

## Eating when depressed, anxious, bored, or happy: An examination in treatment-seeking adults with overweight/obesity

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### ABSTRACT

Emotions that differ in valence are uniquely associated with eating. In our previous study with an online sample of adults with overweight/obesity, eating in response to depression was the type of emotional eating most closely associated with negative psychosocial correlates (Braden et al., 2018). The current study extended this research by examining associations between emotional eating types (eating in response to depression, anxiety, boredom, happiness) and psychological correlates among treatment-seeking adults. The present study was a secondary analysis of adults ( $N = 63$ ; 96.8% female) with overweight/obesity and self-identified emotional eating who completed a baseline assessment for a behavioral weight loss intervention. Emotional eating in response to depression (EE-depression), anxiety/anger (EE-anxiety/anger), and boredom (EE-boredom) were assessed with the revised Emotional Eating Scale (EES-R), and positive emotional eating (EE-positive) was assessed with the positive emotions subscale of the Emotional Appetite Questionnaire (EMAQ). The Eating Disorder Examination Questionnaire (EDE-Q), Binge Eating Scale (BES), Difficulties in Emotion Regulation Scale (DERS), and Patient Health Questionnaire-9 (PHQ-9; depressive symptoms) were also administered. Frequencies showed the most endorsed emotional eating type was EE-depression (44.4%;  $n = 28$ ). Four multiple regression analyses examined associations between emotional eating (EE-depression, EE-anxiety/anger, EE-boredom, and EE-positive) and dependent variables (EDE-Q, BES, DERS, and PHQ-9). Results showed that depression was the emotional eating type most closely related to disordered eating, binge eating, and depressive symptoms. Eating in response to anxiety was closely related to emotion regulation difficulties. Positive emotional eating was related to less depressive symptoms. Exploratory analyses showed that lower levels of positive emotional eating were related to higher depressive symptoms among adults with greater emotion regulation difficulties. Researchers and clinicians may consider tailoring weight loss treatment based on unique emotions that trigger eating.

### 1. Introduction

Emotional eating is characterized by eating in response to a range of negative (Arnou, Kenardy, & Agras, 1995) and positive (Geliebter & Aversa, 2003) emotions. Although survey-based, cross-sectional studies indicate emotional eating occurs in a substantial minority of adults, rates of emotional eating are higher among adults with overweight/obesity (Gibson, 2012). Fifty to sixty percent of adults with elevated body mass index (BMI) endorse frequent emotional eating (Karlsson, Persson, Sjöström, & Sullivan, 2000; Péneau, Ménard, Méjean, Bellisle, & Hercberg, 2013). In addition to its relationship with BMI, emotional eating is associated with a greater intake of sugary, high-fat foods (Camilleri et al., 2014) and soda (Ling & Zahry, 2021). Furthermore, emotional

eating impacts body weight. According to a 2018 review (Frayn and Knäuper, 2018), longitudinal and intervention studies show that emotional eating is associated with weight gain and less weight loss. Recent treatment studies have provided additional support for this link (Annesi, 2020; Markham Risica et al., 2021). Given that emotional eating is a common barrier among treatment-seeking adults with overweight/obesity, continued investigation of emotional eating in clinical samples is warranted.

Research on emotional eating typically examines general emotional eating without focusing on distinct emotions (Arnou et al., 1995). However, discrete emotions may be linked to eating in distinctive ways (Macht, 2008). Emotional eating may occur only in the presence of specific emotions (Alzheimer & Urry, 2019). For example, experimental,

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laboratory-based studies have shown that anxiety, but not anger, is related to greater food intake (Schneider et al., 2010, 2012). Moreover, certain emotions may be more likely to prompt eating than others. For example, a previous systematic review showed that sadness and tension were strongly associated with eating among adults with obesity and binge eating disorder (Nicholls, Devonport, & Blake, 2016). In a sample of adults seeking weight loss treatment in primary care, loneliness and boredom were the emotions that most often prompted eating among people with and without binge eating, respectively (Wiedemann, Ivezaj, & Barnes, 2018). Other research has also highlighted boredom as an emotion that often precipitates eating. For example, in non-clinical samples of adults, boredom was related to snacking (Clebury & Tapper, 2014; Jackson, Anderson, Weybright, & Lanigan, 2021). Likewise, in a convenience sample of undergraduates, boredom was the emotion most frequently identified as triggering eating (Koball, Meers, Storfer-Isser, Domoff, & Musher-Eizenman, 2012). Positive emotions are also related to eating. In a recent systematic review, eating was more strongly associated with positive than negative affect among adults with “normal” and overweight BMI (as opposed to obese BMI; Devonport, Nicholls, & Fullerton, 2019). Thus, although emotional eating is often broadly measured, examining relationships between unique emotions that prompt eating and psychosocial correlates in samples of adults with overweight/obesity could add to the conceptualization of emotional eating behavior in this population.

