An exploration of the relationships between mindfulness and obesity-related eating behaviors

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An Exploration of the Relationships Between Mindfulness and Obesity-Related Eating Behaviors

by

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Thesis

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Abstract

Little research has explored the basic relationships between different components of mindfulness and eating behaviors associated with obesity even though mindfulness-based interventions (MBIs) have been widely utilized to treat eating behaviors. This study explored these relationships in order to inform more effective MBIs for obesity. Participants ($N = 533$) from a mixed community and undergraduate sample completed an online battery of assessments. All components of mindfulness were related to eating behaviors as would be expected, with the exception of trait mindful awareness. A series of multiple hierarchical regressions showed that mindful eating was a unique predictor of eating behaviors accounting for an additional 13.9 to 29.4% of the variance observed. These findings suggest mindful eating may be a better treatment target for MBIs for eating-related outcomes compared to general mindfulness inductions. Inconsistencies in mindfulness measurement were found, highlighting the need for further investigation of the relationships among mindfulness components.
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Literature Review

Obesity is one of the most pervasive and complicated medical conditions currently facing the globe (Flegal, Kruszon-Moran, Carroll, Fryar, & Ogden, 2016; Uzogara, 2017). The Centers for Disease Control and Prevention (CDC) reported that in the United States over 70.7% of adults and 38% of children and adolescents are overweight or obese (CDC, 2017; Dietz, 2015). The cost of obesity has risen to billions of dollars a year, mostly due to the high prevalence of obesity-related medical conditions such as type II diabetes and cardiovascular disease (CDC, 2017). Beyond the medical complications of obesity, Uzogara (2017) highlights the factors of obesity that impact quality of life such as stigma, weight discrimination, and body dissatisfaction. The consequences of obesity are related to the complex interaction of numerous genetic, biological, environmental, social, and psychological factors (Brownell & Walsh, 2017).

The negative impact of obesity has been researched for decades, and scientists are calling for innovative methods and interventions to target both the prevention of obesity and weight reduction following excessive weight gain.

Researchers in various fields have dedicated time and effort to studying the causes and treatments for obesity (Dietz, 2015). One target for these efforts has been mindfulness. Mindfulness training, or intentionally developing the ability to be nonjudgmentally present in the current moment and accept the context of the present moment (Bishop et al., 2004; Kabat-Zinn, 1990), has been studied as an intervention that may impact weight (Olson & Emery, 2015). Conversely, the inability to be mindful, especially regarding food intake, may be a unique contributor to the etiology of obesity (Bahl, Milne, Ross, & Chan, 2013). Research on the construct of mindfulness and its relationship to eating is lacking. Even though the application of mindfulness-based interventions (MBIs) has been increasing within the past decade (Davidson &
Kaszniak, 2015), little work has been done to understand the basic relationship of mindfulness to maladaptive eating behaviors. Specifically, more work is needed to understand which components and contexts of mindfulness contribute to the maintenance of behaviors associated with healthy weight.

**Mindfulness**

Mindfulness has gained popularity within the past decade both within academic research and pop culture. Because of its recent popularity, mindfulness has been defined in numerous ways (Brown & Ryan, 2003; Kabat-Zinn, 1990; Shapiro, Carlson, Astin, & Freedman, 2006) creating confusion within professional literatures (Chiesa, Serretti, & Jakobsen, 2013). Davidson and Kaszniak (2015) proposed that mindfulness research needs to begin by clarifying the intended definition of mindfulness before discussing a research protocol or intervention. By clearly defining mindfulness, readers can differentiate relevant aspects of previous research studies and proposed treatment outcomes. For the purposes of this project, the following integrative definition was utilized: *mindfulness is a skill set that involves the active process of paying attention to the present moment with acceptance, which can include having an openness to novel experiences and choosing to act most appropriately in that moment* (Bishop et al., 2004; Kabat-Zinn, 1990; Kang, Gruber, & Gray, 2013). This definition was adapted from the two-component model of mindfulness suggesting it is a metacognitive skill that requires sustained attention, attention switching, and the inhibition of elaborative processing. This definition of mindfulness has been widely utilized in psychological research and proposes a simple way to operationalize this construct.

A common misconception is that meditation and mindfulness are synonymous. Meditation is one tool that may facilitate the development of a mindful state. It focuses on the
quality of the mind while practicing and has often been linked to various religious practices (e.g. Buddhism; Kang et al., 2013). Mindfulness, at least from this study’s perspective, is a state of being characterized by attention to the present moment that leads to acceptance and clarity about what the most appropriate action is for the current context. Mindfulness may mean something different when operationalized based on other levels of mindfulness, such as more habitual trait mindfulness or mindfulness training as a clinical intervention (Davidson, 2010). Trait or dispositional mindfulness refers to a stable tendency to be aware of and accept the present moment. It has been argued that individuals with characteristic trait mindfulness have the disposition to be more mindful in the moment given their environmental, biological, and genetic background. State mindfulness involves the first-person experience of mindfulness in the moment in a particular context, as opposed to a recurrent pattern of mindful attention one would expect with trait mindfulness. Mindfulness interventions incorporate exercises designed to increase state mindfulness during practices and aim to ultimately increase trait mindfulness. This training is often utilized to treat psychopathology.

**Mechanisms of mindfulness.** Mindfulness skills are theorized to function as a method to observe and ultimately regulate internal events such as emotion. Kang et al. (2013) describe four elements of mindfulness (i.e., awareness, sustained attention, focus on the present moment, and nonjudgmental acceptance) that contribute to de-automatization, or the process of slowing down daily internal and external events so that an individual can observe the situation and act appropriately. The process of de-automatization serves as an emotion regulatory skill.

Awareness involves having conscious knowledge of one's experience while also having sustained attention or placing one's attention on the ongoing stream of internal and external stimuli. Internal stimuli could include thoughts, emotions, and sensations that are constantly
changing within a person. Individuals who are more mindful are less susceptible to the automatization of daily events, and are, therefore, more likely to have increased cognitive flexibility when making decisions (Kang et al., 2013). Focus on the present moment helps one direct attention, with or without effort, to the internal and external stimuli occurring at each moment of awareness. Nonjudgmental acceptance requires that an individual experiences thoughts, emotions, sensations, and events as they are without judging the stimuli as being good or bad. The mechanisms of mindfulness through de-automatization proposed by Kang et al. (2013) suggest one potential theory for how mindfulness may be measured and how mindfulness interventions operate. However, this theory is relatively new and requires further investigation to support the de-automatization process. These mechanisms have not been specifically applied to obesity-related eating behaviors, but they may be a beneficial target to help individuals regulate daily emotion, a contributing factor to disordered eating (Brockmeyer et al., 2014).

Evidence for mindfulness as an emotion regulatory strategy has increased. Guendelman, Medeiros, and Rampes (2017) reviewed clinical and neurobiological studies linking emotion regulation-related mechanisms to mindfulness from various theoretical models. They determined that changes in emotion may serve as a mechanism for mindfulness and MBIs; however, empirical evidence is still needed to solidify this general observation. Because of the lack of consensus on what mindfulness means and the varied approaches to measuring mindfulness, research on the mechanisms of mindfulness is particularly challenging. Beyond emotion regulation, mindfulness may operate as a skill addressing an individual’s ability to regulate potential obesogenic behaviors.

**Mindfulness and eating.** Little is known about the basic relationships between mindfulness and eating behaviors, and how mindfulness-training can impact disordered eating behaviors.
Within the last decade, researchers have found that mindfulness inductions can enhance the enjoyment of food (Arch et al., 2016) and decrease “mindless” eating (Bahl et al., 2013). Several studies have explored the relationship between the lack of trait and state mindfulness and eating pathology (Adams et al., 2012; Cowdrey & Park, 2012; Lavender, Gratz, & Tull, 2011; Lavender, Jardin, & Anderson, 2009; Masuda & Wendell, 2010). While it has become increasingly popular to study the relationship between mindfulness and eating behaviors, many studies are limited by solely focusing on a few components of eating. Because of the complex nature of eating behaviors related to obesity, mindfulness research may benefit from a more comprehensive evaluation of eating patterns contributing to overweight and obesity while specifically identifying potential treatment targets of MBIs.

Additionally, considering the challenges currently facing mindfulness research, many in the field are moving to ask the question “mindfulness of what?” as opposed to focusing on trait or state levels of general mindfulness. Measuring mindfulness in a particular context may be a more meaningful way to conceptualize the function of state mindfulness and provide greater clinical utility. For example, mindful eating can be defined as the process of noticing and accepting internal and external stimuli, such as the obesogenic environment and internal satiety cues, while consuming food (Framson et al., 2009).

Mindful eating has been shown to mediate the relationship between trait mindfulness and serving size estimates of energy dense foods, pointing to another possible mechanism of action. Beshara, Hutchinson, and Wilson (2013) found that trait mindfulness was positively associated with self-reported levels of mindful eating, and that mindful eating mediated the relationship between trait mindfulness and service size. In general, those who endorsed more mindful eating reported a smaller serving size estimate of energy dense foods. This finding suggests that
mindful eating may be a better predictor of healthy food choices than trait mindfulness. Conversely, Jordan, Wang, and Donatoni (2014) found that state levels of mindfulness without the specific mindful eating induction improved healthy eating by reducing caloric consumption and influencing preference for healthy food choices. The authors argue that trait and state mindfulness are enough to influence eating behaviors, and that mindful eating may not be required to see benefits. Given the mixed evidence on mindful eating, more research is needed to understand the unique contribution of mindful eating to eating behaviors. Additionally, the measurement of trait, state, and context-dependent mindfulness complicate research on this construct and its relationship with eating behaviors.

**Measurement of mindfulness.** Mindfulness has been studied extensively (Chiesa et al., 2013). However, when attempting to measure mindfulness, several problems arise (Bergomi, Tschacher, & Kupper, 2013; Davidson & Kaszniak, 2015). The most widely used method for measuring mindfulness is self-report assessment, which has many inherent problems. First, self-report assessment is susceptible to bias. Several factors such as social desirability undermine the validity of any self-report measure. Measuring mindfulness with a self-report questionnaire becomes even more challenging considering the inconsistency of mindfulness definitions and conceptualizations. Unsurprisingly, each currently validated self-report measure of mindfulness specifically assesses for constructs proposed in one individual researcher’s definition of mindfulness, making each assessment unique to that conceptualization.

Bergomi et al. (2013) reviewed the most frequently utilized mindfulness self-report measures and determined that while most of these measures are psychometrically sound (e.g., adequate internal consistency, appropriate construct validity), additional work is needed to unify the field moving forward. Bergomi et al. (2013) suggested that when working with self-report measures
of mindfulness, researchers take caution when considering the various aspects of the construct and its measurement. Further research is needed to determine which and how many aspects of mindfulness are required to meaningfully capture the process of mindfulness, as well as how these different aspects are interrelated. Again, a clear conceptualization of mindfulness is needed before a useful study can be conducted given the wide array of problems facing mindfulness research.

Yet another challenge facing mindfulness measurement lies with the inconsistency of trait and state mindfulness outcomes. Conceptually, trait and state mindfulness should be associated and predictive of similar trends in behavior. However, several researchers have found that trait and state mindfulness are unrelated and predict different constructs (Tanay & Bernstein, 2013; Thompson & Waltz, 2007). Bravo, Pearson, Wilson, and Witkiewitz (2017) randomized college participants to receive a mindfulness induction or a control condition and measured trait mindfulness before the intervention and state levels of mindfulness following the intervention. They found that participants’ levels of trait and state mindfulness were weakly associated, and that for those with more meditation experience, the association between trait and state mindfulness became stronger. These findings suggest that trait and state mindfulness may measure different components of the experience of mindfulness, and previous exposure to meditation greatly impacts this relationship. Researchers need to be cautious when deciding what component (e.g., state, trait) of mindfulness to measure.

Context-dependent mindfulness (e.g., mindful eating) may be an even more appropriate target for the measurement of mindfulness. Currently, mindful eating is only measured as a trait construct with self-report questionnaires (Framson et al., 2009; Hulbert-Williams, Nicholls, Joy, & Hulbert-Williams, 2013). While Framson et al.'s (2009) and Hulbert-Williams et al.'s (2013)
questionnaires have both shown adequate correlation with previously validated measures of mindfulness, few studies have compared mindful eating measurement to general trait or state mindfulness measurement, especially within the context of obesity-related behaviors. Despite limitations concerning the measurement of mindfulness, MBIs utilize these measures to assess intervention-effects on mindfulness levels and behavior change.

**MBIs.** The majority of MBIs have been designed to either generally increase mindfulness due to its transdiagnostic value (Brake et al., 2016; Greeson, Garland, & Black, 2014) or to treat specific problems, such as depression or stress (Khoury et al., 2013; Khoury, Sharma, Rush, & Fournier, 2015; Kuyken et al., 2016). MBIs are generally not directly eating-related. However, following a general MBI protocol, clients have been shown to have modest improvements in eating pathology (e.g., reduced binge episodes, reduced purging; Kristeller, Baer, & Quillian-Wolever, 2009) and have demonstrated efficacy with weight loss (Olson & Emery, 2015). The results of these MBI trials are often mixed, and little work has been done to understand the unique contribution of mindfulness to treatment packages. While several therapies utilize mindfulness interventions to target problematic eating and general psychopathology, the therapies that have demonstrated the most efficacy and effectiveness are reviewed.

Mindfulness-based Stress Reduction (MBSR) was one of the first therapies to incorporate mindfulness into psychological treatment. Developed by Kabat-Zinn (1996), MBSR utilizes experiential mindfulness techniques in combination with psychoeducation to help clients make healthier choices and reduce stress. MBSR is a group-based treatment that requires clients to practice mindfulness both within group and for daily homework, with the goal of increasing awareness to the present moment in multiple contexts (Santorelli, 2014). Since the development of MBSR, several other interventions, such as Mindfulness-based Cognitive Therapy (MBCT;
Teasdale, Williams, Ridgeway, Soulsby, & Lau, 2000), Dialectical Behavior Therapy (DBT; Linehan, 1993, 2015), Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999), and Acceptance-based Behavioral Weight Loss (ABWL; Forman & Butryn, 2016), have included mindfulness-based components. The majority of these treatments conceptualize mindfulness as a technique to help clients contact the present moment to gain awareness of patterns of behavior affecting their daily life. As in MBSR, mindfulness is taught both as an experiential exercise in session and assigned as homework to help clients generalize mindfulness.

The most relevant MBI for the current study is Mindfulness-based Eating Awareness Training (MB-EAT; Kristeller et al., 2009; Kristeller & Wolever, 2010). MB-EAT utilizes mindfulness to help clients make healthier food choices by increasing awareness of hunger and satiety cues, while also working towards self-acceptance. Within MB-EAT several experiential mindful eating exercises are conducted to teach awareness and acceptance of hunger and satiety. For example, a commonly used mindful eating exercise involves mindfully eating raisins, originally a part of the MBSR protocol (Kabat-Zinn, 1996) that has been widely used in MBIs. The mindfully eating a raisin exercise asks the client to notice the physical sensation of eating a raisin by slowing down the process of eating. In the MB-EAT program, participants gradually increase the types of foods they mindfully eat to include foods that are more challenging, such as highly palatable foods. This process is meant to increase participants’ enjoyment of food while also demonstrating awareness to satiety cues while eating these palatable foods. Interventions like MB-EAT target eating behaviors associated with obesity. However, more research is needed to understand how and why mindfulness may be a useful treatment target for these behaviors. While MB-EAT primarily focuses on mindful eating, most other interventions utilize mindful
eating as a method to teach broader mindfulness, and few studies examine the unique contribution of mindful eating to treatment gains. The majority of research on mindful eating specifically evaluates the effectiveness of mindful eating inductions on desired eating outcomes.

