.995	.987-1.003	.227
Condition X cNU	1.001	.899-1.116	.979
cAB X cNU	1.000	.999-1.001	.415
cAB X Condition	1.000	.988-1.013	.996
Model 4			.037
Block 4			.689
BULITRtotal	.973	.945-1.001	.058
DCethnicity	2.463*	1.121-5.412	.025
BMI	1.075	.975-1.186	.145
Condition	.686	.309-1.526	.356
cNU	1.073	.994-1.159	.073
cAB	.995	.987-1.003	.211
Condition X cNU	1.000	.879-1.114	1.000
cAB X cNU	1.001	.999-1.002	.374
cAB X Condition	1.000	.988-1.013	.940
CAB X cNU X Condtion	1.000	.998-1.001	.688

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), Condition = neutral (coded 0) or anger (coded 1), AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.

Table 22

Logistic Regression Analysis Predicting Food Consumption (Arousal)

Model/Variable	OR	95% C. I.	*p*
Model 1			<.000
Block 1			<.000
BULITRtotal	1.003	.984-1.022	.785
DCethnicity	4.792*	2.287-10.038	<.000
BMI	.998	.911-1.093	.959
Model 2			<.000
Block 2			.007
BULITRtotal	.990	.968-1.012	.376
DCethnicity	5.342*	2.448-11.657	<.000
BMI	1.009	.920-1.105	.855
cNU	1.072*	1.017-1.131	.010
cAB	1.006*	1.000-1.011	.036
cAG2ar	1.088	.915-1.292	.340
Model 3			<.000
Block 3			.248
BULITRtotal	.988	.966-1.011	.320
DCethnicity	5.158*	2.344-.11.350	<.000
BMI	1.012	.920-1.113	.810
cNU	1.072*	1.015-1.133	.012
cAB	1.006*	1.000-1.012	.036
cAG2ar	1.071	.897-1.279	.447
cABXcNU	1.001	1.000-1.001	.194
cAG2ar X cNU	.982	.956-1.009	.195
cAG2ar X cAB	1.001	.998-1.004	.535
Model 4			<.000
Block 4			.406
BULITRtotal	.989	.967-1.012	.345
DCethnicity	5.308*	2.390-11.786	<.000
BMI	1.008	.916-1.110	.864
cNU	1.072*	1.014-1.133	.014
cAB	1.006*	1.000-1.011	.042
cAG2ar	1.070	.895-1.279	.456
cAB X cNU	1.001	1.000-1.001	.243
cAG2ar X cNU	.981	.954-1.008	.170
cAG2ar X cAB	1.001	.998-1.003	.548
cAG2ar X cAB X cNU	1.000	.999-1.000	.407

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2ar = arousal levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.

Table 23

Logistic Regression Analysis Predicting Candy Consumption (Arousal)

Model/Variable	OR	95% C. I.	*p*
Model 1			<.000
Block 1			<.000
BULITRtotal	1.009	.990-1.028	.346
DCethnicity	3.605*	1.821-7.137	<.000
BMI	.903*	.821-.994	.036
Model 2			<.000
Block 2			<.000
BULITRtotal	1.000	.978-1.023	.999
DCethnicity	4.479*	2.114-9.490	<.000
BMI	.905	.816-1.004	.059
cNU	1.059*	1.004-1.116	.036
cAB	1.009*	1.004-1.015	.001
cAG2ar	1.246*	1.042-1.490	.016
Model 3			<.000
Block 3			.527
BULITRtotal	.999	.977-1.022	.958
DCethnicity	4.575*	2.126-9.842	<.000
BMI	.900	.810-1.001	.053
cNU	1.058*	1.003-1.117	.040
cAB	1.009*	1.003-1.015	.002
cAG2ar	1.253*	1.043-1.506	.016
cABXcNU	1.000	.999-1.001	.529
cAG2ar X cNU	.988	.962-1.014	.364
cAG2ar X cAB	.999	.996-1.002	.473
Model 4			<.000
Block 4			.397
BULITRtotal	1.000	.978-1.023	.995
DCethnicity	4.674*	2.165-10.090	<.000
BMI	.899*	.808-1.000	.050
cNU	1.055	.999-1.115	.056
cAB	1.009*	1.003-1.015	.002
cAG2ar	1.254*	1.043-1.507	.016
cAB X cNU	1.000	.999-1.001	.623
cAG2ar X cNU	.988	.962-1.015	.397
cAG2ar X cAB	.999	.996-1.002	.480
cAG2ar X cAB X cNU	1.000	.999-1.000	.405

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2ar = arousal levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.