One particular psychological construct that may be related to eating in response to specific emotions is emotion regulation. Theoretical models posit that emotional eating is caused by a lack of adaptive emotion regulation skills needed to manage emotional discomfort (Wiser & Telch, 1999). Laboratory-based, experimental studies have demonstrated positive relationships between maladaptive aspects of emotion regulation (i.e., emotional suppression; Evers, Marijn Stok, & de Ridder, 2010) and poor emotional awareness (Moon & Berenbaum, 2009) and food intake. This association has also been demonstrated in cross-sectional studies of adults with overweight and obesity. For example, significant, positive relationships between emotion regulation difficulties and emotional eating have been observed in samples of adults with elevated BMI and binge eating disorder (Gianini, White, & Masheb, 2013) as well as adults seeking bariatric surgery (Dalrymple, Clark, Chelminski, & Zimmerman, 2018). In particular, among adults with overweight/obesity, higher emotional eating is related to limited access to emotion regulation strategies, lack of emotional clarity, and difficulties engaging in goal-directed behavior (Sultson, Kukk, & Akkermann, 2017).

Although this research shows a consistent positive relationship between general, negative emotional eating and emotion regulation difficulties, the association between eating in response to specific emotions and emotion regulation is less clear. A small number of studies have examined the relationship between eating in response to boredom and emotion regulation. Nonetheless, research examining boredom has shown a significant association between boredom eating and emotion regulation difficulties in college students (Crockett, Myhre, & Rokke, 2015). Another study of college students revealed that emotion regulation difficulties were associated with greater levels of self-reported boredom eating for individuals who performed below average on a working memory task (Ferrell, Watford, & Braden, 2020). With regard to positive emotions, in an online sample of adults with elevated BMI, eating in response to positive emotions was unrelated to emotion regulation difficulties (Braden, Musher-Eizenman, Watford, & Emley, 2018). However, in a community sample, Sultson et al. (2017) identified a relationship between high levels of eating in response to positive emotions and poor emotion regulation, although this was in a group of adults with “normal” BMI. Furthermore, in another online sample of adults, emotion regulation difficulties strengthened the relationship between reported parental feeding behaviors (i.e., monitoring and restriction of child intake) and greater positive emotional eating (Barnhart, Braden, & Dial, 2021).

In addition to emotion regulation, emotional eating is related to a range of problematic psychological characteristics (Braden et al., 2018). However, distinct relationships between discrete emotions that prompt eating (as opposed to broadly measured emotional eating) and psychological correlates are less understood (Braden et al., 2018). Moreover, considering the theoretical link between emotion regulation and emotional eating (Wiser & Telch, 1999), and given that emotion dysregulation is a transdiagnostic risk factor for psychopathology (Sheppes, Suri, & Gross, 2015), emotion regulation difficulties and emotional eating may interact in their relationships with other psychological phenomena. For example, in a sample of college students, emotion regulation difficulties strengthened the relationship between eating in response to negative (but not positive) emotions and disordered eating (Barnhart, Braden, & Price, 2021). Thus, when emotional eating is high and emotion regulation is limited, the presence of related psychological symptoms such as general disordered eating, binge eating, and depressive symptoms may be higher. The present study aimed to examine associations between specific emotions that prompt eating and psychological correlates (i.e., disordered eating, binge eating, and depressive symptoms) and whether emotion regulation difficulties strengthened those relationships.

In addition to emotion regulation difficulties, eating in response to specific emotions may also be related to greater levels of disordered eating. Given that emotions frequently precipitate binge eating (Leehr et al., 2015), it is unsurprising that repeated associations between emotional eating and binge eating have been observed. For example, among adults with obesity, those with binge eating disorder report higher levels of emotional eating than those without binge eating disorder, in weight loss seeking (Pinaquy, Chabrol, Simon, Louvet, & Barbe, 2003; Ricca et al., 2009) and convenience (Escandón-Nagel, Peró, Grau, Soriano, & Feixas, 2018) samples. The relationship between emotional eating and binge eating has also been found when examining eating in response to positive emotions, more specifically. For example, results of a study that used experience sampling methodology showed that positive emotional eating was related to binge eating, even though the relationship between eating in response to negative emotions and binge eating was stronger (Sultson et al., 2017). The same pattern was found in an online sample of adults (Barnhart, Braden, & Jordan, 2020). In this study, eating triggered by both negative and positive emotions was associated with binge eating, but the association between negative emotional eating and binge eating was strongest.