For example, Hendrickson and Rasmussen (2017) conducted a brief mindful eating training with adults and adolescents and measured impulsivity as it related to food and monetary choices. They found that adults, but not adolescents, with a higher body fat percentage had increased impulsivity compared to those with a lower body fat percentage. However, no matter what percent body fat or age, participants who had completed the mindful eating training exhibited less food-choice impulsivity as opposed to those who were in the control condition. Similarly, Hendrickson and Rasmussen (2013) demonstrated that a mindful eating training session increased participants’ self-control and reduced risk-averse delay discounting patterns for food that were observed at baseline. Mindful eating training has also shown to have immediate impact on snack choices. Seguias and Tapper (2018) found that after listening to an audio recording of a mindful eating induction while eating lunch, participants consumed significantly less energy-dense snack foods compared to control participants. These findings suggest mindful eating may be a useful tool to improve self-control and impulsivity around food choices, which is highly relevant for overweight and obese individuals.

The impact of mindful eating can be broadened outside of lab-based settings to more a specified context where obesity-related eating behaviors are present most frequently. Timmerman and Brown (2012) evaluated the efficacy of a group intervention focused on reducing caloric and fat intake, decreasing emotional eating, and increasing mindful eating. They randomized 35 women who reported eating out at restaurants at least three times a week to six weekly two-hour sessions dedicated to addressing the barriers to weight management when
eating out. The intervention group lost significantly more weight, had lower average daily caloric and fat intake, and had increased diet related self-efficacy. Because mindful eating was only a component of this treatment, it is unclear how much the mindful eating training contributed to the reduction in weight, and further research is needed to dismantle the intervention.

Additionally, Timmerman and Brown (2012) did not measure improvements in mindful eating following the mindful eating intervention, so it is unclear if treatment gains were caused by increased mindful eating. However, similar efficacy results for mindful eating interventions as an added component to treatment in lab-based settings have been found for managing Type II diabetes (Miller, Kristeller, Headings, Nagaraja, & Miser, 2012). Furthermore, Fung, Long, Hung, and Cheung (2016) argue that mindful eating can be utilized for general health promotion.

While mindful eating has been shown as an effective component to treatment, little work has been done specifically looking at the relationship between mindful eating and many disordered eating behaviors associated with overweight and obesity.

**Unawareness and Non-Acceptance within Eating Behaviors**

While interventions are needed at every stage of the development of obesity, this study focused on the link between individuals’ unawareness and non-acceptance of behaviors, cognitions, and emotions that are related to eating. Numerous factors contribute to the development of obesity (e.g., genetics, food availability, family environment); however, specific attention to unawareness and non-acceptance of problematic eating behaviors may be a necessary link to further treatment effectiveness. For example, the LEARN program (Brownell, 2004) is an empirically supported treatment for weight loss. The program utilizes self-monitoring of eating and physical activity behavior as beginning targets of intervention. The process of self-monitoring is an aspect of mindfulness, which works to bring one’s awareness to the present
moment. Understanding the relationship between mindfulness and eating behaviors could help LEARN program researchers improve current intervention methods. The purpose of this project was to examine the contribution of inadequate mindfulness to eating behaviors associated with obesity.

While numerous eating behaviors could be targeted, the following eating behaviors were explored due to the demonstrated importance of their relationships with overweight. Binge eating, or eating an excessive amount of food in a short period of time while feeling out of control, has been associated with rapid weight gain and occurs in anywhere from 2% to 8.8% of the obese population (Kessler et al., 2013). Night eating syndrome (NES) is an eating pattern prevalent among obese and overweight populations characterized by consuming food in the evening followed by insomnia, morning restriction, and negative affect (American Psychiatric Association, 2013). Emotional eating, or eating in response to both positive and negative affect, is a commonly reported trigger to overeating (Cornelis et al., 2014), which ultimately leads to excess weight gain. Broadly, binge eating and emotional eating can be described as disinhibited eating, or eating without attention to satiety cues, which has been cited as a common trait among those who are overweight or obese (Vannucci et al., 2013). Overweight individuals may also be more likely to overeat palatable foods, or foods that are high in sugar and fat content, that are readily available in the environment, which has been termed as hedonic hunger (Cappelleri, Bushmakin, Gerber, Leidy, Sexton, Karlsson, & Lowe, 2009). It has been argued that those who are obese may become addicted to these palatable foods paralleling a substance use disorder (Gearhardt, Corbin, & Brownell, 2009).

**Binge eating.** Binge eating occurs when an individual has a feeling of loss of control while eating a large amount of food in a short period of time (American Psychiatric Association,
Most frequently, binge eating is associated with the diagnoses of binge eating disorder (BED) or bulimia nervosa (BN); however, binge eating can occur without these diagnoses present. The dual-pathway model of binge eating is one of the most supported theories explaining the prompting events leading to a binge episode (Stice, 2001; Welsh & King, 2016). This model proposes that an individual with high body dissatisfaction may engage in binge eating most frequently for one of two reasons (or their combination). First, individuals may binge after restricting their diet for a prolonged period. Second, binge eating may occur after experiencing negative affect. In both pathways to binge eating, an individual feels relief following the binge, which increases the likelihood that he or she will binge eat in the future.

Tests of the dual-pathway model have produced mixed results, leading many to view binge eating as simply a method to regulate difficult emotion. Leehr et al. (2015) wrote a review summarizing the evidence for binge eating as an emotion regulation strategy specifically within the obese population. After reviewing 18 experimental studies, Leehr et al. (2015) concluded that negative affect can trigger binge eating, which is followed by a period of relief, but this method of regulating emotion is only a short-term solution to the general negative affect individuals experience in daily life. Importantly, many of these studies had small sample sizes and homogeneous populations, limiting the conclusions that can be drawn. Despite these limitations, the etiology of binge eating is still being explored, and the emotion regulation and dual-pathway model are the starting ground for further research.

Exploring the triggers for binge eating is an important goal not only for experimental research, but also for clinical intervention. Empirically supported treatments for BED (e.g. Cognitive-Behavior Therapy) begin by tracking a client’s pattern of binge eating and helping individuals identify antecedents to bingeing (Agras & Apple, 2008). This is often a difficult task
because clients frequently lack the skills needed to observe and describe the triggers associated with bingeing behavior. Improving awareness through mindfulness may provide clients with the skills necessary to begin this process. Similarly, acceptance of difficult private events (e.g., cognition, emotions, and physiological sensations) may improve general emotion regulation, effectively replacing the binge eating function.

**Night eating.** NES was added to the Diagnostic and Statistical Manual for Mental Disorders-5 (DSM-5, American Psychiatric Association, 2013) as an Other Specified Feeding or Eating Disorder. Allison et al. (2010) proposed that to classify NES individuals must consume about 25% of their food intake after their evening meal or experience at least two episodes of nocturnal eating a week. Importantly, individuals must be aware of these eating patterns. Frequently, individual also endorse symptoms such as: a lack of desire to eat in the morning, a strong urge to eat between an evening meal and sleep, insomnia, beliefs that eating is required before beginning or returning to sleep, and depressed mood. About 4-9% of the obese population have NES (Cleator, Abbott, Judd, Wilding, & Sutton, 2013), although not all individuals who have NES are also obese (Vander Wal, 2012).

Several factors such as age, emotional eating, and impulsivity impact night eating. Interestingly, Meule, Allison, Brähler, and de Zwaan (2014) found that age moderated the relationship between NES and obesity. Night eating was only associated with body mass index (BMI) for individuals between 31 and 60 years of age, suggesting that age plays an important role in the development of obesity concurrent with NES. Emotional eating may be another important moderator of the relationship between NES and obesity. Meule, Allison, and Platte (2014) found that only for those who endorsed high emotional eating did a strong relationship among night eating severity, binge eating, and BMI emerge. Impulsivity is yet another factor
associated with night eating. Vinai et al. (2015) discovered that individuals with nocturnal eating scored higher on measures of attentional impulsivity, indicating that methods to reduce impulsivity, such as mindfulness, may improve night eating symptoms. Taken together, night eating appears to be associated with several of the other eating behaviors examined in this study confirming the complex network of eating behaviors commonly associated with obesity.

**Emotional eating.** Emotional eating, or eating in response to positive or negative affect, has been associated with obesity and several problematic eating behaviors, such as uncontrolled eating and binge eating (Cornelis et al., 2014). Several factors, such as parenting style and emotion dysregulation, affect the prevalence of emotional eating in individuals of every BMI, such as parenting style and emotion dysregulation. Braden et al. (2014) determined that even from an early age, some individuals are reinforced to emotionally eat later in life depending on the parenting style of their caregivers. Specifically, emotional feeding, or providing food to children when they experience negative affect, was found to be the strongest predictor of a child’s emotional eating habits. Similarly, other early life variables can impact childhood and, ultimately, adulthood emotional eating.

Research has found a link between exposure to trauma and emotional eating (Talbot, Maguen, Epel, Metzler, & Neylan, 2013), and recent research has explored the variables that may mediate this relationship (Michopoulos et al., 2015). Within an inner-city, mostly African-American population, Michopoulos et al. (2015) found that emotional dysregulation and depression mediated the relationship between childhood trauma and emotional eating. While these relationships are statistically significant, more research is needed to determine the impact of emotion dysregulation and depression on eating behavior. However, Michopoulos et al. (2015) provided further evidence that having a lack of coping skills to regulate emotion or
handle difficult events contributes to the prevalence of emotional eating and unwanted weight gain. This suggests that introducing regulatory strategies, such as mindfulness, may influence emotional eating.

**Disinhibited eating.** Uncontrolled eating, or disinhibited eating, occurs when an individual tends to overeat with the intention not to overeat, generally in response to negative affect or to the food environment (Goldstein et al., 2014; Lattimore, Fisher, & Malinowski, 2011). Some researchers conceptualize disinhibited eating as a susceptibility to food that leads to greater food consumption. Disinhibited eating has been associated with the overweight and obese population and has been found to impact an individual’s ability to lose and maintain weight (Teixeira et al., 2010). Goldstein et al. (2014) found that a discrepancy between implicit, or automatic, and explicit, or purposeful, attitudes towards food predicted greater disinhibited eating. Interestingly, their study showed that implicit or explicit attitudes alone did not alter disinhibited eating, but that the discrepancy between these attitudes is important for potentially altering disinhibited eating.

Lattimore et al. (2011) conducted a cross-sectional study examining the relationships between disinhibited eating, impulsivity, and mindfulness. They found that mindfulness was negatively related to disinhibited eating, and impulsivity mediated this relationship. Importantly, this study was conducted with a primarily normal weight population. Further research is needed to understand the relationship between these variables in an overweight or obese population.

**Hedonic hunger.** Because in almost every developed country there is an abundance of food available, individuals may overeat in response to numerous factors (e.g., social, environmental, psychological) even when they are not hungry (Cappelleri, Bushmakin, Gerber, Leidy, Sexton, Karlsson, & Lowe, 2009). Many individuals report feeling controlled by the
pleasure of food, and food consumption does not strictly follow satiety cues. This process is especially relevant within the overweight and obese population, whose members indicate preferring highly palatable food, such as those dense in sugar and fat, more so than normal weight individuals (Lowe & Butryn, 2007).

Interestingly, hedonic hunger, most commonly measured by the Power of Food Scale (PFS; Cappelleri, Bushmakin, Gerber, Leidy, Sexton, Karlsson, & Lowe, 2009; Lowe & Butryn, 2007), has been shown to predict subjective feelings of loss of control while eating, a common characteristic of overweight or obese individuals and those engaging in binge eating. A study conducted by Lowe et al. (2016) with females at risk for weight gain demonstrated that hedonic hunger, as measured by the PFS, predicted participants’ first emergence of loss of control eating over a two-year time period. Those with higher PFS scores were more likely to endorse loss of control eating two years later even if they did report loss of control eating at baseline. These results suggest that targeting hedonic hunger early on can prevent future problematic eating behaviors. Mindfulness may be one method to improve awareness around eating that occurs without hunger, and further help individuals choose not to eat once they observe the absence of hunger.

**Food addiction.** The food addiction model suggests that for some individuals, highly processed foods that are high in sugar and fat can produce a response similar to substance addiction (Schulte, Joyner, Potenza, Grilo, & Gearhardt, 2015). Pursey, Stanwell, Gearhardt, Collins, and Burrows (2014) estimated the prevalence of a food addiction diagnosis at 19.9%, with the highest prevalence among middle-aged, female, overweight and obese individuals. The prevalence of a food addiction diagnosis was highest among those with disordered eating (57.6%). However, the majority of the studies examined for this review were collected within a
primarily female, overweight or obese sample, limiting the generalizability of these results. To qualify for a food addiction diagnosis, researchers utilize the Yale Food Addiction Scale (YFAS; Gearhardt et al., 2009) or versions of this scale, which is a self-report measure of food addiction symptoms. A participant can be diagnosed with food addiction when he or she endorses clinically significant impairment or distress and exhibits two or more of the food addiction symptoms, such as feelings of withdrawal from food.

Many have criticized the food addiction model, questioning whether someone can be addicted to a substance that is needed for survival (Schulte et al., 2015). The authors argue that food addiction research has specifically focused on highly palatable foods that are not necessarily needed for survival, but highly desired. Evidence for the food addiction model has grown significantly within the last few years, and experimental research has shown the commonality of food addiction with substance dependence. For example, Gearhardt et al. (2011) demonstrated that for individuals who endorsed more symptoms of food addiction on the YFAS, more neural activity was observed in the reward-related regions of the brain when that individual was anticipating a highly processed food.

Davis et al. (2011) proposed that food addiction may be a phenotype of obesity, arguing that those who meet criteria for food addiction had greater rates of BED, attention-deficit/hyperactivity disorder (ADHD), and depression. Obese individuals who also had a food addiction diagnosis were more likely to be emotionally reactive, have greater impulsivity and food cravings, and tend to use food as a coping strategy. Despite the growing evidence for food addiction, little research has been done regarding the treatment of food addiction and none has specifically looked at the relationship between food addiction and mindfulness. Mindfulness may be a preventative intervention for food addiction by bringing awareness to the highly addictive
nature of certain foods and helping clients choose to eat these foods strategically. Mindfulness may also be a useful addition to future treatment developments for food addiction. Mindfulness has already been utilized in the treatment of substance use disorder (Hsu, Grow, & Marlatt, 2008) and may be beneficial for relapse-prevention of substance use disorders (Grant et al., 2017). However, before mindfulness can be adapted for work with food addiction, more research on the relationship between this and other problematic eating behaviors and mindfulness is needed to adequately understand the role mindfulness plays in the development and treatment of these behaviors.

**Purpose of the Current Study**

Obesity is currently one of the most pervasive and complicated medical conditions. Interventions targeting the prevention and treatment of obesity are needed, and mindfulness may be one solution. Mindfulness is a widely researched topic that is controversial because of the varying definitions and methods of assessment currently available (Davidson & Kaszniak, 2015). Many researchers argue over what aspects of mindfulness (e.g., trait, state, or context-dependent mindfulness) are most important to treatment outcomes. While mindfulness and mindful eating are widely utilized in MBIs, little research focuses on the relationship between these different components of mindfulness and the eating behaviors that are the targets of interventions. Additionally, many studies are limited by only examining mindfulness in relation to a few eating behaviors as opposed to understanding the complex relationship among multiple eating behaviors associated with obesity.

The purpose of the current study was to expand upon the existing literature on the relationships between mindfulness and eating behaviors associated with obesity (e.g., binge eating, night eating, emotional eating, disinhibited eating, hedonic hunger, and food addiction).
First, the relationships among mindfulness components were explored and compared to emotion regulation. Next, because of the widespread use of mindfulness within research and pop culture, further investigation into the active components of mindfulness, such as the impact of trait, state, or context-dependent mindfulness on eating behaviors was warranted. Specifically, this study explored the unique contribution of mindful eating on eating behaviors related to obesity and contrasted those findings with trait and state mindfulness. Lastly, the role of BMI on the relationship between mindfulness and eating was investigated, because the eating behaviors surveyed in this study are frequently endorsed by an overweight or obese sample. BMI has been investigated as a reasonable proxy for the many other factors that contribute to overweight that are not under investigation in this study. Better understanding the relationships between mindfulness and eating behaviors associated with overweight may inform the assessment and treatment of weight management and disordered eating.