Table 24

Logistic Regression Analysis Predicting Orange Consumption (Arousal)

Model/Variable	OR	95% C. I.	*p*
Model 1			.019
Block 1			.019
BULITRtotal	.991	.969-1.013	.412
DCethnicity	2.672*	1.265-5.648	.010
BMI	1.078	.980-1.186	.124
Model 2			.008
Block 2			.059
BULITRtotal	.975	.949-1.003	.077
DCethnicity	2.577*	1.192-5.571	.016
BMI	1.075	.978-1.183	.136
cNU	1.071*	1.008-1.138	.026
cAB	.996	.990-1.002	.155
cAG2ar	1.018	.836-1.240	.857
Model 3			.026
Block 3			.692
BULITRtotal	.974	.947-1.002	.065
DCethnicity	2.527*	1.158-5.514	.020
BMI	1.069	.970-1.178	.178
cNU	1.074*	1.010-1.142	.024
cAB	.995	.989-1.001	.115
cAG2ar	1.037	.847-1.269	.726
cABXcNU	1.000	1.000-1.001	.362
cAG2ar X cNU	.991	.964-1.019	.543
cAG2ar X cAB	1.001	.998-1.004	.549
Model 4			.034
Block 4			.441
BULITRtotal	.973	.946-1.001	.059
DCethnicity	2.439*	1.111-5.358	.026
BMI	1.076	.975-1.187	.144
cNU	1.077*	1.011-1.147	.021
cAB	.995	.989-1.002	.150
cAG2ar	1.023	.834-1.256	.826
cAB X cNU	1.000	1.000-1.001	.299
cAG2ar X cNU	.992	.964-1.020	.572
cAG2ar X cAB	1.001	.998-1.004	.633
cAG2ar X cAB X cNU	1.000	1.000-1.001	.446

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2ar = arousal levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.

Table 25

Logistic Regression Analysis Predicting Food Consumption (Valence)

Model/Variable	OR	95% C. I.	*p*
Model 1			<.000
Block 1			<.000
BULITRtotal	1.003	.984-1.022	.785
DCethnicity	4.792*	2.287-10.038	<.000
BMI	.998	.911-1.093	.959
Model 2			<.000
Block 2			.007
BULITRtotal	.989	.967-1.011	.317
DCethnicity	5.395*	2.462-11.822	<.000
BMI	1.007	.919-1.103	.889
cNU	1.072*	1.016-1.131	.011
cAB	1.006*	1.000-1.011	.038
cAG2val	.920	.770-1.099	.357
Model 3			<.000
Block 3			.299
BULITRtotal	.987	.965-1.010	.272
DCethnicity	5.747*	2.594-.12.733	<.000
BMI	1.008	.916-1.108	.875
cNU	1.072*	1.016-1.131	.012
cAB	1.006*	1.000-1.011	.046
cAG2val	.902	.751-1.083	.268
cABXcNU	1.001	1.000-1.001	.168
cAG2val X cNU	1.009	.984-1.034	.495
cAG2val X cAB	.999	.996-1.002	.337
Model 4			<.000
Block 4			.242
BULITRtotal	.989	.966-1.011	.320
DCethnicity	5.695*	2.557-12.685	<.000
BMI	1.003	.912-1.103	.954
cNU	1.071*	1.014-1.131	.014
cAB	1.006*	1.000-1.011	.047
cAG2val	.911	.757-1.096	.323
cAB X cNU	1.001	1.000-1.001	.177
cAG2val X cNU	1.010	.985-1.036	.420
cAG2val X cAB	.998	.995-1.001	.244
cAG2val X cAB X cNU	1.000	1.000-1.001	.250

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2val = valence levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.

Table 26

Logistic Regression Analysis Predicting Candy Consumption (Valence)

Model/Variable	OR	95% C. I.	*p*
Model 1			<.000
Block 1			<.000
BULITRtotal	1.009	.990-1.028	.346
DCethnicity	3.605*	1.821-7.137	<.000
BMI	.903*	.821- .994	.036
Model 2			<.000
Block 2			.001
BULITRtotal	.997	.975-1.020	.785
DCethnicity	4.321*	2.057-9.076	<.000
BMI	.911	.823-1.007	.068
cNU	1.054*	1.000-1.112	.049
cAB	1.009*	1.003-1.014	.002
cAG2val	.876	.773-1.047	.147
Model 3			<.000
Block 3			.698
BULITRtotal	.996	.974-1.019	.730
DCethnicity	4.484*	2.118-9.493	<.000
BMI	.913	.826-1.009	.076
cNU	1.053	.999-1.111	.055
cAB	1.009*	1.003-1.014	.002
cAG2val	.867	.722-1.041	.126
cABXcNU	1.000	1.000-1.001	.281
cAG2val X cNU	1.002	.978-1.025	.893
cAG2val X cAB	.999	.996-1.002	.637
Model 4			<.000
Block 4			.627
BULITRtotal	.997	.974-1.020	.771
DCethnicity	4.449*	2.097-9.439	<.000
BMI	.912	.824-1.008	.072
cNU	1.052	.997-1.110	.062
cAB	1.009*	1.003-1.014	.002
cAG2val	.870	.724-1.046	.139
cAB X cNU	1.000	1.000-1.001	.328
cAG2val X cNU	1.002	.978-1.026	.880
cAG2val X cAB	.999	.996-1.002	.583
cAG2val X cAB X cNU	1.000	1.000-1.001	.630

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2val = valence levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.