Elevated emotional eating has also been observed in other eating disorders. For example, in a study that examined emotional eating in a clinical sample of adults, emotional eating was higher in adults with bulimia nervosa compared to BMI-matched healthy controls (Reichenberger et al., 2021). Furthermore, although adults with restrictive anorexia nervosa reported less emotional eating in response to negative emotions than other eating disorders, they reported greater eating in response to positive emotions than other eating disorders. In another study that utilized a clinical sample, eating in response to negative emotions was higher in anorexia and bulimia nervosa than in controls (Ricca et al., 2012). Moreover, when examining disordered eating symptoms in a college student sample, eating in response to negative emotions was positively related to restraint and eating, weight, and shape concerns (Barnhart, Braden, & Price, 2021). However, eating in response to positive emotions was not related to these disordered eating symptoms. Likewise, in a sample of adults with overweight/obesity (Braden et al., 2018), eating in response to depression, anxiety/anger, and boredom were associated with higher levels of disordered eating but eating in response to positive emotions was unrelated to disordered eating.

In addition to emotion regulation and disordered eating, emotional eating types may be associated with depressive symptoms. Significant, positive relationships between emotional eating and depressive symptoms have been observed in multiple, general samples of adults (Antoniou, Bongers, & Jansen, 2017; Kontinen, Van Strien, Männistö,

Jousilahti, & Haukkala, 2019; van Strien et al., 2016), a sample of adults who were primarily African American and of low socioeconomic status (Michopoulos et al., 2015), and a sample of college students from Mexico (Lazarevich, Irigoyen Camacho, Velázquez-Alva, & Zepeda Zepeda, 2016). Furthermore, a longitudinal study that included a national sample of adults in the United States observed bidirectional relationships between emotional eating and depressive symptoms (Vittengl, 2018). This link between emotional eating and depressive symptoms has also been documented in a sample of women concerned about their weight (Ouwens, van Strien, & van Leeuwe, 2009), a community sample of adults with obesity (Goldschmidt et al., 2014), and a sample of bariatric surgery candidates (Dalrymple et al., 2018). As BMI increases, the association between emotional eating and depression may be stronger. For example, in another sample of adults seeking bariatric surgery, emotional eating and depression were significantly, positively associated among adults with severe obesity (BMI >40) but not moderate obesity ( $30 \leq \text{BMI} < 40$ ; Willem et al., 2020). Although these studies have consistently found significant associations between emotional eating and depression, studies have examined general, negative emotional eating, as opposed to examining eating in response to specific emotional triggers.

In summary, a unique pattern of relationships may exist between eating in response to various emotional triggers (i.e., depression, anxiety/anger, boredom, and positive emotions) and emotion regulation, disordered eating, binge eating, and depressive symptoms. The present study was designed to build upon our previous study examining similar relationships in a non-treatment-seeking sample of adults with overweight/obesity (Braden et al., 2018). In that study, eating in response to depression, anxiety/anger, and boredom were significantly related to emotion regulation difficulties, greater disordered eating symptoms, and lower levels of psychological well-being. Findings also revealed that eating in response to depression was the emotional eating type most closely associated with negative psychosocial correlates while eating in response to positive emotions was unrelated to psychosocial correlates. The current study extended this previous research by examining associations between eating in response to a variety of emotions (i.e., depression, anxiety/anger, boredom, and positive emotions) and psychological correlates in a sample of adults seeking weight loss treatment. It was hypothesized that eating in response to depression would be most closely associated with psychological correlates (i.e., emotion regulation, disordered eating, binge eating, and depressive symptoms) in regression models. An exploratory aim was to examine whether relationships between eating in response to specific emotions and general disordered eating, binge eating, and depression were strengthened by emotion regulation difficulties.