**Hypotheses**

**Examining the Relationship Between Measures of Mindfulness and Emotion Regulation**

1. It was hypothesized that trait measures of mindfulness, the Philadelphia Mindfulness Scale (PHLMS) awareness and acceptance subscales, would be positively correlated with the state measure of mindfulness, the State Mindful Attention Awareness Scale (State MAAS).

2. It was hypothesized that mindful eating, measured with the Mindful Eating Scale (MES), would be positively correlated with both trait and state measures of mindfulness as evaluated with a correlation matrix. Because previous literature has found that trait and state mindfulness do not always relate or predict the same constructs (Tanay & Bernstein,
2013; Thompson & Waltz, 2007), it was hypothesized that trait and state measures of mindfulness would differ in their ability to predict mindful eating.

3. It was hypothesized that trait and state mindfulness and mindful eating would be positively correlated with emotion regulation, measured with the Difficulties in Emotion Regulation Scale (DERS).

**Examining the Relationship Between Mindfulness and Eating Behaviors**

4. It was hypothesized that trait and state mindfulness and mindful eating would be negatively correlated with various measures of eating behaviors commonly observed among those who are overweight and obese. The following eating behaviors were measured: binge eating measured by the Binge Eating Scale (BES), night eating measured by the Night Eating Questionnaire (NEQ), emotional eating measured by the Emotional Eating Scale (EES), disinhibited eating measured by the Three-Factor Eating Questionnaire (TFEQ), hedonic hunger measured by the Power of Food Scale (PFS), and food addiction measured by the Modified Yale Food Addiction Scale (mYFAS).

5. It was hypothesized that higher scores on state and trait measures of mindfulness would predict lower scores on each of eating behaviors measures listed. Negative affect measured by the Positive Affect Negative Affect Scale (PANAS – negative affect subscale) would be controlled for in this analysis should there be any significant group differences on negative affect.

6. It was hypothesized that mindful eating would be a unique predictor of the eating behaviors listed after controlling for trait and state mindfulness.
Understanding the Role of BMI

7. Assuming Hypothesis 4 was supported by the data, it was hypothesized that BMI would moderate the relationship between state and trait mindfulness and eating behaviors.

8. Assuming Hypothesis 5 was supported by the data, it was hypothesized that BMI would moderate the relationship between mindful eating and the eating variables.
Methods

Participants

Participants were recruited from undergraduate psychology courses at a large Midwestern university, Eastern Michigan University (EMU). Additional community participants were recruited from the Amazon Mechanical Turk (MTurk) online platform, which allows individuals to complete online surveys for monetary compensation. Social science research has utilized the MTurk population increasingly within the last few years (Buhrmester, Kwang, & Gosling, 2011). The MTurk population was included in this study to gain a more diverse sample of individuals, specifically targeting the age and gender discrepancy that is found in a university pool. Behrend, Sharek, Meade, and Wiebe (2011) demonstrated that compared to an undergraduate subject pool, MTurk participants had greater

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Table 1. Demographic Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Entire Sample (N = 533)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic Characteristic</td>
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<tr>
<td>Age, mean (SD)</td>
<td>31.77 (11.80)</td>
</tr>
<tr>
<td>Gender</td>
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<tr>
<td>Male</td>
<td>44.70%</td>
</tr>
<tr>
<td>Female</td>
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<tr>
<td>Ethnicity</td>
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<tr>
<td>White</td>
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<tr>
<td>Asian or Asian American</td>
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<tr>
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<td>Middle Eastern or Arab American</td>
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<tr>
<td>Mixed Heritage</td>
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<tr>
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<tr>
<td>&gt;$250,000</td>
<td>0.80%</td>
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<tr>
<td>BMI, mean (SD)</td>
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<tr>
<td>Underweight</td>
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<tr>
<td>Normal Weight</td>
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<tr>
<td>Overweight</td>
<td>25.30%</td>
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<tr>
<td>Obese</td>
<td>20.30%</td>
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</table>

Mindfulness Practice

Estimated lifetime practice

<table>
<thead>
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<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>0-50 hours</td>
<td>49.30%</td>
<td></td>
</tr>
<tr>
<td>50-100 hours</td>
<td>25.00%</td>
<td></td>
</tr>
<tr>
<td>100-200 hours</td>
<td>12.90%</td>
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<td>200-500 hours</td>
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<td></td>
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<tr>
<td>500+ hours</td>
<td>6.20%</td>
<td></td>
</tr>
</tbody>
</table>
variability in age, ethnicity, educational level, and employment. Arditte, Demet, Shaw, and Timpano (2015) conducted an MTurk study with over 1,000 participants and reported that 51.50% of participants were female, suggesting that an MTurk subject pool can provide gender variability.

A total of 603 participants completed the study. After deleting data from participants that did not pass the attention check items in the survey, 533 participants remained. By including and combining participants from two non-clinical samples, the generalizability of these results may increase, making these findings more relevant to a wider population. Additionally, the combined data were utilized to increase the variability among the study’s measures. Demographic data for the sample is provided in Table 1. This study was approved by the Eastern Michigan University Institutional Review Board prior to data collection (see Appendix A for approval and Appendix B for informed consent).

**Design**

The study utilized a single-session, cross sectional design. The aim of the study was to understand how different components of mindfulness, and specifically mindful eating, predict eating behaviors that are associated with obesity, such as emotional eating and binge eating.

**Measures**

**Demographic information.** A demographic questionnaire asked for the following information: age, gender, ethnicity, relationship status, annual household income, educational status, height, and weight. BMI (kg/m²) was calculated from participants’ self-reported weight and height. The CDC (2015) recommends the following parameters for BMI categories: below 18.5 is underweight, 18.5–24.9 is normal weight, 25–29.9 if overweight, and 30 and above is obese. Participants answered questions regarding their mindfulness and meditation history based
on Davidson and Kasznia (2015) recommendations. Mindfulness and meditation type, frequency, and duration of practice were also assessed. See Appendix C.

**Philadelphia Mindfulness Scale (PHLMS).** The PHLMS (Cardaciottio, Herbert, Forman, Moitra, & Farrow, 2008) is a 20-item questionnaire that measures trait mindfulness, which is divided into two components: awareness and acceptance. The awareness subscale assesses an individual’s ability to notice his or her thoughts, feelings, perceptions, and bodily sensations (example item: “When I am startled, I notice what is going on inside my body”). The acceptance subscale assesses experiential avoidance (example item: “There are aspects of myself I don’t want to think about”). For ease of interpretation, the PHLMS acceptance subscale was reverse scored so that higher scores indicated greater acceptance, which aligns with the directionality of the other measures used for mindfulness (higher scores represent higher mindfulness). Participants rate these statements based upon frequency over the past week with a 5-point Likert scale anchored at 1 (*never*) and 5 (*very often*). Cardaciotto et al. (2008) demonstrated that the PHLMS subscales have good internal consistency ($\alpha = 0.85$ for the awareness subscale and $\alpha = 0.90$ for the acceptance subscale). For this study, the PHLMS awareness and acceptance subscales had adequate internal reliability ($\alpha = 0.82$; $\alpha = 0.88$, respectively). See Appendix D.

**State Mindfulness Attention Awareness Scale (State MAAS).** The State MAAS (Brown & Ryan, 2003) is a five-item measure that assesses state levels of mindfulness, or an individual’s current experience with the present moment. The five items are derived from the original trait version of the MAAS (Brown & Ryan, 2003). The state MAAS can be adapted to assess both recent (i.e., past day) and current experiences with mindfulness. Participants rate their current experience on a 7-point Likert scale that is anchored at 0 (*not at all*) to 6 (*very*
much). Example items include: “I was finding it difficult to stay focused on what was happening” and “I was preoccupied with the future or the past.” Brown and Ryan (2003) have demonstrated that the state MAAS has excellent internal consistency ($\alpha = 0.92$). Trait scores on the MAAS have been shown to predict state MAAS scores. For this study, the State MAAS had adequate internal reliability ($\alpha = 0.91$). See Appendix E.

**Mindful Eating Scale (MES).** The MES (Hulbert-Williams et al., 2013) is a 28-item measure that assesses mindfulness specifically in regard to eating behaviors. Items are rated on a 4-point Likert scale ranging from 1 (never) to 4 (usually). The scale can be utilized as a total score ($\alpha = .86$), where higher scores reflect greater mindful eating, or with six subscales: Acceptance ($\alpha = 0.89$), Awareness ($\alpha = 0.82$), Non-reactivity ($\alpha = 0.77$), Routine ($\alpha = 0.75$), Distractibility ($\alpha = 0.81$), Unstructured ($\alpha = 0.86$; Hulbert-Williams et al., 2013). This measure is relatively new and has not been widely utilized in research so far. However, the creators of the scale utilized a definition during scale development that was more consistent with this study’s definition of mindfulness, making this questionnaire a more appropriate choice for project. For this study, the total MES had adequate internal reliability ($\alpha = 0.89$). See Appendix F.

**Binge Eating Scale (BES).** The BES (Gormally, Black, Daston, & Rardin, 1982) is a 16-item measure that was designed to assess for binge eating in obese individuals. Importantly, this measure cannot be utilized as a diagnostic indicator. The measure includes behavioral, cognitive, and emotional components of binge eating. Items are presented as groups of statements, and the participant is asked to indicate which statement from the group represents how he or she feels. An example group of items includes the choice between four statements: “I have no difficulty eating slowly,” “I may eat quickly, but I never feel too full,” “Sometimes after I eat fast I feel too full,” and “Usually I swallow my food almost without chewing, then feel as if
I ate too much.” Higher scores on the BES indicate greater severity of binge eating. A continuous and categorical score can be calculated for the BES, where the latter categorizes binge eating into three groups: little or no binge eating, moderate binge eating, and severe binge eating. The BES has adequate validity and reliability (Gormally et al., 1982; Timmerman, 1999). For this study, the BES had adequate internal reliability ($\alpha = 0.90$). See Appendix G.

**Night Eating Questionnaire (NEQ).** The NEQ (Allison et al., 2008) is a 14-item questionnaire that is used to assess for night eating symptoms characteristic of NES. Participants rate the items on a 5-point Likert with anchors that vary for each question. Example items include “Do you have cravings or urges to eat snacks after supper, but before bedtime?” and “How often do you have trouble getting to sleep?” Two additional questions measuring distress around the night eating are optional (e.g., “How upsetting is your night eating to you?”), and for the purposes of this study these questions were included. The NEQ has demonstrated adequate internal consistency (Allison et al., 2008) and shown to be significantly associated with disorder eating pathology, depression, and stress. (Allison et al., 2008). For this study, the NEQ had adequate internal reliability ($\alpha = 0.68$). See Appendix H.

**Emotional Eating Scale (EES).** The EES was designed to facilitate investigation of the relationships between specific negative emotional states and overeating. The EES (Arnow, Kenardy, & Agras, 1995) is a 25-item scale with three subscales: anger, anxiety, and depression. Participants rate the extent to which certain feelings lead to the urge to eat using a 5-point Likert scale ranging from *no desire to eat* to *an overwhelming urge to eat*. Scores on the EES are summed, and higher scores indicate a greater urge to eat in response to negative affect. The EES demonstrates adequate reliability and validity (Arnow et al., 1995), and coefficient alphas for this study were 0.89 and 0.85 for the anger and anxiety subscales respectively. Although these scores
should not be used as clinical cutoffs, Arnow et al.'s (1995) study indicated the mean for the anger subscale was 23.96 ($SD = 7.94$), the mean for anxiety subscale was 15.19 ($SD = 6.51$), and for depression subscale the mean was 12.00 ($SD = 4.00$). For this study, the EES total score had adequate internal reliability ($\alpha = 0.97$). See Appendix I.

**Three-Factor Eating Questionnaire (TFEQ-R18V2).** The TFEQ-R18V2 (Cappelleri, Bushmakin, Gerber, Leidy, Sexton, Lowe, & Karlsson, 2009) is the newest addition of the Three-Factor Eating Questionnaire (Stunkard & Messick, 1985). This measure has 21 items that assess eating behaviors within three domains: cognitive restraint, uncontrolled or disinhibited eating, and emotional eating. Items on each domain are rated on various 4-point Likert scales. An example of an item and Likert scale on the cognitive restraint domain is as follows: “I deliberately take small helpings to control my weight (1) Definitely True, (2) Mostly True, (3) Mostly False, (4) Definitely False.” An example of an item and Likert scale on the uncontrolled eating domain is as follows: “Do you go on eating binges even though you’re not hungry? (1) Never, (2) Rarely, (3) Sometimes, (4) At Least Once A Week.” An example of an item and Likert scale on the emotional eating domain is as follows: “When I feel tense or ‘wound up,’ I often feel I need to eat (1) Definitely True, (2) Mostly True, (3) Mostly False, (4) Definitely False.” Cappelleri, Bushmakin, Gerber, Leidy, Sexton, Lowe, and Karlsson (2009) have demonstrated that the TFEQ-R18V2 has good internal reliability for each domain ($\alpha = 0.70–0.78$ cognitive restraint, $\alpha = 0.84–0.89$ uncontrolled eating, $\alpha = 0.92–0.94$ emotional eating) both within clinical and community samples of normal and overweight or obese individuals. Bohrer, Forbush, and Hunt (2015) further validated the TFEQ-R18V2 within the overweight and obese population. They determined that the TFEQ-R18V2 was a reliable and valid measure within all weight classes, with adequate internal consistency for each subscale. For this study, the TFEQ-
R18V2 uncontrolled eating subscale (TFEQ-UE; the only one used in this study’s analysis) had adequate internal reliability ($\alpha = 0.86$). See Appendix J.

**Power of Food Scale (PFS).** The PFS (Cappelleri, Bushmakin, Gerber, Leidy, Sexton, Karlsson, & Lowe, 2009) is a 15-item questionnaire measuring individuals’ appetite for palatable foods that are readily available in the environment. The PFS derives from the two-factor model of appetite developed by Lowe and Butryn (2007) and Lowe and Levine (2005). The model suggests that people will eat beyond satiety cues based on varying idiographic motivation levels, which are highly influenced by an environment that has large quantities of palatable foods. Therefore, the PFS asks participants about their thoughts, feelings, and motivations for eating highly palatable foods in food-rich environments. A three-factor solution is possible with the PFS: food available, food present, and food tasted. Items on the PFS are rated on the extent to which the participant agrees with the statement with a 5-point Likert scale anchored at 1 (I don’t agree) to 5 (I strongly agree). Cappelleri, Bushmakin, Gerber, Leidy, Sexton, Karlsson, and Lowe (2009) demonstrated that the PFS has good validity and reliability, with a Cronbach’s alpha of 0.91, and test-retest reliability with a four-month follow up ($r = 0.77$).

The PFS appears to reflect a stable trait that is not significantly impacted by present moment hunger (i.e., after a brief fast). Witt, Raggio, Butryn, and Lowe (2014) conducted an experimental study examining the impact of hunger and exposure to food on individual’s responses to the PFS. Sixty-seven participants were randomized to one of four groups that varied in fasting or no fasting and exposure to or no exposure to food. They found that participants’ scores on the PFS were not associated with individuals’ levels of hunger or exposure to food in the present moment, suggesting that the PFS is a reliable measure despite these situational
variations. For this study, the PFS total had adequate internal reliability ($\alpha = 0.95$). See Appendix K.