Table 27

Regression Analysis Predicting Orange Consumption (Valence)

Model/Variable	OR	95% C. I.	*p*
Model 1			.019
Block 1			.019
BULITRtotal	.991	.969-1.013	.412
DCethnicity	2.672*	1.265-5.648	.010
BMI	1.078	.980- 1.186	.124
Model 2			.006
Block 2			.048
BULITRtotal	.976	.949-1.003	.083
DCethnicity	2.497*	1.156-5.394	.020
BMI	1.078	.976-1.186	.126
cNU	1.073*	1.009-1.140	.024
cAB	.996	.990-1.002	.154
cAG2val	1.072	.883-1.301	.483
Model 3			.027
Block 3			.837
BULITRtotal	.974	.974-1.019	.072
DCethnicity	2.579*	1.179-5.641	.018
BMI	1.074	.974-1.183	.151
cNU	1.074*	1.010-1.142	.023
cAB	.995	.989-1.001	.116
cAG2val	1.050	.851-1.295	.652
cABXcNU	1.000	.999-1.001	.422
cAG2val X cNU	1.004	.979-1.031	.743
cAG2val X cAB	1.000	.997-1.003	.849
Model 4			.043
Block 4			.996
BULITRtotal	.974	.947-1.002	.073
DCethnicity	2.579*	1.179-5.642	.018
BMI	1.074	.974-1.183	.152
cNU	1.074*	1.009-1.143	.024
cAB	.995	.989-1.001	.116
cAG2val	1.050	.850-1.296	.653
cAB X cNU	1.000	.999-1.001	.424
cAG2val X cNU	1.004	.979-1.031	.745
cAG2val X cAB	1.000	.996-1.003	.864
cAG2val X cAB X cNU	1.000	1.000-1.000	.996

Note. c = centered, BMI = body mass index, BULITRtotal = total score from the BULIT-R, DCethnicity = dummy coded ethnicity (white = 0 and non-white = 1), AG2val = valence levels from the second affect grid (post-mood induction) AB = interference from the Food Stroop with between subject and within subject outliers removed, NU = negative urgency.

Chapter 4

DISCUSSION

The main purpose of this study was to test an integrated model of disordered eating attitudes and beliefs, negative affect, and impulsivity in the prediction of food attentional bias and to further determine if these variables were associated with food cravings and consumption. Individuals who engage in emotional eating or who express higher concerns regarding their eating habits, weight, and shape expend a larger amount of their cognitive capacity on hypervigilance to food "threat" cues (Fairburn, 2008). As a result, limited self-regulatory resources are available to manage stressors or distractions like negative moods (Baumeister, et al., 1998; Muraven, et al.; Macht, 2008) such that, in accordance with restraint theory (Herman and Polivy, 1980), cognitive control would become disrupted and the incentive value of food becomes more salient (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004).). We proposed that individuals who also exhibit higher levels of trait negative urgency would correspondingly experience increased difficulty managing food and eating cues while distressed. We anticipated a break in cognitive control for individuals with heightened eating concerns to manifest as an attentional bias to food words, increased cravings and urges to eat or binge, and increased food consumption. More specifically, we hypothesized that individuals who reported disordered eating attitudes and behaviors would demonstrate increased attentional biases to binge-related words on the Food Stroop. We also hypothesized that an induced negative mood would catalyze cognitive resource depletion such that individuals with preexisting eating concerns would demonstrate greater attentional bias on the Food Stroop. We predicted that highly urgent

individuals with eating pathology would have the most difficulty ignoring stressful food stimuli while concurrently experiencing a negative mood. We expected that an attentional bias for food words would predict cravings for foods and actual palatable food consumption. As even individuals without clinical eating pathology may engage in emotional eating during negative moods (Macht, 2008), we also anticipated that individuals who underwent the angry mood induction would be more likely to experience food cravings and consume food. Negative urgency was hypothesized to interact with mood and attentional bias to increase food cravings and food consumption, but was also expected to demonstrate significant main effects on food cravings and consumption.

Attentional Bias to Food Cues

None of the hypotheses related to the prediction of attentional bias to food words were supported. Specifically, there was no difference in interference scores on the Food Stroop between the anger and neutral mood conditions. Additionally, there was no relationship between emotional arousal or valence and interference scores from the Food Stroop. Surprisingly, there also was no relationship between eating pathology (whether measured by the EDE-Q global score, the BULIT-R, the restraint subscale, the eating concerns subscale, the weight concerns subscale, or the shape concerns subscale) and attentional bias to food words. Finally, negative urgency did not show a significant relationship with interference scores from the Food Stroop. Therefore, no main or interactive effects were significant predictors of attentional bias to food cues.

Our results were surprising given we utilized a word list that was shown to produce attentional biases and recruited our sample with BULIT-R scores in the same manner as Rofey and colleagues (2004), who reported a significant interaction between mood and eating

pathology. However, there were several methodological differences that may have contributed to our contradictory findings. Although the sample recruited by Rofey et al. (2004) also was composed of nonclinical college women, their range of reported eating pathology using the BULIT-R was higher (30 – 107 versus 30 -128). This is particularly important given that there is no description of the participant's average BMI. We elected to remove participants based on low BMI (below 17.5) as this is an indicator for anorexia and previous work indicated that concentration difficulties related to malnutrition may impact performance on cognitive tasks (Faunce, 2002). Failure to exclude emaciated participants could account for the wider range of eating pathology in their sample, which was well past the clinically significant cut-off score of 104. During study recruitment, eight individuals were excluded because their BMI was too low to meet study criteria. In the current study, interference score outliers were removed from analysis. It is unclear if this was done in Rofey, et al. (2004). Finally, it does not appear that the blocked words were counterbalanced or randomized within each block, nor is it described the order in which blocks were presented. Thus, participants may have always responded to food words first (including errors as the participants learned to respond to the cues) or last (including participant fatigue and boredom in interference scores).