## 2. Methods

### 2.1. Participants

Participants included 63 adults with overweight/obesity (BMI  $\geq 25$ ) and elevated self-reported emotional eating who completed a baseline assessment required for enrollment in a weight control program, Live FREE: Freedom from Emotional Eating. Live FREE aims to improve emotion regulation and emotional eating and promote weight loss via dialectical behavior therapy (DBT) skills and behavioral weight loss (BWL) techniques (Braden & O'Brien, 2021; Braden et al., 2022). Adults were recruited from the surrounding area of a large midwestern university. To be considered for enrollment in the pilot trial, participants had to meet a variety of inclusion and exclusion criteria, and details can be found in the trial description (Braden et al., 2022). Nonetheless, key study eligibility criteria included high levels of self-reported emotional eating (based on previously generated means; Braden et al., 2018), no current compensatory behaviors, not concurrently enrolled in a weight management program or psychotherapy, and absence of a significant psychological or medical condition that would interfere with study

participation (e.g., psychosis, severe depression with suicidality, uncontrolled hypertension, orthopedic problems). In addition, participants had to be between the ages of  $\geq 22$  and  $< 65$ , and the lower limit was incorporated to avoid a sample primarily comprised of traditional college students given that the intervention was not tailored for this demographic. Participants included in this secondary analysis were almost exclusively female (96.8%), typically middle-aged ( $M = 47.0$ ,  $SD = 12.50$ ), often married (45.2%), and generally well educated (i.e., bachelor's degree or higher, 69.8%).

### 2.2. Measures

#### 2.2.1. Emotional Eating Scale-Revised (EES-R; Koball et al., 2012)

The EES-R, a revised version of the Emotional Eating Scale (EES; Arnou et al., 1995), asks participants to rate their urge to eat in response to 25 specific emotions on a Likert scale ranging from 1 "no desire to eat" to 5 "an overwhelming urge to eat." The original EES showed evidence of adequate temporal stability and internal consistency (Arnou et al., 1995). Construct validity was shown via a high correlation with self-reported binge eating, and discriminant validity was demonstrated by showing that the EES was unrelated to measures of general psychopathology (Arnou et al., 1995). As opposed to the EES, the EES-R includes a focus on eating in response to boredom. The EES-R yields three subscales assessing self-reported eating in response to depression (EE-depression; e.g., lonely, discouraged, sad), boredom (EE-boredom; e.g., disinterested, unstimulated), and anxiety/anger (EE-anxiety/anger; e.g., worried, irritated, furious). The mean score of the items in each subscale represents subscale scores. Higher scores on the EES-R represent a greater urge to eat in response to emotions. In the revised version, factor analytic results support the measure's construct validity, and subscale internal consistency scores ranged from  $\alpha = 0.83$ - $0.88$  (Koball et al., 2012). In the present study, adequate internal consistency was obtained for the EES-R subscales: depression ( $\alpha = 0.86$ ), boredom ( $\alpha = 0.82$ ), anxiety/anger ( $\alpha = 0.79$ ).

#### 2.2.2. Emotional Appetite Questionnaire (EMAQ; Nolan, Halperin, & Geliebter, 2010)

The EMAQ measures eating in response to positive and negative emotions and situations. For the present study, only the 5-item positive emotions (EE-positive; e.g., confident, happy, relaxed) subscale was used. On the EMAQ, participants rate the quantity of food they typically consume in response to specific emotions and situations, as compared to usual, on a 9-point Likert scale with 1 through 4 representing "much less," 5 indicating "the same," and 6 through 9 representing "much more." Additionally, participants can respond to each item indicating they either do not know the answer or they believe the item does not apply to them. Responses to items with these options were not included in scoring. Mean scores were calculated for items on the positive emotions subscale to yield an overall positive emotional eating score. Higher scores on the EMAQ positive emotions subscale represent greater eating in response to positive emotions. The positive emotions subscale has demonstrated adequate internal consistency ( $\alpha = 0.75$ ) and excellent test-retest ( $\alpha = 0.95$ ) reliability (Geliebter & Aversa, 2003). Evidence of discriminant validity for the positive emotion subscale was shown in that it was weakly related to the emotional eating subscale of the Dutch Eating Behavior Scale (Van Strien, Frijters, Bergers, & Defares, 1986), a widely used measure of eating in response to negative emotions (Nolan et al., 2010). In the present study, good internal consistency was shown for the EMAQ positive emotions subscale ( $\alpha = 0.87$ ).