**Modified Yale Food Addiction Scale (mYFAS).** The mYFAS (Flint et al., 2014) measures markers of food addiction to high fat and high sugar foods that mirror criteria for substance dependence. While a newer addition of the mYFAS has since been developed (see Schulte & Gearhardt, 2017), the older version was utilized in this study. This 9-item measure requires participants to answer questions in a dichotomous and Likert-type format, where the five-point Likert items are anchored at “Never” to “4 or More Times Daily.” The statement “I find myself consuming certain foods even though I am no longer hungry” is an example of one of the items scored on the Likert scale. The statement “I kept consuming the same types or amounts of food despite significant emotional and/or physical problems related to me eating” is an item that is scored dichotomously as “Yes” or “No.” Following score of the mYFAS, clinicians are able to determine if a client meets a food addiction threshold consistent with the DSM-IV diagnostic criteria (American Psychiatric Association, 2000). The brief mYFAS is a modified version of the full YFAS (Gearhardt et al., 2009). The mYFAS had demonstrated good reliability and validity, with alpha values ranging from 0.74 to 0.84. For the purposes of this study, the symptom count derived from the mYFAS was used because this provides a continuous variable that allows for ease of interpretation in comparison to the other variables in the study. For this study, the mYFAS had adequate internal reliability ($\alpha = 0.80$). See Appendix L.

**Difficulties in Emotion Regulation Scale (DERS).** The DERS (Gratz & Roemer, 2004) is a 36-item questionnaire that measures emotional dysregulation on four different dimensions: “(a) awareness and understanding of emotions, (b) acceptance of emotions, (c) the ability to engage in goal-directed behavior, and refrain from impulsive behavior, when experiencing
negative emotions; and (d) access to emotion regulation strategies perceived as effective” (p. 44). Participants rate how the items apply to them with a 5-point Likert scale anchored at 1 (almost never [0-10%]) and 5 (almost always [91-100%]). The measure yields a total score as well as scores on six scales derived through factor analysis: 1. non-acceptance of emotional responses, 2. difficulties engaging in goal directed behavior, 3. impulse control difficulties, 4. lack of emotional awareness, 5. limited access to emotion regulation strategies, 6. lack of emotional clarity. Gratz and Roemer (2004) showed that the DERS has high internal consistency (\(\alpha = 0.93\)) and good test-retest reliability over a period ranging from 4 to 8 weeks. For this study, the DERS total had adequate internal reliability (\(\alpha = 0.95\)). See Appendix M.

**The Positive Affect Negative Affect Schedule (PANAS).** The PANAS (Watson, Clark, & Tellegen, 1988) presents participants with 10 positive (i.e., excited) and 10 negative (i.e., distressed) emotional words. Participants rate how much they feel these emotions “generally,” using a Likert scale from 1 to 5. The instructions for the PANAS can be altered for a specific time frame as well (e.g., moment, today, past few days), and higher scores on either scale indicate a stronger emotional experience. Watson et al. (1988) demonstrated that the PANAS has good convergent and discriminant validity, and its scores have good test-retest reliabilities after an eight-week retest interval, \(r = 0.68\) and \(r = 0.71\) for positive and negative affect scales, respectively. The positive and negative affect scales also demonstrate good internal consistencies (\(\alpha = 0.88\) and \(\alpha = 0.87\) for positive and negative affect scales respectively). For the purposes of this study, only the negative affect scale was utilized, with the instructions requesting participants to rate their emotional experience in the current moment. This allowed the PANAS negative affect scale to be used as a controlling variable in the analyses. For this study, the PANAS negative affect scale had adequate internal reliability (\(\alpha = 0.95\)). See Appendix N.
Procedure

Participants from the undergraduate population were recruited through SONA research system, which allowed students in psychology courses to sign up for and record their participation in the proposed study. The SONA system had a brief description of the survey, which included the eligibility requirements (i.e., at least 18 years of age), the estimated time to complete the survey, extra credit information, researcher contact information, and a link to the study’s survey. Students who wished to earn extra credit were granted credit on SONA once they completed the survey. Community participants were recruited from MTurk and were awarded $0.70 for their completion of the survey. The initial page for the study on MTurk contained a brief description of the survey, which included the eligibility requirements (i.e., at least 18 years of age), the estimated time to complete the survey, payment information, researcher contact information, and a link to the study’s survey.

The survey was designed and hosted on Qualtrics, which is an online research tool utilized to develop surveys for data collection. The survey began with an informed consent (see Appendix A) that outlines the study’s purpose, the voluntary nature of the study, the potential benefits and risks associated with participating in the study, and the researcher’s contact information. Once participants read and signed the informed consent, they were directed to the battery of assessments which included: demographic questionnaire, PHLMS, TMS, State MAAS, MES, EES, NEQ, BES, mYFAS, PFS, TFEQ-R18V2, DERS, and PANAS. The battery of assessments was presented in a standardized order, switching between mindfulness-based and eating-based questionnaires. At the end of the survey, participants were thanked for their completion of the survey, and information about extra credit or monetary compensation was provided.
Results

Data Analyses

All analyses were conducted in IBM’s Statistical Package for Social Sciences (SPSS) version 24. Prior to analysis, trait mindfulness (PHLMS Acceptance and Awareness), state mindfulness (State MAAS), mindful eating (MES), emotional eating (EES), night eating (NEQ), binge eating (BES), food addiction (mYFAS), power of food (PFS), disinhibited eating (TFEQ-R18V2), emotion dysregulation (DERS), and negative affect (PANAS) were examined for accuracy of data entry, missing values, and fit between their distributions and the assumptions of multivariate analysis.

The descriptive statistics (Table 2) showed that the means and standard deviations were relatively normal, and all values were within an accurate range for the questionnaire. Missing data were handled with pairwise deletion, a method of excluding participants data only when their data were missing for that analysis (Schlomer, Bauman, & Card, 2010). Variations in degrees of freedom throughout the analyses for this study reflect the pairwise method of handling missing data. No multivariate outliers were found using Mahalanobis distance with $p < 0.001$. A bivariate correlation matrix was run to check for multicollinearity among the variables and none of the variables were too highly correlated ($r \geq 0.90$; see Table 2). Tolerance and variance inflation factors (VIF) tests were conducted as well to test for violations of the assumption of multicollinearity. While the tolerance test values were all above the recommended cutoff of 0.20, suggesting no problems with multicollinearity, VIF values were slightly higher than the recommended cutoff of one (range 1.00 to 1.46), indicating potential issues with multicollinearity (Field, 2009). However, because the VIF values were close to the cutoff and other the other tests for multicollinearity did not concur, no changes were made to the data. The
The assumption of normality was checked by examining skewness and kurtosis values for each of the variables, and all were found to be normal, so no changes were made. Additionally, multivariate normality plots showed that results were normally distributed. The normal P-P Plot of regression standardized residual scatter plots showed that these variables were linear as well. The standardized regression scatter plots showed that these results met the assumptions of homogeneity and homoscedasticity.

The data analysis plan included first examining the bivariate correlations produced with Pearson’s r. Next, hierarchical multiple regression analyses were utilized to examine the predictive validity of mindfulness measures (i.e., trait and state mindfulness and mindful eating) on eating behaviors associated with obesity. Multivariate multiple regression analyses were initially planned for this project because this analysis allows for several predictors and outcome variables within the same model and the analysis accounts for the relationships among all inputted variables (Mielke & Berry, 2003). However, to conduct multivariate multiple regression analyses, the outcome variables need to be correlated, and while all the eating behaviors were significantly related to one another (see Table 2), only three of the eating behaviors were related to obesity. Only uncontrolled eating \( r = 0.10, p = 0.02 \), binge eating \( r = 0.10, p = 0.03 \), and emotional eating \( r = -0.12, p = 0.01 \) were significantly correlated with BMI, while night eating \( r = -0.06, p = 0.18 \), food addiction \( r = -0.07, p = 0.10 \), and hedonic hunger \( r = -0.07, p = 0.13 \) were not associated with BMI. These eating behaviors were initially conceptualized to be connected to BMI, and because the correlational data suggested they were not, it is not appropriate to use an analysis like multivariate multiple regression because the theory was not supported. Additionally, moderation analyses (using BMI as the moderator) were only conducted for eating behaviors that were associated with BMI, because this analysis requires that the
moderator and outcome variable are related (Warner, 2008). Moderation analyses were conducted in PROCESS macro in SPSS (Hayes, 2012).
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
<th>Min, Max</th>
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<th>2</th>
<th>3</th>
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<th>6</th>
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<td>State MAAS</td>
<td>3.31 (1.72)</td>
<td>[0, 6]</td>
<td>0.53***</td>
<td>-0.05</td>
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<td>MES</td>
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<td>0.56***</td>
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<td>EES</td>
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<td>0.12***</td>
<td>-0.57***</td>
<td>-0.72***</td>
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<td>0.56***</td>
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<td>-0.68***</td>
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<td>mYFAS</td>
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<td>-0.69***</td>
<td>0.64***</td>
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<td>0.56***</td>
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<td>0.15***</td>
<td>-0.43***</td>
<td>-0.73***</td>
<td>0.66***</td>
<td>0.52***</td>
<td>0.60***</td>
<td>0.65***</td>
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<td>TFEQ-UE</td>
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<td>-0.20***</td>
<td>-0.18***</td>
<td>-0.50***</td>
<td>0.35***</td>
<td>0.32***</td>
<td>0.53***</td>
<td>0.30***</td>
<td>0.52***</td>
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<tr>
<td>DERS</td>
<td>12.50 (27.07)</td>
<td>[36, 153]</td>
<td>-0.57***</td>
<td>-0.08</td>
<td>0.03***</td>
<td>-0.70***</td>
<td>0.28***</td>
<td>0.36***</td>
<td>0.56***</td>
<td>0.56***</td>
<td>0.52***</td>
<td>0.02***</td>
<td>0.59***</td>
<td>1</td>
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<tr>
<td>PANAS</td>
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<td>[10, 50]</td>
<td>-0.48***</td>
<td>0.12***</td>
<td>-0.50***</td>
<td>-0.66***</td>
<td>0.76***</td>
<td>0.55***</td>
<td>0.52***</td>
<td>0.58***</td>
<td>0.53***</td>
<td>0.22***</td>
<td>0.67***</td>
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Note: * p < .05, ** p < .01, *** p < .001
**Hypotheses 1, 2, and 3**

Hypothesis 1 was examined with a bivariate correlation and was only partially supported. Trait mindful acceptance and state mindfulness were positively correlated ($r = 0.53, p < 0.001$). Inconsistent with the hypothesis, trait mindful awareness was significantly inversely correlated with trait mindful acceptance ($r = -0.28, p < 0.001$), and was not significantly correlated with state mindfulness ($r = -0.05, p = 0.30$).

Hypothesis 2 was first examined with a bivariate correlation and was partially supported. Mindful eating was significantly, positively associated with trait mindful acceptance ($r = 0.48, p < 0.001$) and state mindfulness ($r = 0.56, p < 0.001$). However, mindful eating was not significantly associated with trait mindful awareness ($r = -0.002, p = 0.97$). A hierarchical multiple regression was used to determine the predictive relationship between trait and state mindfulness on mindful eating. Trait mindfulness variables (PHLMS Aware, PHLMS Accept) were entered into the first step of the equation and the overall model was significant, $F (2, 479) = 80.00, p < 0.001, R^2 = 0.25$. Trait mindful acceptance was a stronger predictor of mindful eating, $b = 0.52, t (479) = 12.72, p < 0.001, pr^2 = 0.25$, than trait mindful awareness, $b = 0.14, t (479) = 3.51, p < 0.001, pr^2 = 0.03$. The addition of state mindfulness in the second step of the model was significant, $F (1, 478) = 93.72, p < 0.001, \Delta R^2 = 0.12$. Participants who had more state mindfulness reported more mindful eating, $b = 0.41, t (478) = 9.46, p < 0.001, pr^2 = 0.16$.

Hypothesis 3 was also examined with a bivariate correlation and was partially supported. Difficulties in emotion regulation were significantly related to trait mindful acceptance ($r = -0.57, p < 0.001$), state mindfulness ($r = -0.63, p < 0.001$), and mindful eating ($r = -0.70, p < 0.001$), but not trait mindful awareness ($r = -0.08, p = 0.07$).
Hypotheses 4, 5, & 6

Hypothesis 4 was tested with a bivariate correlation and was found to be partially supported. Trait mindful acceptance was negatively correlated with emotional eating ($r = -0.43$, $p < 0.001$), night eating ($r = -0.34$, $p < 0.001$), binge eating ($r = -0.38$, $p < 0.001$), food addiction ($r = -0.44$, $p < 0.001$), hedonic hunger ($r = -0.45$, $p < 0.001$), and disinhibited eating ($r = -0.15$, $p < 0.001$). Trait mindful awareness was negatively correlated with binge eating ($r = -0.12$, $p < 0.01$) and uncontrolled eating ($r = -0.20$, $p < 0.001$). Interestingly, trait mindful awareness was positively correlated with emotional eating ($r = 0.12$, $p < 0.01$), food addiction ($r = 0.18$, $p < 0.001$), and hedonic hunger ($r = 0.15$, $p = 0.001$) and not related to night eating ($r = 0.02$, $p = 0.68$). State mindfulness was negatively correlated with emotional eating ($r = -0.57$, $p < 0.001$), night eating ($r = -0.46$, $p < 0.001$), binge eating ($r = -0.40$, $p < 0.001$), food addiction ($r = -0.43$, $p < 0.001$), hedonic hunger ($r = -0.43$, $p < 0.001$), and disinhibited eating ($r = -0.18$, $p < 0.001$).

Lastly, mindful eating was negatively correlated with emotional eating ($r = -0.72$, $p < 0.001$), night eating ($r = -0.58$, $p < 0.001$), binge eating ($r = -0.68$, $p < 0.001$), food addiction ($r = -0.69$, $p < 0.001$), hedonic hunger ($r = -0.73$, $p < 0.001$), and disinhibited eating ($r = -0.50$, $p < 0.001$).

Hypothesis 5 and 6 were examined with a series of hierarchical multiple regression analyses. Trait mindfulness components were entered into the first step, state mindfulness was entered into the second, and mindful eating into the third to predict emotional eating, night eating, binge eating, food addiction, hedonic hunger, and disinhibited eating (total of six hierarchical multiple regression analyses conducted). No other variables, such as negative affect, were controlled for in these analyses because there were no significant group differences found between the MTurk and student sample, $t (531) = -0.20$, $p = 0.84$, $d = 0.02$. 
Emotional eating. Hierarchical multiple regression revealed that at step one, trait mindfulness contributed significantly to the model, $F(2, 479) = 55.67, p < 0.001$, and accounted for 19% of the variance in emotional eating. The introduction of state mindfulness added an additional 16% of the variance in emotional eating, and this change in $R^2$ was significant, $F(3, 478) = 85.22, p < 0.001$. Lastly, the addition of mindful eating in the third step explained an additional 22.30% of the variance in emotional eating, and this change in $R^2$ was significant, $F(4, 477) = 158.94, p < 0.001$. With all the variables included in the three-step regression model, trait mindful acceptance was no longer a significant predictor of emotional eating. The most important predictor of emotional eating was mindful eating, which uniquely explained 34.22% of the variation in emotional eating. Together the four independent variables accounted for 57.10% of the variation in emotional eating. See Table 3 for a summary of the results.

Table 3.

Summary of Hierarchical Multiple Regression Analysis for Emotional Eating

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>$t$</th>
<th>$pr^2$</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
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<td>Step 1</td>
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<tr>
<td>PHLMS Accept</td>
<td>-0.44</td>
<td>-10.16***</td>
<td>0.18</td>
<td>0.19</td>
<td>0.19</td>
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<tr>
<td>PHLMS Aware</td>
<td>-0.004</td>
<td>-0.10</td>
<td>0.00</td>
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<td>Step 2</td>
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<tr>
<td>PHLMS Accept</td>
<td>-0.17</td>
<td>-3.62***</td>
<td>0.03</td>
<td>0.35</td>
<td>0.16</td>
</tr>
<tr>
<td>PHLMS Aware</td>
<td>0.05</td>
<td>1.28</td>
<td>0.00</td>
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<tr>
<td>State MAAS</td>
<td>-0.48</td>
<td>-10.83***</td>
<td>0.20</td>
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<tr>
<td>Step 3</td>
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<tr>
<td>PHLMS Accept</td>
<td>0.01</td>
<td>0.20</td>
<td>0.00</td>
<td>0.57</td>
<td>0.22</td>
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<tr>
<td>PHLMS Aware</td>
<td>0.11</td>
<td>3.41**</td>
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<tr>
<td>State MAAS</td>
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<td>-5.99***</td>
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<tr>
<td>MES</td>
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<td>-15.75***</td>
<td>0.34</td>
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</table>

Note: * $p < .05$, ** $p < .01$, *** $p < .001$
**Night eating.** Hierarchical multiple regression revealed that at step one, trait mindfulness contributed significantly to the model, $F(2, 475) = 33.24, p < 0.001$, and accounted for 12.90% of the variation in night eating. The introduction of state mindfulness added an additional 10.10% of the variance in night eating, and this change in $R^2$ was significant, $F(3, 474) = 44.75, p < 0.001$. Lastly, the addition of mindful eating in the third step explained an additional 13.90% of the variance in night eating, and this change in $R^2$ was significant, $F(4, 473) = 66.39, p < 0.001$. With all the variables included in the three-step regression model, trait mindful acceptance and awareness were no longer significant predictors of night eating. The most important predictor of night eating was mindful eating, which uniquely explained 17.81% of the variance in night eating. Together the four independent variables accounted for 36% of the variance in night eating. See Table 4 for a summary of the results.