Our study design also differed from that of Rofey et al. (2004), in that we induced an angry mood in the lab as opposed to accounting for participant's moods directly before the task. Participant's "negative mood" was determined based on aggregated PANAS (Positive and Negative Affect Schedule) composite scores (Rofey et al., 2004). Thus, the findings reported by Rofey et al. (2004) were not able to clarify which type of negative mood interacted with higher eating pathology to demonstrate larger attentional biases. We chose to investigate the relationship between acute anger and disordered eating attitudes and beliefs because anger has

repeatedly been associated with emotional eating even in nonclinical women (Fox & Froom, 2009; Milligan & Waller, 2000; Milligan, Waller, & Andrews 2002; Waller, Babbs, Milligan, Meyer, Ohanian, & Leung, 2003) and has demonstrated an interactive relationship with impulsivity, such that more impulsive individuals were more likely binge eat at higher levels of anger (Engel, et al., 2007). Furthermore, we suggested that anger would demonstrate a unique relationship with attentional bias because it is classified as an appetitive emotion, thus, signifying anger's ability to motivate behavior or promote interaction with the environment (Carver & Harmon-Jones, 2009). Anger, therefore, is unique from other negatively valenced emotions, such as anxiety, which are also highly arousing but promote withdrawal, avoidance, or disengagement from the environment (Harmon-Jones, Schmeichel, Mennit, & Harmon-Jones, 2011).

It is possible that we failed to find a significant interaction between mood and eating pathology because other negative mood states, such as anxiety or sadness, may better evoke attentional biases to food more so than anger. A vast emotional literature suggests that both sadness and anxiety are also positively related to disordered eating (e.g., Fulton, Lavender, Tull, Klein, Muehlenkamp, & Gratz, 2012; Macht, 2008; Presnell, Stice, Seidel, & Madeley, 2009). Perhaps anxiety, which is known to direct attentional resources to the encoding of threat stimuli (Mogg & Bradley, 2005), would have demonstrated longer reaction times to threatening food words for individuals with eating concerns. Recent evidence suggests that, at least at the trait level, anxiety but not anger accounts for unique variance in increases in global eating pathology in college samples (Davis & Fischer, 2012). Therefore, as emotional eating may represent an avoidance behavior to distract from aversive stimuli rather than engagement in the environment, induction of anxiety may have made food cues more salient for individuals with higher eating

concerns. Theoretically, attentional bias, whether indicative of preferential processing of salient stimuli or an inability to inhibit interfering effects of salient stimuli, arises from latent maladaptive schemas about weight, shape, and eating (Faunce, 2002). Additionally, it is well known that depression commonly is comorbid with eating pathology (APA, 2000). It may be that sadness represents the best emotion to elicit the thinking styles proposed to engender attentional biases to food words, because many individuals who experience emotional eating also suffer from depression. In accordance with this hypothesis, a recent study found that an induced sad or miserable mood increased attentional biases to food pictures in a visual probe task (Hepworth, Mogg, Brignell, & Bradley, 2010).

Notably, many other studies have also utilized nonclinical samples and reported evidence of attentional biases in individuals with elevated eating concerns or restrictive dieting (see Johansson, Ghaderi, & Andersson, 2005 for a review). Many of these studies selected participants based on restraint scores because measure of dietary restriction are purported to specifically assess efforts to regulate the intake of certain foods for weight and shape concerns (Forestell, Lau, Gyurovski, Dickter, Haque 2012). It is proposed that the cognitive override of interoceptive signals reduces the impact of hunger and satiety cues for restrained eaters, creating vulnerability to external food cues and limiting self-regulatory resources (Forestall et al. 2012). Collectively, findings suggest that individuals with highly restrained diets demonstrate a food attentional bias when compared to unrestrained eaters but the overall effect size is small (Brooks, et al., 2011; Johansson et al., 2005) and multiple studies and reviews also report null findings (Ahern, Field, Yokum, Bohon, & Stice, 2010; Dobson & Dozois, 2004; Faunce, 2002; Forestall et al. 2012; Wilson & Wallis 2013). Therefore, it is unlikely that our use of the BULIT-R to screen for eating pathology, instead of a restraint scale, contributed to our null findings,

particularly since several of the restraint scores used in previous studies have been found to correlate strongly with measures of bulimic symptomatology (Ahern et al., 2010) and high scores on other measures of bulimic pathology correspond to food attentional bias (Brooks et al., 2011). Furthermore, attentional bias was unrelated to the EDE-Q restraint scale in our sample.