### Table 4.

Summary of Hierarchical Multiple Regression Analysis for Night Eating

<table>
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<tr>
<th>Variable</th>
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<th>$pr^2$</th>
<th>$R^2$</th>
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<tr>
<td>PHLMS Accept</td>
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<td>-8.02***</td>
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<td>PHLMS Aware</td>
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<td>PHLMS Aware</td>
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<td>0.17</td>
<td>0.00</td>
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<td>State MAAS</td>
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<td>-3.91***</td>
<td>0.03</td>
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<td>MES</td>
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<td>-10.13***</td>
<td>0.18</td>
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*Note:* *p < .05, **p < .01, ***p < .001*
Binge eating. Hierarchical multiple regression revealed that at step one, trait mindfulness contributed significantly to the model, $F(2, 466) = 57.61$, $p < 0.001$, and accounted for 19.80% of the variation in binge eating. The introduction of state mindfulness increased the variance observed in binge eating by 4.20% and this change in $R^2$ was significant, $F(3, 465) = 49.12$, $p < 0.001$. Lastly, the addition of mindful eating in the third step explained an additional 24.90% of the variance in binge eating and this change in $R^2$ was significant, $F(4, 464) = 111.08$, $p < 0.001$.

With all the variables included in the three-step regression model, state mindfulness was no longer a significant predictor of binge eating. The most important predictor of binge eating was mindful eating, which uniquely explained 32.72% of the variation in binge eating. Together the four independent variables accounted for 48.90% of the variation in binge eating. See Table 5 for a summary of the results.

| Table 5. Summary of Hierarchical Multiple Regression Analysis for Binge Eating |
|------------------|----------|----------|----------|----------|----------|
| Variable         | $\beta$ | $t$      | $p^2$    | $R^2$    | $\Delta R^2$ |
| Step 1           |          |          |          |          |          |
| PHLMS Accept     | -0.45    | -10.37***| 0.19     |          | 0.20      |
| PHLMS Aware      | -0.24    | -5.57*** | 0.06     |          | 0.20      |
| Step 2           |          |          |          | 0.24     | 0.04      |
| PHLMS Accept     | -0.31    | -6.16*** | 0.08     |          | 0.24      |
| PHLMS Aware      | -0.21    | -5.02*** | 0.05     |          | 0.04      |
| State MAAS       | -0.25    | -5.10*** | 0.05     |          | 0.05      |
| Step 3           |          |          |          | 0.49     | 0.25      |
| PHLMS Accept     | -0.13    | -2.93**  | 0.02     |          | 0.49      |
| PHLMS Aware      | -0.15    | -4.31*** | 0.04     |          | 0.04      |
| State MAAS       | 0.01     | 0.27     | 0.00     |          | 0.00      |
| MES              | -0.63    | -15.03***| 0.33     |          | 0.33      |

Note: * $p < .05$, ** $p < .01$, *** $p < .001$
Food addiction. Hierarchical multiple regression revealed that at step one, trait mindfulness contributed significantly to the model, $F (2, 479) = 59.18, p < 0.001$, and accounted for 19.80% of the variation in food addiction. The introduction of state mindfulness increased the variation observed in food addiction by 5.80%, and this change in $R^2$ was significant, $F (3, 478) = 54.95, p < 0.001$. Lastly, the addition of mindful eating in the third step explained an additional 25.60% of the variance in food addiction, and this change in $R^2$ was significant, $F (4, 477) = 125.43, p < 0.001$. With all the variables included in the three-step regression model, trait mindful acceptance and state mindfulness were no longer significant predictors of food addiction. The most important predictor of food addiction was mindful eating, which uniquely explained 34.46% of the variation in food addiction. Together the four independent variables accounted for 51.30% of the variation in food addiction. See Table 6 for a summary of the results.

Table 6.
Summary of Hierarchical Multiple Regression Analysis for Food Addiction

<table>
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<th>$\beta$</th>
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<th>$\Delta R^2$</th>
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<td>-5.31***</td>
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<td>-6.12***</td>
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<td>0.51</td>
<td>0.26</td>
</tr>
<tr>
<td>PHLMS Accept</td>
<td>-0.07</td>
<td>-1.78</td>
<td>0.01</td>
<td></td>
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</tr>
<tr>
<td>PHLMS Aware</td>
<td>0.16</td>
<td>4.75***</td>
<td>0.04</td>
<td></td>
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</tr>
<tr>
<td>State MAAS</td>
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<td>-0.65</td>
<td>0.00</td>
<td></td>
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</tr>
<tr>
<td>MES</td>
<td>-0.64</td>
<td>-15.84***</td>
<td>0.34</td>
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</tr>
</tbody>
</table>

Note: * $p < .05$, ** $p < .01$, *** $p < .001$
Hedonic hunger. Hierarchical multiple regression revealed that at step one, trait mindfulness contributed significantly to the model, $F(2, 479) = 62.12, p < 0.001$, and accounted for 20.60% of the variation in hedonic hunger. The introduction of state mindfulness increased the variance observed in hedonic hunger by 5.30%, and this change in $R^2$ was significant, $F(3, 478) = 55.54, p < 0.001$. Lastly, the addition of mindful eating in the third step explained an additional 29.40% of the variance in hedonic hunger, and this change in $R^2$ was significant, $F(4, 477) = 147.29, p < 0.001$. With all the variables included in the three-step regression model, state mindfulness was no longer a significant predictor of hedonic hunger. The most important predictor of hedonic hunger was mindful eating, which uniquely explained 39.69% of the variation in hedonic hunger. Together the four independent variables accounted for 55.30% of the variation in hedonic hunger. See Table 7 for a summary of the results.

Table 7.
Summary of Hierarchical Multiple Regression Analysis for Hedonic Hunger

<table>
<thead>
<tr>
<th>Variable</th>
<th>β</th>
<th>t</th>
<th>$pr^2$</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
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<td>0.21</td>
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<td>-10.54***</td>
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<td>PHLMS Aware</td>
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<td>Step 2</td>
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<td>0.05</td>
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<tr>
<td>PHLMS Accept</td>
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<td>1.28</td>
<td>0.00</td>
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</tr>
<tr>
<td>State MAAS</td>
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<td>-5.82***</td>
<td>0.07</td>
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<td></td>
</tr>
<tr>
<td>Step 3</td>
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<td></td>
<td></td>
<td>0.55</td>
<td>0.29</td>
</tr>
<tr>
<td>PHLMS Accept</td>
<td>-0.09</td>
<td>-2.35*</td>
<td>0.01</td>
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</tr>
<tr>
<td>PHLMS Aware</td>
<td>0.12</td>
<td>3.71***</td>
<td>0.03</td>
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<td></td>
</tr>
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<td>State MAAS</td>
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<td>0.16</td>
<td>0.00</td>
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</tr>
<tr>
<td>MES</td>
<td>-0.68</td>
<td>-17.71***</td>
<td>0.4</td>
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<td></td>
</tr>
</tbody>
</table>

Note: * $p < .05$, ** $p < .01$, *** $p < .001$
Hierarchical multiple regression revealed that at step one, trait mindfulness contributed significantly to the model, $F(2, 479) = 23.08, p < 0.001$, and accounted for 8.80% of the variation in disinhibited eating. The introduction of state mindfulness increased the variance observed in disinhibited eating by 0.80%, and this change in $R^2$ was significant, $F(3, 478) = 16.86, p < 0.001$. Lastly, the addition of mindful eating in the third step explained an additional 20.40% of the variance in disinhibited eating, and this change in $R^2$ was significant, $F(4, 477) = 51.03, p < 0.001$. With all the variables included in the three-step regression model, trait mindful acceptance was no longer a significant predictor of disinhibited eating. The most important predictor of disinhibited eating was mindful eating, which uniquely explained 22.56% of the variation in disinhibited eating. Together the four independent variables accounted for 30% of the variation in disinhibited eating. See Table 8 for a summary of the results.

**Hypotheses 7 & 8**

To address hypotheses seven and eight, a series of moderation analyses were conducted with emotional eating, binge eating, and disinhibited eating as outcome variables because these were the only eating behaviors significantly correlated with BMI. The PROCESS macro in SPSS
(Hayes, 2012) was used to center variables and analyze the interaction between mindfulness and BMI in predicting eating behaviors. For the purposes of these analyses, BMI was grouped into three categories: average weight, overweight, and obese. Participants who had a BMI that was classified as underweight were excluded from analyses because only 58 participants qualified. A summary of all of the moderation analyses conducted can be reviewed in Table 9. Importantly, BMI only moderated two relationships: the relationship between state mindfulness and binge eating and the relationship between trait mindful awareness and disinhibited eating. Only the moderation analyses associated with these models will be discussed for brevity.

![Graph showing the interaction between BMI and state mindfulness predicting binge eating](image)

*Figure 1.*

The interaction between BMI and state mindfulness predicting binge eating
In the overall model, state mindfulness and BMI were significant predictors of binge eating, $F(3, 456) = 47.99, p < 0.001, R^2 = 0.23$. As state mindfulness increased binge eating decreased, $b = -2.09, t(456) = -8.87, p < 0.001, 95\% \text{ CI } [-2.55, -1.63]$, and as BMI increased so did binge eating, $b = 2.75, t(456) = 6.12, p < 0.001, 95\% \text{ CI } [1.87, 3.63]$. Binge eating was also predicted by the interaction between state mindfulness and BMI, $b = 0.71, t(456) = 2.47, p = 0.01, 95\% \text{ CI } [0.14, 1.28]$. Figure 1 shows the interaction between predictors. For average BMI, less state mindfulness led to greater binge eating, $b = -2.61, t(456) = -8.27, p < 0.001, 95\% \text{ CI } [-3.23, -1.99]$. A similar result was observed for overweight BMI, $b = -2.09, t(456) = -8.87, p < 0.001, 95\% \text{ CI } [-2.55, -1.63]$, and obese BMI, $b = -1.52, t(456) = -4.57, p < 0.001, 95\% \text{ CI } [-2.17, -0.87]$. 

![Graph showing the interaction between BMI and trait mindful awareness predicting disinhibited eating](image)

**Figure 2.**

The interaction between BMI and trait mindful awareness predicting disinhibited eating
In the overall model, trait mindful awareness and BMI were significant predictors of disinhibited eating, $F(3, 469) = 10.67, p < 0.001, R^2 = 0.08$. As trait mindful awareness increased disinhibited eating decreased, $b = -0.02, t(469) = -3.91, p < 0.001, 95\% \text{ CI} [-0.03, -0.01]$, and as BMI increased so did disinhibited eating, $b = 0.11, t(469) = 3.27, p < 0.001, 95\% \text{ CI} [0.05, 0.18]$. Disinhibited eating was also predicted by the interaction between trait mindful awareness and BMI, $b = 0.02, t(469) = 2.79, p = 0.01, 95\% \text{ CI} [0.01, 0.02]$. Figure 2 shows the interaction between predictors. For average BMI, less trait mindful awareness led to greater disinhibited eating, $b = -0.03, t(469) = -4.90, p < 0.001, 95\% \text{ CI} [-0.04, -0.02]$ and a similar result was observed for overweight BMI, $b = -0.02, t(469) = -3.91, p < 0.001, 95\% \text{ CI} [-0.03, -0.01]$. For obese BMI, there was a non-significant difference in scores when increasing trait mindful awareness, $b = -0.01, t(469) = -0.75, p = 0.45, 95\% \text{ CI} [-0.02, 0.01]$. 
<table>
<thead>
<tr>
<th>Variable</th>
<th>$b$</th>
<th>$t$</th>
<th>95% CI</th>
<th>$R^2$</th>
<th>df</th>
<th>$R^2$</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Moderation 1</td>
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<td>(3, 469)</td>
<td>0.16</td>
<td></td>
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<tr>
<td>BMI</td>
<td>0.98</td>
<td>0.84</td>
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<td>-8.54***</td>
<td>[-1.49, -0.93]</td>
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<tr>
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<td>0.01</td>
<td>0.06</td>
<td>[-0.33, 0.35]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderation 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>2.17</td>
<td>1.66</td>
<td>[-0.39, 4.73]</td>
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<td>PHLMS Aware</td>
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<td>1.34</td>
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<tr>
<td>BMI x PHLMS Aware</td>
<td>0.23</td>
<td>1.00</td>
<td>[-0.22, 0.68]</td>
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<tr>
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<tr>
<td>BMI</td>
<td>2.83</td>
<td>2.52**</td>
<td>[0.62, 5.04]</td>
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<tr>
<td>State MAAS</td>
<td>-7.23</td>
<td>-12.64***</td>
<td>[-8.36, -6.11]</td>
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<tr>
<td>BMI x State MAAS</td>
<td>0.30</td>
<td>0.41</td>
<td>[-1.13, 1.72]</td>
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<td></td>
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<tr>
<td>Moderation 4</td>
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<td></td>
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<tr>
<td>BMI</td>
<td>-0.16</td>
<td>-1.45</td>
<td>[-0.38, 0.06]</td>
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<tr>
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<td>-18.81***</td>
<td>[-1.41, -1.15]</td>
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<tr>
<td>BMI x MES</td>
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<td>1.06</td>
<td>[-0.01, 0.03]</td>
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</tr>
<tr>
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<td>(3, 456)</td>
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<td>[-0.52, -0.33]</td>
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<td>-0.30</td>
<td>[-0.13, 0.10]</td>
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<td></td>
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<tr>
<td>BMI</td>
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<td>5.38***</td>
<td>[1.64, 3.53]</td>
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<tr>
<td>BMI x PHLMS Aware</td>
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<td>1.39</td>
<td>[-0.05, 0.27]</td>
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<td></td>
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<tr>
<td>Moderation 3</td>
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<td></td>
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<tr>
<td>BMI</td>
<td>2.75</td>
<td>6.12***</td>
<td>[1.87, 3.63]</td>
<td></td>
<td></td>
<td>0.23</td>
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<tr>
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<td>-8.87***</td>
<td>[-2.55, -1.63]</td>
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<tr>
<td>BMI x State MAAS</td>
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<td>2.46**</td>
<td>[0.14, 1.28]</td>
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<tr>
<td>BMI</td>
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<td>[0.08, 0.27]</td>
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<tr>
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<td>[-0.52, -0.42]</td>
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<tr>
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<td>7.70***</td>
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<tr>
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<td>3.03**</td>
<td>[0.04, 0.18]</td>
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<td>[0.05, 0.18]</td>
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<td>-3.91***</td>
<td>[-0.03, -0.01]</td>
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<tr>
<td>BMI x PHLMS Aware</td>
<td>0.02</td>
<td>2.79**</td>
<td>[0.01, 0.03]</td>
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<tr>
<td>BMI</td>
<td>0.13</td>
<td>3.68***</td>
<td>[0.06, 0.20]</td>
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<tr>
<td>State MAAS</td>
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<td>-4.74***</td>
<td>[-0.12, -0.01]</td>
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<td>BMI x State MAAS</td>
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<td>[-0.01, 0.07]</td>
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<td></td>
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<tr>
<td>Moderation 4</td>
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<td></td>
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<td></td>
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<tr>
<td>BMI</td>
<td>0.01</td>
<td>2.26*</td>
<td>[0.001, 0.01]</td>
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<td>-11.25***</td>
<td>[-0.03, -0.02]</td>
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<tr>
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<td>-1.88</td>
<td>[-0.01, 0.00]</td>
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</table>

Note: * $p < .05$, ** $p < .01$, *** $p < .001$; The conditional effects of the interaction terms bolded are discussed in more detail.
Discussion

This study was designed as an exploration of the relationships between mindfulness, mindful eating, and eating behaviors that are commonly associated with obesity. This is one of the first studies to examine multiple components of mindfulness (i.e., trait, state, and context-dependent) in conjunction with multiple components of problematic eating behaviors (e.g., emotional eating, binge eating, disinhibited eating). It was hypothesized that trait and state mindfulness and mindful eating would be positively associated, and that trait and state mindfulness would differ in their ability to predict mindful eating given the mixed findings with these measures in previous literature (Tanay & Bernstein, 2013; Thompson & Waltz, 2007). The findings partially support these hypotheses. Trait mindful acceptance, state mindfulness, and mindful eating were all positively associated with one another; however, trait mindful awareness was not significantly related to state mindfulness or mindful eating and was negatively correlated with trait mindful acceptance. These results suggest that a general tendency towards awareness does not necessarily mean an individual will possess more comprehensive mindfulness.

The inverse relationship between trait mindful awareness and acceptance was surprising and inconsistent with the conceptualization of mindfulness from this study’s perspective. The developers of the PHLMS, the measure used in this study to assess trait mindfulness, developed the awareness and acceptance subscales to be unique constructs during the initial validation of the measure (Cardaciotto et al., 2008). Therefore, finding differences between these subscales is unsurprising; however, theoretically it is unclear why trait mindful awareness was not related or inversely related to other measures of mindfulness because awareness has been viewed as a central component of any mindfulness. However, the PHLMS validation studies produced similar findings (Cardaciotto et al., 2008). These results are at odds with early
conceptualizations of mindfulness that debated the role of acceptance and awareness in the development and practice of mindfulness. For example, Brown and Ryan (2003) argued that mindfulness consisted of awareness only, and that sustained attention was mechanism of change, while Bishop et al. (2004) proposed that acceptance was a vital additional component of mindfulness. It is possible that differences in how questions are worded between mindfulness measures can help explain the mixed results observed. The PHLMS awareness subscale has 10 items that ask participants to rate how often they are aware of internal and external events while they complete a variety of activities of daily life (e.g., “I am aware of thoughts I’m having when my mood changes,” “When talking with other people, I am aware of the emotions I am experiencing,” “When I shower, I am aware of how the water is running over my body”). This is in contrast to other mindfulness measures such as the State MAAS (Brown & Ryan, 2003) that ask participants about sustained attention in the moment (e.g., “I was doing something without paying attention”). While theoretically these measures should be related, it is possible that these measures are capturing different constructs calling for continued evaluation of the operational definition and mechanisms of change for mindfulness.

The mixed relationships among types of mindfulness were explored further. While trait and state mindfulness were significant predictors of mindful eating, results indicated that state mindfulness was a better predictor. The importance of context has been highlighted in literature for both eating behaviors (Cobb et al., 2015; Lavender et al., 2016) and emotion regulation (Dixon-Gordon, Aldao, & De Los Reyes, 2015; English, Lee, John, & Gross, 2017), and this study further supports the notion that action in a particular context is perhaps more important than a general disposition skill set. Future research may benefit from understanding how trait mindfulness impacts the ability of an individual to be mindful in a given context considering the
relative importance of state over trait mindfulness. These findings are also consistent with recent studies that find trait and state mindfulness measures may be assessing different aspects of the experience of mindfulness (Bravo et al., 2017; Medvedev, Krägeloh, Narayanan, & Siegert, 2017) and literature supporting the unique effects of trait and state mindfulness (Egan, Hill, & Foti, 2017). The general lack of consistency among these measures further validates the need for continued assessment and critique of methodology used to examine mindfulness.

Additionally, it was hypothesized that trait and state mindfulness and mindful eating would be negatively related to difficulties in emotion regulation. Trait mindful acceptance, state mindfulness, and mindful eating were significantly negatively associated with difficulties in emotion regulation; however, trait mindful awareness was not. Previous literature has shown that lower general dispositional mindfulness, as measured by the Five-Facet Mindfulness Questionnaire (Baer, Smith, Hopkins, & Toney, 2006), is significantly related to greater difficulties in emotion regulation (Fisher, Mead, Lattimore, & Malinowski, 2017); however, the literature has failed to explain why there may be differences between dispositional mindful awareness and acceptance. It is possible that having a lack of trait mindful acceptance is more strongly associated with emotion regulation difficulties than trait mindful awareness. Taken together, this might mean that interventions utilizing mindfulness may be more effective if acceptance of the present moment is emphasized over simply having awareness of the present moment. Importantly, further research and replication of these results is needed before changes to existing treatments are recommended.

This study also explored the associations between each of the mindfulness components with eating behaviors. It was hypothesized that mindfulness measures would be negatively correlated with each of the eating behaviors, and this hypothesis was partially supported. Trait
mindful acceptance, state mindfulness, and mindful eating were all significantly, negatively correlated with each of the eating behaviors examined. In other words, less trait mindful acceptance, state mindfulness, and mindful eating were associated with more problematic eating behavior consistent with previous literature (Adams et al., 2012; Cowdrey & Park, 2012; Lavender et al., 2011, 2009; Masuda & Wendell, 2010). For trait mindful awareness, this relationship was only found for binge eating and disinhibited eating. Night eating and trait mindful awareness did not have a significant relationship. This is one of the first studies to explore the relationship between night eating and mindfulness, and further replication of these results is needed to understand this unique finding. Conversely, having greater trait awareness was associated with greater emotional eating, food addiction, and hedonic hunger. This indicated that a general tendency towards awareness actually led to greater problematic eating for some topographies of behavior. Importantly, having higher trait mindful awareness, as measured in this study, does not specify what the participant is aware of on a daily basis. Therefore, having greater trait mindful awareness could equate to having a disproportionate amount of awareness of negative external or internal events that contributes to the cycle of engaging in these eating behaviors or even to problematic food cues. If an individual does not possess the skills need to manage these negative events, having greater awareness may be more harmful than beneficial. In this study, trait mindful awareness was not related to difficulties in emotion regulation supporting the idea that increased awareness does not equate to skillful behavior, at least in the context of emotion regulation.

It was hypothesized that each of the mindfulness components would be able to predict eating behaviors and that mindful eating would be a unique predictor above and beyond the other components of mindfulness. In general, trait and state mindfulness were significant predictors of
eating behaviors. However, for each eating behavior unique trends among these components were found. For emotional eating and hedonic hunger, trait mindful awareness was not a significant predictor until mindful eating was added to the model, and for night eating, trait mindful awareness was not a significant predictor throughout the model. Trait mindful acceptance was no longer a significant predictor with the addition of mindful eating for emotional eating, night eating, or disinhibited eating. State mindfulness was also no longer a significant predictor with the addition of mindful eating for binge eating and food addiction. Lastly, the addition of state mindfulness in the second step of the model reduced the variance observed for food addiction, hedonic hunger, and disinhibited eating. In other words, adding state mindfulness to the model was not helpful in explaining the variance among these specific eating behaviors. Taken together, these results suggest that subtle differences among mindfulness components exist and their impact may depend on the specific eating behavior being measured. Mixed results in the predictive validity of trait and state mindfulness extend previous findings on the inconsistencies between these measures of mindfulness (Bravo et al., 2017). This supports the need to tailor mindfulness interventions to the specific needs of clients and their presenting problems, and possibly to attend to acquisition of acceptance skills if mindful awareness skills are included.

While trait and state mindfulness were significant predictors of these eating behaviors, mindful eating accounted for an additional 13.9 to 29.4% of the variance in the models tested, suggesting that measuring mindfulness in context may be more meaningful than trait or state mindfulness. Across eating behaviors, mindful eating was a unique and stable predictor which may indicate that mindful eating is a better treatment target. For night eating, mindful eating contributed the least amount of additional variance compared to the other eating behaviors tested.
This is one of the first studies to examine mindfulness and mindful eating in relation to night eating, and further research is needed to understand why mindful eating accounted for less variance in this form of eating behavior compared to others. Interestingly, the entire model for night eating, which included trait and state mindfulness along with mindful eating, accounted for only 36% of the variance observed suggesting other variables are contributing to the development and maintenance of night eating. Vander Wal (2012) reviewed the current literature on night eating syndrome and found that this behavior usually occurs with depression, anxiety, substance use, and sleep disorders, indicating that further research is needed to understand the most important contributing variables to night eating and how to intervene in or prevent it.

When considering the relative contribution of mindful eating across these models, mindful eating consistently accounted for more variance than other facets of mindfulness. MBIs utilize a variety of strategies to teach mindfulness; however, when eating behaviors are the target of the intervention, mindful eating exercises may be more appropriate. This finding is consistent with Beshara et al.’s (2013) results suggesting that mindful eating was a better predictor of healthy food choices than trait mindfulness. While trait and state mindfulness may also produce changes in eating behaviors (Jordan et al., 2014), focusing on mindful eating inductions may provide a more sensitive and efficient treatment target. Interestingly, previous studies have largely examined trait and state mindfulness and mindful eating in the context of healthy eating, where this study explores these the unique characteristics of mindfulness components as related to problematic eating behaviors frequently associated with obesity. These results also suggest that interventions could benefit from making a clear distinction between mindfulness and mindful eating when addressing eating behaviors as a primary outcome variable. Most of the research to date synthesizes mindful eating and mindfulness interventions (Warren, Smith,
Ashwell, 2017); however, future research may benefit from exploring the unique characteristics of mindful eating versus mindfulness more broadly.

Lastly, the moderating role of BMI was explored in the relationship between mindfulness and eating behaviors to account for the association between obesity and these eating behaviors. Interestingly, only three of the six eating behaviors examined in this study were significantly associated with BMI. It is unclear why night eating, food addiction, and hedonic hunger were not significantly related to BMI as previous literature has supported this relationship (Cheung, Ko, Chow, & Kong, 2018; Davis et al., 2011; Ferrario, 2017; Pinto-bastos, Ramalho, Conceição, & Mitchell, 2016; Ullrich et al., 2013). One explanation is a lack of variability among these eating behaviors. For example, few individuals in the sample endorsed a high frequency of food addiction symptoms which would be expected given the nonclinical sample that was utilized. Without that representative sample, this study may be underpowered to detect the relationship between BMI and these eating behaviors.

Additionally, because the data are limited by the self-report methodology and the nature of the items, it is uncertain how long individuals have experienced these eating behaviors. Therefore, it could be the case that individuals who endorse night eating, food addiction, and hedonic hunger have not experienced these eating behaviors long enough to see changes in BMI. Specifically, night eating has been shown to only be associated with BMI for those between the ages of 31 and 60 (Meule et al., 2014). Considering the mean age of the sample was 31.77, it may not be expected that BMI and night related. Additionally, self-reported BMI has been critiqued as an unreliable measure of BMI due to a number of concerns. Rothman (2008) discussed the non-linear trend of BMI and body fat percentage, as well as the lack of sensitivity to variables such as age. Therefore, using self-report BMI as measure of weight status may have
contributed to the misclassification of participant’s weight category, which may explain the lack of association between these eating behaviors and BMI. Interestingly, all of the eating behaviors were significantly associated with one another (see Table 2), suggesting that these eating behaviors have some commonalities. Future research may extend upon on these findings by exploring the individual characteristics that predict differences in presentation of eating behaviors that result in BMI changes.

Only moderation analyses for eating behaviors that were significantly associated with BMI (emotional eating, binge eating, and disinhibited eating) were examined. Of the nine moderation models, only two supported a significant moderation effect. BMI moderated the relationship between state mindfulness and binge eating. Across all levels of BMI (normal weight, overweight, and obese), a decrease in state mindfulness led to an increase in binge eating. BMI was also found to moderate the relationship between trait mindful awareness and disinhibited eating. For average and overweight individuals, a decrease in trait mindful awareness led to an increase in disinhibited eating. However, obese individuals did not show differences in disinhibited eating dependent on trait mindful awareness. It was surprising that only two of the nine moderation models tested were significant and suggests that other variables besides BMI are influencing the relationship between mindfulness and eating.

**Limitations**

While this study had a large and diverse sample size, the project was limited by the cross-sectional design. The results from this study need to be taken with caution because causal relationships cannot be inferred from the data collected and the results need to be replicated. Additionally, the measures used in this study entirely relied on self-report assessment, which has several disadvantages. Self-report methodology is particularly susceptible to social desirability;
participants may alter their responses to match what they believe is socially acceptable or is the desired outcome of the researcher (Chan, 2009). Individuals also have difficulty remembering and estimating their behavior, and given that the majority of the questionnaires used rely on some awareness of past behavior, results can be inaccurate of true behavior in context.

Measuring mindfulness with a self-report questionnaire has unique limitations because it relies on an individual’s ability to be aware of internal events while answering the questionnaire (Bergomi et al., 2013). Essentially, to answer these questionnaires, an individual had to have some mindfulness already to accurately provide data. Lastly, a large number of participants failed a validity check or did not complete the survey, suggesting participant fatigue while taking the survey. While data from these participants was removed, the results may be impacted by the length of the survey. For example, data collected at the end of the survey may be less accurate than at the beginning due to lack of attention. While these limitations are important to recognize, the findings presented here represent some of the first work to explore the relationship between mindfulness and eating behaviors associated with obesity.

**Future Directions**

While this project adds to the literature on the relationships between mindfulness, mindful eating, and eating behaviors associated with obesity, no causal inferences can be made. Therefore, future research will benefit from exploring the relationship between mindfulness, mindful eating, and eating behaviors experimentally. While recent experimental data have demonstrated that mindfulness inductions can impact eating behavior (Seguías & Tapper, 2018), little has been done to differentiate the impact various methods or length of teaching may have on problematic eating behaviors. This will be an important question to answer because a multitude of mindfulness techniques are utilized in MBIs for eating behaviors without a clear
understanding of which methods works the best for a given presenting problem. To date, no researchers have explicitly compared the effects of general mindfulness and mindful eating inductions on eating behavior. Additionally, longitudinal research is needed to determine how long the effects of mindfulness training and mindful eating inductions last. By understanding the longitudinal impact of these techniques, treatment dose and frequency of intervention can be improved to optimize effects for the majority of clients.

Future research can also explore the differential role of trait mindful awareness and acceptance. Throughout this study, trait mindful acceptance was a better predictor of mindful eating, emotion dysregulation, and eating behaviors. Further understanding of the unique role these concepts play in the development of emotion regulation and eating behaviors can inform treatment and begin to clarify some of the controversy around operationally defining mindfulness. Little research has explored the unique contribution of awareness and acceptance skills in the development of trait mindfulness, which may be an important first question. This may also be tested with an experimental design exploring the immediate and delayed effects while comparing mindfulness interventions that emphasis awareness versus acceptance.