Despite the nonsignificant relationships found between the Food Stroop and non-clinical bulimic symptoms, anger, and negative urgency, this study is an important contribution to the literature because it was well designed to maximize the likelihood of finding a food attentional bias using the Stroop task within rigorous methodological limitations. Importantly, we limited our list of target words to include only food-related words, thus, limiting our conclusions to food attentional biases. Previous studies included words from multiple categories (e.g., weight, shape, appearance), making it difficult to determine the type of word related to increased interference scores (Faunce, 2002). We also utilized a word list that was shown to be sensitive to mood and varying levels of non-clinical eating concerns (Rofey et al., 2004). Furthermore, both the neutral and food word lists were matched in a previous study for frequency of use and length to control for confounding effects in reaction time between highly recognized and unknown words (Israeli & Stweart, 2001). Words from the neutral list were representative of a single category (i.e., animals) such that reaction time differences between food and animal words could not be explained via a general categorical effect (e.g., priming effect generated by multiple words from the same category; Wilson & Wallis, 2013). A blocked, rather than a mixed, design was chosen in order to amplify the effect of the food words by focusing cognitive processing on potential threatening stimuli for a longer period of time (Brooks, 2011). Although a blocked presentation may produce longer reaction times due to the interference created by the mental representation of a theme, this confound is controlled for by a matched neutral category.

Furthermore, threat-related latencies have been shown to be larger than general category-related delays (McKenna & Sharma, 1995). Order of effects confounds were controlled for by both counterbalancing the blocks of neutral and food words and by randomizing individual words within blocks (Wilson & Wallis, 2013). By including the Color-Stroop in our paradigm we controlled for potential general deficits in inhibitory tasks, which may have been present in those with higher negative urgency and BULIT-R scores. With no relationship found between the Color-Stroop interference scores, any measure of eating pathology, or negative urgency, it does not appear that higher scoring individuals in our sample are simply inferior at such tasks or color-naming. In place of the raw reaction times and accuracy scores sometimes reported in the attentional bias literature, we calculated interferences scores to better account for a participant's baseline reaction time (Dobson & Dozois, 2004). In addition, the order of our paradigm controlled for any confounding effects of additional food cues (e.g., questionnaires were either completed in a previous session or at the end of the session and the candy and oranges were not available until after the Stroop task; Overduin et al., 1995).

Although not clinical, our sample is extremely large, as compared to most other studies investigating attentional bias, and can be considered to represent high-risk population for the development and maintenance of disordered eating, specifically emotional eating. Recent estimations suggest that between 40 and 49% of college women endorse binge eating and/or some form of compensatory behavior (e.g., fasting, compulsive exercising, vomiting, laxative use, diuretic use) once a week (Berg, et al., 2009). Therefore, it seemed important to test our model in a college population to help understand the nature of attentional bias throughout the full continuum of eating pathology. However, some contend that the modified Stroop effect is limited to clinical levels of eating pathology (Dobson & Dozois, 2004). In particular, Dobson

and Dozois (2004) assert that attentional bias is unreliably found in restrained eaters or dieters by citing various studies in which deceasing latency times are found for less severe pathology and nonsignificant differences are reported between controls and dieters or restrained eaters on the Food Stroop. However, Hepworth and colleagues, (2010) reported that attentional bias to food pictures was correlated with emotional eating, external eating (eating in response to external food cues), and restrained eating in a college sample chosen for high and low disordered eating styles. Thus, the lack of a significant relationship in our sample between bulimic pathology (some individuals did report clinically significant symptoms) and attentional bias on the Food Stroop may add credence to allegations that attentional bias is only robustly found within clinical populations.

Negative urgency was neither a predictor of food attentional bias nor significantly correlated with interference scores from the Food Stroop. Consistently, negative urgency did not demonstrate a significant relationship to the general category of "distractor interferences tasks" (i.e., the Stroop task, the Flanker task, word-naming task, shape matching task, or the perceptional scan task) in a recent meta-analysis comparing self-report assessments and lab tasks of impulsivity to lab tasks. However, it should also be noted that this comparison was underpowered (Cyders & Coskupinar, 2011). Although Hou et al., (20011) reported a significant positive relationship between trait impulsivity and pictorial food cues during a visual probe task, the nature of impulsivity assessed in this study does not correspond to the construct of negative urgency but is, instead, more akin to lack of perseverance, inattention, and lack of planning. Neither of the predicted interactions between mood and attentional bias or negative urgency and mood were a significant nor was the three-way interaction between negative urgency, total BULIT-R scores, and condition. Considering that the construct of negative urgency represents

impulsive action under negative mood states, it is noteworthy that several studies also have failed to find significant interactions between negative urgency and various negative moods in the prediction of disordered eating (Davis & Fischer, 2012; Davis, Peterson, & Fischer, under review; Culbert et al., under review). Despite differences in the types of negative emotions evaluated between these studies (state versus trait), it may be important to reconsider the proposed relationship between negative urgency and negative moods.