In summary, this study provided further evidence for the mixed relationship between components and types of mindfulness. Trait and state mindfulness and mindful eating were related to emotion regulation in this study; however, again, distinct patterns emerged in the data. Most important, the findings demonstrated the unique ability of mindful eating, above and beyond trait and state measures of mindfulness, to predict a variety of eating behaviors that are of clinical interest. These findings suggest that context-dependent mindfulness may be a better target for research, assessment, and intervention. Researchers and clinicians alike may benefit from assessing for preexisting knowledge and use of mindful eating in participants and clients.
Additionally, interventions targeting eating behaviors may need to emphasize mindful eating more than general mindfulness to gain the most benefit from treatment. To extend these findings, future researchers might experimentally test the differential effects of mindful eating and general mindfulness inductions on eating behaviors associated with obesity.
References


https://doi.org/10.1016/j.appet.2015.03.036


https://doi.org/10.2466/pr0.2003.92.3.763


https://www.umassmed.edu/contentassets/24cd221488584125835e2eddce7dbb89/mbsr_sta


APPENDICIES
Appendix A: Eastern Michigan University Institutions Review Board Approval

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</tr>
<tr>
<td>Creation Date: 12-1-2017</td>
</tr>
<tr>
<td>Status: Approved</td>
</tr>
<tr>
<td>Principal Investigator: Jennifer Battles</td>
</tr>
<tr>
<td>Review Board: University Human Subjects Review Committee</td>
</tr>
<tr>
<td>Sponsor:</td>
</tr>
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</table>

**Study History**

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</table>

**Key Study Contacts**

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<thead>
<tr>
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<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jennifer Battles</td>
<td>Principal Investigator</td>
<td><a href="mailto:jbbatt10@emich.edu">jbbatt10@emich.edu</a></td>
</tr>
<tr>
<td>Tamara Loverich</td>
<td>Co-Principal Investigator</td>
<td><a href="mailto:tpenix@emich.edu">tpenix@emich.edu</a></td>
</tr>
<tr>
<td>Jennifer Battles</td>
<td>Primary Contact</td>
<td><a href="mailto:jbbatt10@emich.edu">jbbatt10@emich.edu</a></td>
</tr>
</tbody>
</table>
Appendix B: Informed Consent

Informed Consent for Online Research Study

Investigator: Tamara Loverich, Ph.D., Associate Professor of Psychology, Eastern Michigan University & Jennifer Battles, M.S., Doctoral Fellow, Eastern Michigan University

Project Title: Mindfulness and Eating

Purpose of the Study and How Long It Will Last: The purpose of this research study is to better understand people’s unique experience of mindfulness and eating. In this study, you will be asked to fill out an online survey that will take approximately 35-50 minutes of your time. You will be asked about your mindfulness experiences and eating habits. Demographic and background information such as your gender, age, ethnicity, marital status, and employment will also be asked.

Confidentiality: All responses and personally identifiable information will be kept confidential within the confines of the Qualtrics privacy policy (see https://www.qualtrics.com/privacy-statement/ for further information). Your responses will be released to the principal investigator, who will download all the responses from Qualtrics.com to a secure university server which will be accessed on a faculty computer that is password protected within a locked office. The Qualtrics survey will be deactivated once all participants have completed the survey. Information from this study may be reported or published in aggregated form, but your anonymity will be maintained in any publications or presentations. Should you choose to participate, we encourage you to complete the consent form and survey in a private location on a secure computer network.

Expected Risks: There are no foreseeable risks to you in completing this survey, as the questions are not of a sensitive nature and all of the data will be kept completely confidential. If,
however, answering this survey causes distress for which you might like some assistance, please note that low cost or free psychological services may be available through the EMU Psychology Clinic (734.487.4987) or EMU Counseling & Psychological Services (734.487.1122).

SAMHSA's National Helpline (also known as the Treatment Referral Routing Service) is a confidential, free, 24-hours-a-day, 365-days-a-year, information service in English and Spanish, for individuals and family members facing mental health and/or substance use disorders. This service provides referrals to local treatment facilities, support groups, and community-based organizations. Callers can also order free publications and other information. Call 1-800-662-HELP (4357) or visit the online treatment locators.

**Expected Benefits:** There may be no personal benefit to participating in this study. Your participation in this study may help us to better understand how people experience and respond to their feelings. **If you are an EMU psychology student,** it is possible that you may receive extra credit in accordance with the guidelines established by your psychology course instructor. In such cases, the online SONA system will provide your name and verification of participation so that the extra-credit can be awarded to you per your instructor’s course policy. There is no monetary compensation for your participation. **If you are participating via MTurk,** you may be compensated .70 for completion of the survey that includes accurate completion of the attention check items, which check to see if you are reading and understanding the instructions of the survey. If you do not pass these attention checks you will not be compensated. You may only complete the survey and receive compensation once.

**Voluntary Participation:** Participation in this study is voluntary. You may choose not to participate. If you do decide to participate, you can change your mind at any time and withdraw from the study without negative consequences if you are not being compensated. If you are
receiving monetary compensation, you may withdraw and forego the compensation at any time. If you do not wish to take part in this study, just close this window.

**Use of Research Results:** Results will be presented in group form only. No names or individually identifying information will be revealed. Results may be presented at research meetings and conferences, and in scientific publications.

**Future Questions:** If you have any questions concerning your participation in this study now or in the future, you can contact the principal investigator, Tamara Loverich, at (734-487-3228) or via e-mail (tpenix@emich.edu). This research protocol and informed consent document has been reviewed and approved by the Eastern Michigan University Human Subjects Review Committee. If you have questions about the approval process, please contact Sonia Chawla at (734.487.0042, human.subjects@emich.edu).

**Consent to Participate:** If you have read all of the above and would like to take part in this study, click the NEXT/Arrow button below. By doing so, you are granting informed consent for us to use your responses in this study. By completing and submitting the questionnaire, you will be giving informed consent for the researchers to use the information you provide.
Appendix C: Demographic Questionnaire

Thank you for answering the following questions. Your thoughtful and careful responses are very important. You can help us better understand mindfulness and eating.

1. How old are you?  
   _______ Years

2. Gender
   □ Female
   □ Male
   □ Transgender

3. Ethnicity (select all that apply)
   □ African-American/Black
   □ Asian or Asian American
   □ Chicano/a/Latino/a/Hispanic American
   □ European American/White
   □ Pacific Islander or PI American
   □ Middle Eastern or Arab American
   □ Mixed Heritage
   □ Other – If other, please specify: _____________________________

4. Relationship status
   □ Divorced, not remarried
   □ Living with partner
   □ Married
   □ Married with children
   □ Remarried
   □ Single, never married, not living with partner
   □ Remarried
   □ Widowed
   □ Other

5. Annual household income
   □ <$10,000
   □ $11,000-24,000
   □ $25,000-49,000
   □ $50,000-74,000
   □ $75,000-99,000
   □ $100,000-250,000
   □ >$250,000
6. Educational status
   - Did not graduate high school
   - GED
   - Some college
   - Bachelor’s degree
   - Master’s degree
   - Doctorate or equivalent in my field

7. How tall are you? _______ inches

8. How much do you currently weigh (in pounds)? _______ lbs.

9. What is your highest adult weight (in pounds)? _______ lbs.

10. What is your lowest adult weight (in pounds)? _______ lbs.

11. Are you currently on a diet? Yes or No

12. Which diet(s) are you currently on?
   - Military diet
   - Paleo Diet
   - Mediterranean Diet
   - South Beach
   - Atkins
   - Other – If other, please specify: _______________________________

13. Are you currently pregnant? Yes or No or Not applicable

14. Have you ever been diagnosed with an eating disorder? Yes or No

15. If yes, please mark all that apply:
   - Anorexia nervosa
   - Bulimia nervosa
   - Binge eating disorder
   - Other specified eating disorder (e.g., purging disorder, night eating syndrome)

**History of Mindfulness Practice**

1. Have you ever practiced meditation or mindfulness? Yes or No

2. How would you define and describe mindfulness? Please be as descriptive as possible and use complete sentences.
   - ______________________________________________________________
3. Mindfulness can be defined as making a purposeful effort to become aware of the present moment without attempting to change or judge the present moment. With this definition in mind, how frequently do you practice mindfulness?
   - 0-1 times per week
   - 2-4 times per week
   - 5 or more times per week

4. With this definition in mind, when you practice mindfulness, how long do you practice mindfulness for (on average)?
   - 0-5 minutes per practice session
   - 5-10 minutes per practice session
   - 10-30 minutes per practice session
   - 30-60 minutes per practice session
   - 1 hour or longer per practice session

5. Have you ever participated in mindfulness training?  
   - Yes or No

6. If yes: In what setting have you participated in mindfulness training?
   - Online instruction
   - Mindfulness App on Phone or another Device
   - Book/CD/DVD
   - Retreat
   - Educational Setting (i.e. in the classroom)
   - Corporate Setting
   - Medical Setting
   - Other – If other, please specify: ________________________

7. Do you engage in a physical mindfulness practice that includes meditation (such as yoga, Tai Chi, Qi Gong, etc.) or any other form of formal meditation?  
   - Yes or No

8. If yes: What type of mindfulness or meditation do you practice?
   - In a studio or home practice
   - Guided meditation in a studio, home, gym, sitting room, retreat, or religious setting
   - Guided online instruction
   - Meditation Apps on Phone or Another Device
   - Book/CD/DVD
   - Other – If other, please specify: ________________________

9. Do you intentionally access mindfulness in another way (e.g. being in nature)? Yes or No

10. If yes: How frequently do you intentionally access mindfulness in another way?
    - 0-1 times per week
    - 2-4 times per week
    - 5 or more times per week

11. If yes: When you access mindfulness in this other way, how long do you practice mindfulness for (on average)?
     - 0-5 minutes per practice session
     - 5-10 minutes per practice session
     - 10-30 minutes per practice session
     - 30-60 minutes per practice session
     - 1 hour or longer per practice session
History of Meditation Practice

Meditation can be defined as the process of improving the quality of the mind through sustained attention often to a specific object, thought, mantra, etc. This may or may not include religious practices (left up to the individual meditating).

1. Have you ever practiced meditation? Yes or No
2. How frequently do you practice meditation?
   - 0-1 times per week
   - 2-4 times per week
   - 5 or more times per week
3. What you practice meditation, how long do you practice meditation for (on average)?
   - 0-5 minutes per practice session
   - 5-10 minutes per practice session
   - 10-30 minutes per practice session
   - 30-60 minutes per practice session
   - 1 hour or longer per practice session
4. Have you ever participated in formal meditation training? Yes or No
5. If yes: In what setting have you participated in meditation training?
   - Online instruction
   - Retreat
   - Educational Setting (i.e. in the classroom)
   - Yoga teacher training
   - Corporate Setting
   - Medical Setting
   - Other – If other, please specify: ________________________
6. How many total hours do you believe you have practiced either mindfulness or meditation in your lifetime?
   - 0-50 hours
   - 50-100 hours
   - 100-200 hours
   - 200-500 hours
   - 500+ hours
Appendix D: PHLMS

**Instructions:** Please circle how often you experienced each of the following statements *within the past week.*

1. I am aware of what thoughts are passing through my mind.

   1 2 3 4 5
   Never Rarely Sometimes Often Very Often

2. I try to distract myself when I feel unpleasant emotions.

   1 2 3 4 5
   Never Rarely Sometimes Often Very Often

3. When talking with other people, I am aware of their facial and body expressions.

   1 2 3 4 5
   Never Rarely Sometimes Often Very Often

4. There are aspects of myself I don’t want to think about.

   1 2 3 4 5
   Never Rarely Sometimes Often Very Often

5. When I shower, I am aware of how the water is running over my body.

   1 2 3 4 5
   Never Rarely Sometimes Often Very Often

6. I try to stay busy to keep thoughts or feelings from coming to mind.

   1 2 3 4 5
   Never Rarely Sometimes Often Very Often

7. When I am startled, I notice what is going on inside my body.

   1 2 3 4 5
   Never Rarely Sometimes Often Very Often

8. I wish I could control my emotions more easily.

   1 2 3 4 5
   Never Rarely Sometimes Often Very Often
9. When I walk outside, I am aware of smells or how the air feels against my face.

   1  2  3  4  5
   Never Rarely Sometimes Often Very Often

10. I tell myself that I shouldn’t have certain thoughts.

   1  2  3  4  5
   Never Rarely Sometimes Often Very Often

11. When someone asks how I am feeling, I can identify my emotions easily.

   1  2  3  4  5
   Never Rarely Sometimes Often Very Often

12. There are things I try not to think about.

   1  2  3  4  5
   Never Rarely Sometimes Often Very Often

13. I am aware of thoughts I’m having when my mood changes.

   1  2  3  4  5
   Never Rarely Sometimes Often Very Often

14. I tell myself that I shouldn’t feel sad.

   1  2  3  4  5
   Never Rarely Sometimes Often Very Often

15. I notice changes inside my body, like my heart beating faster or my muscles getting tense.

   1  2  3  4  5
   Never Rarely Sometimes Often Very Often

16. If there is something I don’t want to think about, I’ll try many things to get it out of my mind.

   1  2  3  4  5
   Never Rarely Sometimes Often Very Often

17. Whenever my emotions change, I am conscious of them immediately.

   1  2  3  4  5
   Never Rarely Sometimes Often Very Often
18. I try to put my problems out of mind.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
<td>Very Often</td>
</tr>
</tbody>
</table>

19. When talking with other people, I am aware of the emotions I am experiencing.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
<td>Very Often</td>
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</table>

20. When I have a bad memory, I try to distract myself to make it go away.

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<th>1</th>
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<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Never</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
<td>Very Often</td>
</tr>
</tbody>
</table>
Appendix E: State MAAS

Experiences at Time of Signal

Instructions: Using the 0-6 scale shown, please indicate to what degree were you having each experience described below when you were paged. Please answer according to what really reflected your experience rather than what you think your experience should have been.

<table>
<thead>
<tr>
<th>Experience</th>
<th>not at all</th>
<th>some what</th>
<th>very much</th>
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<tbody>
<tr>
<td>1. I was finding it difficult to stay focused on what was happening.</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. I was doing something without paying attention.</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3. I was preoccupied with the future or the past.</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4. I was doing something automatically, without being aware of what I was doing.</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5. I was rushing through something without being really attentive to it.</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
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</table>
Appendix F: MES

Response Form

A number of statements are written below. Please read each one and then state how well it describes you or your behavior.

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Usually</th>
</tr>
</thead>
<tbody>
<tr>
<td>I become very short tempered if I need to eat.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I snack without being aware that I'm eating.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I multi-task whilst eating.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I don't pay attention to what I'm eating because I'm daydreaming, worrying or distracted.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I need to eat like clockwork.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I can tolerate being hungry for a while.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I tell myself I shouldn't be hungry.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I criticise myself for the way I eat.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>When I get hungry, I can't think about anything else.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I have a routine for what I eat.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I tend to evaluate whether my eating is right or wrong.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I eat the same thing for lunch each day.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I notice how my food looks.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I eat something without really being aware of it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I stay aware of my food whilst I'm eating.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I wish I could control my hunger.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>It's easy for me to concentrate on what I'm eating.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I notice the smells and aromas of food.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I eat the same thing on the same day of each week.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I eat between meals.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Once I've decided to eat, I have to eat straight away.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I have a routine for when I eat.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I wish I could control my eating more easily.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I snack when I'm bored.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I eat automatically without being aware of what I'm eating.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I notice flavours and textures when I'm eating my food.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I eat at my desk or computer.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I tell myself I shouldn't be eating what I'm eating.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Appendix G: BES

Binge Eating Scale (BES)

Binge Eating Scale

1. I do not think about my weight or size when I'm around other people.
   - I worry about my appearance, but it does not make me unhappy.
   - I think about my appearance or weight and I feel disappointed in myself.
   - I frequently think about my weight and feel great shame and disgust.

2. I have no difficulty eating slowly.
   - I may eat quickly, but I never feel too full.
   - Sometimes after I eat fast I feel too full.
   - Usually I swallow my food almost without chewing, then feel as if I ate too much.

3. I can control my impulses towards food.
   - I think I have less control over food than the average person.
   - I feel totally unable to control my impulses toward food.
   - I feel totally unable to control my relationship with food and I try desperately to fight my impulses toward food.

4. I do not have a habit of eating when I am bored.
   - Sometimes I eat when I am bored, but I can often distract myself and not think about food.
   - I often eat when I am bored, but I can sometimes distract myself and not think about food.
   - I have a habit of eating when I am bored and nothing can stop me.