Craving and Urges to Binge

Our hypotheses related to craving and urges to binge also were not supported. Neither the main effects of food attentional bias, negative mood (measured by condition, arousal or valence), or negative urgency, nor any interactions between these, added significant variance above and beyond the variance in craving accounted for by demographic covariates and preexisting eating pathology. More specifically, BULIT-R scores, BMI, and ethnicity were the only significant predictors of any items assessing urges to eat or binge (the PBS). All of the items from the PBS reflect either urges to overeat or the likelihood of binge eating or out-of-control eating, therefore, it is unremarkable that total BULIT-R scores were significantly associated with, and predictive of, all items because the BULIT-R is also a measure of bulimic pathology. More interestingly, the BULIT-R was not associated with any cravings reported on the FCI or food consumption. However, often when bulimic symptoms are correlated with food cravings, it is not with specific foods (as measured by the FCI) but with general eating styles. For example, individuals with bulimic pathology report higher intentions to eat, greater positive anticipation from eating, higher lack of control, more feelings of hunger, more thoughts about food, higher anticipation that eating will relieve negative affect, more eating in the presence of food cues, and higher guilty feelings related to craving foods than healthy controls after watching

others eat and being presented with (but not allowed to eat) snack foods (Van Den Eynde et al. 2012).

Several of these associations seem more representative of constructs measured by the PBS rather than the FCI. Furthermore, only BMI and ethnicity emerged as significant predictors of carbohydrate cravings. BMI was negatively related with urges to eat, carbohydrate cravings, and candy consumption. Other studies have also found that BMI correlates negatively with cravings and food consumption in lab settings, potentially because heavier individuals feel uncomfortable reporting unhealthy cravings and consuming high-calorie, high-fat, foods. Social desirability is known to bias reporting of energy intake and body weight, especially for obese and overweight individuals (Nijs, Franke, & Muris, 2010).

Although ethnicity was significantly positively related to carbohydrate carvings, urges to eat, and all consumption variables (i.e., total food, oranges, and candy); it is likely that this relationship reflects statistical bias rather than increased cravings and consumption for non-white ethnicities. As our sample included mostly Caucasian women, higher food cravings and urges to eat reported by few participants did not elevate mean cravings and urges for the entire group. However, several non-Caucasian ethnicities in our sample were represented by few participants. In some cases, only one participant self-identified with a particular group. Thus, these mean scores for these groups were highly susceptible to distortion by higher scores for few participants.

Contrary to our results, it is suggested, at least in research with substance users, that attentional bias and subjective ravings are robustly related. Positive associations have been found with various measures of attentional bias, including substance specific Stroop tasks, and alcohol, cocaine, tobacco, caffeine, and cannabis cravings (Field & Cox, 2008). Nevertheless,

not all studies report significant associations between subjective cravings and attentional bias and it is not clear under which measures best detect these relationships (Field & Cox, 2008). Moreover, significant differences exist between the substance related cues used in the addiction literature and the food cues used to detect attentional biases in clinical and nonclinical disordered eating populations. Primarily, food stimuli typically depict a varied selection of high calorie foods, some of which are unlikely to be craved foods (e.g., cream, nut, honey) and many of which may not be specifically craved by every individual (e.g., vegetarians may not crave hamburgers; Kemps & Tiggeman, 2009). This, for example, is rather unlike cigarette cues for tobacco users because most smokers would respond to the same pictures or words related to cigarettes. It is, therefore, most likely that attentional biases to food stimuli, when measured without first inducing particular cravings, do not reflect specific food cravings but indicate a more general preoccupation with food (Kemps & Tiggeman, 2009).

Kemps & Tiggeman (2009) demonstrated that particular food cues can be primed causing specific cravings in normal eaters. Results indicated that an experimentally induced state-level craving for chocolate can be detected as an attentional bias even in the presence of other food cues and with individuals who do not habitually crave chocolate. Those in the chocolate-priming condition also reported higher subjective cravings specifically for chocolate (Kemps & Tiggeman, 2009). In contrast, our paradigm did not include a food priming condition and items on the Food Stroop did not exclusively target one type of highly palatable food (e.g., carbohydrates). Thus, it is possible that the food words utilized in the Food Stroop were not related closely enough to items on the FCI to elicit specific subjective food cravings, especially without a food priming condition. However, an aim of this study was not to induce specific cravings, but to determine if causal relationships exist between elicited eating concerns (via the

Food Stroop and mood induction) and cravings for highly palatable foods, urges to eat those foods, and food consumption. Our results suggest that, at least in this sample while in an angry mood state, attentional bias to food cues does not predict subsequent subjective food cravings. Importantly, this conclusion is congruent with results reported by Nijs et al. (2010) who reported that larger interference scores for palatable food words were associated with subjective food cravings only for obese participants (mean BMI = 36.69). Stroop reaction times for food words were not correlated with cravings in normal-weight participants who had a mean BMI 22.68, which is very close to our mean of 22.84 (Nijs et al., 2010).

It may also be that particular cravings manifest only when there is high perceived availability of the substance. It appears that cigarette craving, in response to smoking cues, is substantially heighted when users expect to be able to smoke. However, when prohibited from smoking (e.g., low perceived availably) cravings are reduced (Field & Cox, 2008). Similarly, reported cravings for sweets and high fat foods on the FCI were related to subsequent consumption of M&M's and jellybeans and potato chips in a sham lab taste test (Martin et al., 2008). FCI cravings (except carbohydrate cravings) also were positively correlated to candy, but not orange, consumption in our study. Thus, subjective cravings elicited by the Food Stroop may have been attenuated, as participants did not expect to be given food during the experiment. However, when left alone to complete the measures in the presence of a highly palatable food (candy), participants' cravings may have increased because the food was readily available. Negative mood is an expected antecedent to disinhibited eating and also probably precedes episodes of overindulgence or cravings for unhealthy foods even in normal eaters (Macht, 2008; Willner et al. 1998) because unpleasant emotions purportedly enhance the reward value of food (Agras & Telch, 1998). Previous research suggests that depressive mood inductions increase

subsequent appetite, especially for individuals with emotional eating styles and bulimic symptoms (Hepworth et al., 2010; Ladberg, Wilson, Eldredge, & Nordby, 1990). Thus, we expected that individuals who underwent the angry mood induction to report higher urges to eat and higher specific food cravings. Contrary to our predictions, however, condition was not related to craving or any of the PBS items. Perhaps the time lapse between the mood induction and the completion of craving questionnaires (extended by both the Food Stroop and the switching of experiment rooms) outlasted the effects of the mood induction, particularly since the effect of some mood inductions are brief (Isen & Gorgoglione, 1983).

Food Consumption

In contrast to models examining food craving, there were significant main effects of negative urgency, attentional bias, and post-mood induction arousal levels on food consumption. Results suggest that higher arousal levels, increased attentional bias to food cues, and higher levels of negative urgency all have unique effects on the prediction of candy consumption. However, no interactions added significant variance to our models. Irrespective of ethnicity, negative urgency was the only predictor of consuming any oranges during the experiment. Additionally, negative urgency emerged as a significant predictor for any candy consumed, suggesting that negative urgency is predictive of overall eating behavior. This represents a unique finding as several studies have demonstrated a relationship between negative urgency and self-report global eating pathology, self-report increases in eating pathology over time, and self-report binge eating, (Davis & Fischer, 2013; Fischer, Peterson, & McCarthy, 2013; Fischer et al. 2008; Pearson, Combs, Zapolski, & Smith, 2012) but only one other study has reported an association between actual food intake and individual differences in negative urgency (unpublished). Although, no interactions between negative urgency and mood were found, our

results corroborate findings which suggest that high levels of trait negative urgency increase the likelihood of food consumption. The insignificant interactions may represent the deterioration of negative mood valence by the time participants were exposed to the candy and oranges. Alternatively, negative urgency may interact with mood states other than anger such as stress, disappointment, defeat, or humiliation.

Attentional bias to palatable food words also significantly predicted food consumption and, more specifically, candy consumption. Other studies have also reported significant correlations between attentional biases to food words and food intake (Maalouf & Yeomans, 2010; Overduin et al., 1995). While Overduin et al. (1995) reported that attentional bias was related to food consumption only in non-restrained eaters who had been given a food preload, Maalouf & Yeomans (2010) suggested that a disinhibited eating style is uniquely associated with attentional bias to food words and subsequent food consumption. Because in our sample neither EDE-Q restraint scores nor total BULIT-R scores were significantly related to attentional bias and we did not prime participants with an appetizer condition, it is likely that selective attention to food cues for these participants reflects broad preoccupations with food rather than primed urges to eat or pathological eating patterns. Also unique to this study, participants were not fooled into consuming food as part of a "taste test." Thus, the eating behavior of our participants may be a more ecologically valid representation of selective attention to palatable food cues on food consumption. Comparable to results reported by Maalouf & Yeomens (2010), participants consumed a similar palatable food, (i.e., chocolate candy) to words embedded in the Food Stroop (i.e., chocolate and caramel). Therefore, even though participants did not subjectively report craving certain foods on the FCI, their eating behavior suggests that cues in the task may have triggered candy consumption as the consumption of oranges was not predicted by Food Stroop

interference scores. Although, disordered eating behaviors and attitudes were not related to attentional bias scores in this sample, participant's selection of a high-calorie, high-fat, food over fruit supports findings demonstrating increased risk for weight gain in individuals with higher attentional biases to food pictures and words (Calitri et al., 2010; Yokum, Ng, & Stice, 2011).

As with food cravings, condition was unassociated with food consumption. Although post-mood induction valence was also unrelated to food consumption, arousal levels following the induction were positively associated with food intake and, in particular, predicted candy consumption. Evidence suggest that differences in valence, arousal, and intensity between emotions may help explain unique influences certain emotions exert over eating behaviors (Macht, 2008) and our findings underline the importance of considering different aspects of emotions in motivational theories. Cools, Schotte, & McNally (1992) also demonstrated that highly restrained eaters, who watched either a horror or comedy film, significantly increased their food consumption relative to those who viewed a neutral film. Therefore, negative valence may not be required to disrupt cognitive control over eating in individuals with higher levels of restraint (Cools et al. 1992). Both the negative and positive mood induction increased arousal in participants, thus, even if valence from the anger mood induction faded quickly it appears that arousal levels from both inductions persisted and partially motivated the consumption of the more palatable food. Nevertheless, these findings do not necessarily support the "trade-off" theory (Haedt-Matt & Keel, 2011) or the boundary theory (Cools et al., 1992), because arousal levels were not correlated with either bulimic symptoms or restraint. This suggests that arousal may, in general, motivate the selection of palatable foods over healthier options. Further highlighting the unique effects specific emotional aspects have on eating behaviors and eating pathology is represented by the significant correlations observed between all measures of eating

pathology (e.g., BULIT-R scores, EDE-Q global scores, and all EDE-Q subscales) and emotional valence at all time points except post-mood induction. Thus, eating pathology was associated with negatively valenced mood, not arousal, at various points in the paradigm. This is consistent with EMA studies reporting that women with disordered eating usually report more negative moods than non-eating disordered women (Smyth et al., 2007).