5. Usually when I eat it is because I am hungry.

https://psychology-tools.com/binge-eating-scale/ 1/26/2015
Binge Eating Scale (BES)

6. After eating too much:
   - Sometimes I eat on impulse without really being hungry.
   - I often eat to satisfy hunger even when I know I've already eaten enough. On these occasions I can't even enjoy what I eat.
   - Although I have not physically hungry, I feel the need to put something in my mouth and I feel satisfied or only when I can fill my mouth (for example with a piece of bread).

   - I do not feel guilty or regretful at all.
   - I sometimes feel guilty or regretful.
   - I almost always feel a strong sense of guilt or regret.

7. When I'm on a diet, I never completely lose control of food, even in times when I eat too much.
   - When I eat a forbidden food on a diet, I think I've failed and eat even more.
   - When I'm on a diet and I eat to much, I think I've failed and eat even more.
   - I am always either binge eating or fasting.

8. It is rare that I eat so much that I felt uncomfortably full.
   - About once a month I eat so much that I felt uncomfortably full.
   - There are regular periods during the month when I eat large amounts of food at meals or between meals.
   - I eat so much that usually, after eating, I feel pretty bad and I have nausea.

9. The amount of calories that I consume is fairly constant over time.
   - Sometimes after I eat too much, I try to consume few calories to make up for the previous meal.
   - I have a habit of eating too much at night. Usually I'm not hungry in the morning and at night I eat too much.
   - I have periods of about a week in which I imposed starvation diets, following periods of when I ate too much. My life is made of binges and fasts.

10. I can usually stop eating when I decide I've had enough.
    - Sometimes I feel an urge to eat that I cannot control.
    - I often feel impulses to eat so strong that I cannot win, but sometimes I can control myself.
    - I feel totally unable to control my impulses to eat.

https://psychology-tools.com/binge-eating-scale/ 1/26/2015
### Binge Eating Scale (BES)

| 11. | I have no problems stopping eating when I am full.  
|     | I can usually stop eating when I feel full, but sometimes I eat so much it feels unpleasant.  
|     | It is hard for me to stop eating once I start, I usually end up feeling too full.  
|     | It is a real problem for me to stop eating and sometimes I vomit because I feel so full. |
| 12. | I eat the same around friends and family as I do when I am alone.  
|     | Sometimes I do not eat what I want around others because I am aware of my problems with food.  
|     | I often eat little around other people because I feel embarrassed.  
|     | I'm so ashamed of overeating, I only eat at times when no one sees me. I eat in secret. |
| 13. | I eat three meals a day and occasionally a snack.  
|     | I eat three meals a day and I usually snack as well.  
|     | I eat many meals, or skip meals regularly.  
|     | There are times when I seem to eat continuously without regular meals. |
| 14. | I don't think about impulses to eat very much.  
|     | Sometimes my mind is occupied with thoughts of how to control the urge to eat.  
|     | I often spend much time thinking about what I ate or how not to eat.  
|     | My mind is busy most of the time with thoughts about eating.  
|     | I seem to be constantly fighting not to eat. |
| 15. | I don't think about food any more than most people.  
|     | I have strong desires for food, but only for short periods.  
|     | There are some days when I think of nothing but food.  
|     | Most of my days is filled with thoughts of food. I feel like I live to eat. |
| 16. | I usually know if I am hungry or not. I know what portion sizes are appropriate.  
|     | Sometimes I do not know if I am physically hungry or not. In these moments, I can hardly understand how much food is appropriate.  
|     | Even if I knew how many calories should I eat, I would not have a clear idea of what is, for me, a normal amount of food. |
Appendix H: NEQ

NIGHT EATING QUESTIONNAIRE

Directions: Please circle ONE answer for each question.

1. How hungry are you usually in the morning?
   
   Not at all  A little  Somewhat  Moderately  Very

   0  1  2  3  4

2. When do you usually eat for the first time?
   
   Before 9am  9:01 to 12pm  12:01 to 3pm  3:01 to 6pm  6:01 or later

   0  1  2  3  4

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

   Not at all  A little  Somewhat  Very much so  Extremely so

   0  1  2  3  4

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

   None at all  A little  Some  Very much  Complete

   0  1  2  3  4

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

   (none)  (up to a quarter)  (about half)  (more than half)  (almost all)

   0%  1-25%  26-50%  51-75%  76-100%

   0  1  2  3  4

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

   Not at all  A little  Somewhat  Very much so  Extremely

   0  1  2  3  4

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

   Early Morning  Late Morning  Afternoon  Early Evening  Late Evening
   Nighttime

   check here if your mood does not change during the day

   0  1  2  3  4

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

   Never  Sometimes  About half the time  Usually  Always

   0  1  2  3  4

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

   Never  Less than once a week  About once a week  More than once a week  Every night

   0  1  2  3  4
10. Do you have cravings or urges to eat snacks when you wake up at night?

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

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

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

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

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

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

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

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

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

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

_______ mos.  _______ years

16. Is your night eating upsetting to you?

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

17. How much has your night eating affected your life?

0 1 2 3 4
Not at all  A little  Somewhat  Very much so  Extremely
Appendix I: EES

**Emotional Eating Scale**

We all respond to different emotions in different ways. Some types of feelings lead people to experience an urge to eat. Please indicate the extent to which the following feelings lead you to feel an urge to eat by checking the appropriate box.

<table>
<thead>
<tr>
<th></th>
<th>No Desire to Eat</th>
<th>A Small Desire to Eat</th>
<th>A Moderate Desire to Eat</th>
<th>A Strong Urge to Eat</th>
<th>An Overwhelming Urge to Eat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resentful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discouraged</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaky</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worn Out</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inadequate</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excited</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Rebellious</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Jittery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uneasy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irritated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jealous</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Worried</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frustrated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lonely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Furious</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>On Edge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confused</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nervous</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Angry</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Guilty</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Bored</td>
<td></td>
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</tr>
<tr>
<td>Helpless</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upset</td>
<td></td>
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</tbody>
</table>
Appendix J: TFEQ-R18V2

The Three-Factor Eating Questionnaire—Revised 21-Item (TFEQ-R21)

1. I deliberately take small helpings to control my weight.
   (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false
   6. Being with someone who is eating, often makes me want to also eat.
   (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false

2. I start to eat when I feel anxious.
   (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false
   7. When I feel tense or “wound up”, I often feel I need to eat.
   (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false

3. Sometimes when I start eating, I just can’t seem to stop.
   (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false
   8. I often feel so hungry that my stomach feels like a bottomless pit.
   (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false

4. When I feel sad, I often eat too much.
   (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false
   9. I’m always so hungry that it’s hard for me to stop eating before finishing all the food on my plate.
   (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false

10. When I feel lonely, I console myself by eating.
    (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false

11. I consciously hold back on how much I eat at meals to keep from gaining weight.
    (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false

12. When I smell a sizzling steak or see a juicy piece of meat, I find it very difficult to keep from eating—even if I’ve just finished a meal.
    (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false

13. I’m always hungry enough to eat at any time.
    (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false

14. If I feel nervous, I try to calm down by eating.
    (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false

15. When I see something that looks very delicious, I often get so hungry that I have to eat right away.
    (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false

16. When I feel depressed, I want to eat.
    (1) Definitely true, (2) Mostly true, (3) Mostly false, (4) Definitely false

17. How often do you avoid “stocking up” on tempting foods?
    (1) Almost never, (2) Seldom, (3) Usually, (4) Almost always

18. How likely are you to make an effort to eat less than you want?
    (1) Unlikely, (2) A little likely, (3) Somewhat likely, (4) Very likely.

19. Do you go on eating binges even though you’re not hungry?
    (1) Never, (2) Rarely, (3) Sometimes, (4) At least once a week

Mark the number that best applies to you: 1 2 3 4 5 6 7 8.
20. How often do you feel hungry?
    (1) Only at mealtime, (2) Sometimes between meals (3) Often between meals (4) Almost always

21. On a scale from 1 to 8, where 1 means no restraint in eating and 8 means total restraint, what number would you give yourself?


The uncontrolled eating domain was composed of items 3, 6, 8, 9, 12, 13, 15, 19, 20. The cognitive restraint domain was composed of items 1, 5, 11, 17, 18, 21. The emotional eating domain was composed of items 2, 4, 7, 10, 14, 16.

Before calculating the domain scores, items 1-16 should be reverse coded and item 21 should be recoded as follows: 1-2 scores as 1; 3-4 as 2; 5-6 as 3; 7-8 as 4.

Note: Items 17, 18 and 21 are not part of the Three-Factor Eating Questionnaire revised 18-item, version 2 (TFEQ-R18V2).
Appendix K

Power of Food Scale (PFS)

**Power of Food Scale**

Please indicate the extent to which you agree that the following items describe you. Use the following 1-5 scale for your responses.

1  
adon’t agree at all
2  
agree a little
3  
agree somewhat
4  
agree
5  
strongly agree

1. I find myself thinking about food even when I’m not physically hungry. ___
2. I get more pleasure from eating than I do from almost anything else. ___
3. If I see or smell a food I like, I get a powerful urge to have some. ___
4. When I’m around a fattening food I love, it’s hard to stop myself from at least tasting it. ___
5. It’s scary to think of the power that food has over me. ___
6. When I know a delicious food is available, I can’t help myself from thinking about having some. ___
7. I love the taste of certain foods so much that I can’t avoid eating them even if they’re bad for me. ___
8. Just before I taste a favorite food, I feel intense anticipation. ___
9. When I eat delicious food I focus a lot on how good it tastes. ___
10. Sometimes, when I’m doing everyday activities, I get an urge to eat “out of the blue” (for no apparent reason). ___
11. I think I enjoy eating a lot more than most other people. ___
12. Hearing someone describe a great meal makes me really want to have something to eat. ___
13. It seems like I have food on my mind a lot. ___
14. It’s very important to me that the foods I eat are as delicious as possible. ___
15. Before I eat a favorite food my mouth tends to flood with saliva. ___
Appendix L: mYFAS

The following question asks about your eating habits in the past year. People sometimes have difficulty controlling their intake of certain foods such as sweets, starches, salty snacks, fatty foods, sugary drinks, and others.

1) I find myself consuming certain foods even though I am no longer hungry. 4
2) I worry about cutting down on certain foods. 4
3) I feel sluggish or fatigued from overeating. 3 OR 4
4) I have spent time dealing with negative feelings from overeating certain foods, instead of spending time in important activities such as time with family, friends, work, or recreation. 3 OR 4
5) I have had physical withdrawal symptoms such as agitation and anxiety when I cut down on certain foods. (Do NOT include caffeinated drinks: coffee, tea, cola, energy drinks, etc.) 3 OR 4
6) My behavior with respect to food and eating causes me significant distress. 3 OR 4
7) Issues related to food and eating decrease my ability to function effectively (daily routine, job/school, social or family activities, health difficulties). 3 OR 4

Answer options for this section:

0 - Never
1 - Once per month
2 - 2-4 times per month
3 - 2-3 times per week
4 - 4+ times per week

IN THE PAST 12 MONTHS...

8) I kept consuming the same types or amounts of food despite significant emotional and/or physical problems related to my eating. YES
9) Eating the same amount of food does not reduce negative emotions or increase pleasurable feelings the way it used to. YES

Answer options for this section:

No Yes

- The bold number(s) at the end of the question is the threshold necessary to meet that symptom
- TO MEET THE FOOD ADDICTION THRESHOLD PEOPLE NEED TO MEET THE THRESHOLD FOR EITHER QUESTION 6 OR 7 AND MEET THE THRESHOLD FOR 3 OR MORE OF THESE QUESTIONS (1-5, 8-9)
Appendix M: DERS

Difficulties in Emotion Regulation Scale (DERS)

Please indicate how often the following 36 statements apply to you by writing the appropriate number from the scale above (1 – 5) in the box alongside each item.

1. I am clear about my feelings (R)
2. I pay attention to how I feel (R)
3. I experience my emotions as overwhelming and out of control
4. I have no idea how I am feeling
5. I have difficulty making sense out of my feelings
6. I am attentive to my feelings (R)
7. I know exactly how I am feeling (R)
8. I care about what I am feeling (R)
9. I am confused about how I feel
10. When I'm upset, I acknowledge my emotions (R)
11. When I'm upset, I become angry with myself for feeling that way
12. When I'm upset, I become embarrassed for feeling that way
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>When I'm upset, I have difficulty getting work done</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>When I'm upset, I become out of control</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>When I'm upset, I believe that I will remain that way for a long time</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>When I'm upset, I believe that I'll end up feeling very depressed</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>When I'm upset, I believe that my feelings are valid and important (R)</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>When I'm upset, I have difficulty focusing on other things</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>When I'm upset, I feel out of control</td>
<td></td>
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<tr>
<td>20</td>
<td>When I'm upset, I can still get things done (R)</td>
<td></td>
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<tr>
<td>21</td>
<td>When I'm upset, I feel ashamed with myself for feeling that way</td>
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<td>22</td>
<td>When I'm upset, I know that I can find a way to eventually feel better (R)</td>
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<tr>
<td>23</td>
<td>When I'm upset, I feel like I am weak</td>
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<tr>
<td>24</td>
<td>When I'm upset, I feel like I can remain in control of my behaviours (R)</td>
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<tr>
<td>25</td>
<td>When I'm upset, I feel guilty for feeling that way</td>
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<tr>
<td>26</td>
<td>When I'm upset, I have difficulty concentrating</td>
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<tr>
<td>27</td>
<td>When I'm upset, I have difficulty controlling my behaviours</td>
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<tr>
<td>28</td>
<td>When I'm upset, I believe that there is nothing I can do to make myself feel better</td>
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<td>29</td>
<td>When I'm upset, I become irritated with myself for feeling that way</td>
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<tr>
<td>30</td>
<td>When I'm upset, I start to feel very bad about myself</td>
<td></td>
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<tr>
<td>31</td>
<td>When I'm upset, I believe that wallowing in it is all I can do</td>
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<tr>
<td>32</td>
<td>When I'm upset, I lose control over my behaviours</td>
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<tr>
<td>33</td>
<td>When I'm upset, I have difficulty thinking about anything else</td>
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<tr>
<td>34</td>
<td>When I'm upset, I take time to figure out what I'm really feeling (R)</td>
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<tr>
<td>35</td>
<td>When I'm upset, it takes me a long time to feel better</td>
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<tr>
<td>36</td>
<td>When I'm upset, my emotions feel overwhelming</td>
<td></td>
</tr>
</tbody>
</table>

Privacy - please note - this form does not transmit any information about you or your assessment scores. If you wish to keep your results, you must print this document. These results are intended as a guide to your health and are presented for educational purposes only. They are not intended to be a clinical diagnosis. If you are concerned in any way about your health, please consult with a qualified health professional.

Appendix N: PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent [INSERT APPROPRIATE TIME INSTRUCTIONS HERE]. Use the following scale to record your answers.

<table>
<thead>
<tr>
<th></th>
<th>1 very slightly or not at all</th>
<th>2 a little</th>
<th>3 moderately</th>
<th>4 quite a bit</th>
<th>5 extremely</th>
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<tbody>
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<td>interested</td>
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<td>distressed</td>
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<td>excited</td>
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<td>upset</td>
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<td>strong</td>
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<td>guilty</td>
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<td>scared</td>
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<td>hostile</td>
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<td>enthusiastic</td>
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<td>proud</td>
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<td>irritable</td>
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<td>alert</td>
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<td>ashamed</td>
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<td>inspired</td>
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<td>nervous</td>
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<td>determined</td>
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<td>attentive</td>
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<td>jittery</td>
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<td>active</td>
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<td></td>
<td>afraid</td>
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</table>

We have used PANAS with the following time instructions:

- **Moment**: (you feel this way right now, that is, at the present moment)
- **Today**: (you have felt this way today)
- **Past few days**: (you have felt this way during the past few days)
- **Week**: (you have felt this way during the past week)
- **Past few weeks**: (you have felt this way during the past few weeks)
- **Year**: (you have felt this way during the past year)
- **General**: (you generally feel this way, that is, how you feel on the average)

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