Limitations

Although our study consisted of a large college sample and was well conducted and controlled, it is not without limitations. First and foremost, we did not control for participant hunger. As previously mentioned, some research suggests that hunger can manifest as increased attentional biases, chiefly for restrained eaters (Brooks, 2011; Forestell et al., 2012; Faunce, 2002; Hepworth et al., 2010). However, this is unlikely to have overestimated relationships between eating pathology and attentional bias because none were significant in this study. Although hunger could have increased Food Stroop interference scores such that they significantly predicted food consumption, this possibility does not alter our conclusion that increased attentional biases may predispose individuals to consume palatable foods. Relatedly, sessions were scheduled at anytime between 8:00am and 8:00pm Monday through Friday. Thus, no effort was made to control for fluctuating cortisol levels throughout the day, which are known to promote food intake especially under stress (Newman, O'Connor, & Conner, 2007). Similar to hunger levels, it is not expected that differing levels of cortisol affected our results because time of day differences should have been randomly distributed between conditions. Importantly, the PBS was used as a series of one-item questions because it did not have a high enough internal consistently to be considered a unitary measure. Furthermore, the PBS was generated specifically for the purpose of this study; another more psychometrically sound measure may

yield different results. Finally, this study was conducted with a sample of high functioning college women with overall low levels of eating pathology. Although varying levels of emotional eating and bulimic symptoms were endorsed, only 0.011% participants reported symptoms that may be considered clinically significant. Furthermore, most of the participants were Caucasian women of average height and weight. Thus, our results cannot be generalized to clinical samples, across ethnic groups, across genders, across ages, nor across BMI classes.

Implications

Given our findings and more recent literature, there are several recommendations for future studies. Because sadness and anxiety likely demonstrate unique relationships with eating pathology and behavior, future studies investigating attentional bias should consider inducing these emotions in lab settings. Additionally, some research indicates that individuals with eating pathology show Stroop interference effects for ego-threatening words (Faunce, 2002; Hepworth et al., 2010), suggesting that social stress or social threat inductions might better elicit eating, weight, and shape concerns than standard mood inductions. It is also proposed that future research with attentional biases and disordered eating, especially in nonclinical samples, utilize pictorial food cues in place of food words. Studies using picture cues in place of words routinely report larger effect sizes, and photographs of food may be more ecologically valid (Brooks, 2011).

As it has been suggested that subjective cravings are highly specific, it may also be important for future studies to personalize food cues to words or pictures that are the most pertinent for each participant. Research with attentional biases and depression indicates that longer reaction times are readily found with cues that are personally relevant (Dobson & Dozois, 2004; Mogg & Bradley, 2005). Particularly in nonclinical populations, as opposed to more

pathological samples where a wider range of cues could be considered "threatening", additional saliency may evoke attentional biases that are missed with general cues. The precise meaning of the Stroop effect is still unknown (e.g., difficulty disengaging from salient information, preferential processing of salient information) and it is likely that different tasks measure unique mechanisms of attention (Nijs, et al., 2010, Faunce, 2002, Dobson & Dozois, 2004). Therefore, future research should be conducted with a variety of cognitive tasks (e.g., dot-probe, visual-probe, flanker, Stroop) in conjunction with mood and individual difference variables to better understand these relationships. Research also should continue to test models of attentional bias, personality, mood, craving, eating behaviors, and eating pathology in a variety of diverse populations including clinical samples, men, different age groups, different ethnic groups, and different weight classifications.

Although the significant relationships reported between attentional bias, negative urgency, arousal, and food consumption are small, their significance is heighted because few studies have reported similar results. For example, no published studies exist demonstrating that negative urgency is associated with actual food consumption in a laboratory setting. This study is an important addition to the literature on eating disorders and attentional bias because it replicates certain findings, disputes others, and extends knowledge with new findings. Even small relationships should be considered relevant given the importance attentional bias purportedly has in the maintenance of eating pathology and potentially obesity. Furthermore, emotional management motivates a variety of behaviors, both adaptive and maladaptive. Thus, a fuller and more nuanced understanding of emotionally influenced behavioral responses is essential for the development of better explanatory models and clinically relevant theories.

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Appendix A

Modified Stroop Words

Food	**Neutral (Animal)**
Bacon	Elephants
Pastry	Falcon
Nut	Deer
Cream	Sheep
Cake	Hawk
Cookie	Coyote
Sugar	Fly
Chocolate	Dolphins
Spaghetti	Crocodile
Caramel	Monkeys
Chips	Geese
Waffles	Raccoon
Hamburger	Armadillo
Pizza	Mules
Honey	Cat

Appendix B

Probability of Binge Eating Questionnaire

Directions: Please answer each question on a scale from 1 to 5 where 1 = not at all and 10 = very much

1. How much do you want to eat your favorite foods right now?

2. How likely would you binge eat right now if your favorite foods were available to you?

3. Do you feel like you would lose control if you could eat right now?