#### 2.2.3. Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 2008)

The EDE-Q (Fairburn & Beglin, 2008) is a 28-item self-report measure of disordered eating attitudes and behaviors based on the commonly used Eating Disorder Examination (Fairburn, Cooper, & O'Connor, 1993) structured clinical interview. On the EDE-Q,

participants complete items on a 7-point Likert ranging from 1 “No days/Not at all” to 7 “Every day/Markedly.” Participants were also tasked with responding to items based on the past 28 days. The current study used an overall score which was computed by calculating the mean of four subscale scores. EDE-Q subscales include: dietary restraint (e.g., “Have you been deliberately trying to limit the amount of food you eat to influence your shape or weight?”); eating concern (e.g., “Have you had a definite fear of losing control over eating?”); weight concern (e.g., “Have you had a strong desire to lose weight?”); and shape concern (e.g., “Have you had a definite desire to have a totally flat stomach?”). Scores for the four subscales were calculated by computing the mean of all the items in the subscale. Higher scores on the EDE-Q represent greater disordered eating attitudes and behaviors. A systematic review concluded that there is adequate evidence of internal consistency and test-retest reliability for EDEQ-subscale in community and treatment-seeking samples (Berg, Peterson, Frazier, & Crow, 2012). Regarding validity, this review also concluded that EDEQ scores have been able to successfully discriminate between people with and without eating disorders. In the present study, internal consistency for the overall score was shown to be strong ( $\alpha = 0.89$ ).

#### 2.2.4. Binge Eating Scale (BES; Gormally, Black, Daston, & Rardin, 1982)

The BES is a 16-item measure assessing binge eating symptoms. Items assess thoughts (e.g., “Most of my days seem to be pre-occupied with thoughts about food”), emotions (e.g., “Almost all the time I experience strong guilt or self-hate after I overeat”), and eating behaviors (e.g., “I have the habit of bolting down my food, without really chewing it”) related to binge eating. Each item includes three to four statements representing a range (i.e., 0 to 3, with 3 representing more severe binge-eating) in binge eating severity. Participants select the statement that most closely represents their eating experiences. Scores range from 0 to 32, and higher scores on the BES represent more severe binge eating symptoms. Scores of 18 or greater and scores of 27 or greater represent mild and severe levels of binge eating symptoms, respectively (Marcus, Wing, & Hopkins, 1988). Evidence exists for concurrent validity. For example, in a sample of women with overweight who engaged in regular binge eating, BES scores were significantly, moderately associated with binge characteristics (e.g., number of binge calories) measured using 28-day food diaries (Timmerman, 1999). In this same sample, test-retest reliability was found to be high ( $\alpha = 0.87$ ). In the present study, adequate internal consistency was shown for the BES ( $\alpha = 0.77$ ).

#### 2.2.5. Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004)

The DERS was used to assess participants’ emotion regulation difficulties. It is a 36-item measure that asks participants to indicate the frequency in which items apply to them on a 5-point Likert scale ranging from 1 “almost never” to 5 “almost always.” The DERS assesses six types of emotion regulation difficulties: (1) non-acceptance of emotional responses (e.g., “When I’m upset, I feel guilty for feeling that way”); (2) difficulty engaging in goal-directed behavior (e.g., “When I am upset, I have difficulty thinking about anything else”); (3) impulse control difficulties (e.g., “When I’m upset, I lose control over my behavior”); (4) lack of emotional awareness (e.g., “I am attentive to my feelings”); (5) limited access to emotion regulation strategies (e.g., “When I’m upset, I believe there is nothing I can do to make myself feel better”); and (6) lack of emotional clarity (e.g., “I have no idea how I am feeling”). An overall score was computed by summing all the items. Higher scores on the DERS represent greater difficulty regulating emotions. High internal consistency ( $\alpha = 0.93$ ), good 2-week test-retest reliability ( $r = 0.87$ ), and predictive validity (as measured by significant associations between the DERS and frequency of self-harm and intimate partner abuse) were found in a sample of undergraduates (Gratz & Roemer, 2004). Also in that study, evidence for construct validity was found as the DERS was significantly related to related measures of mood regulation and

experiential avoidance. In the present study, good internal consistency was shown for the DERS ( $\alpha = 0.91$ ).

#### 2.2.6. Patient Health Questionnaire – 9 (PHQ-9; Kroenke, Spitzer, & Williams, 2001)

The PHQ-9 is 9-item scale used to assess depressive symptoms. Participants are asked to indicate how many days they have experienced each depressive symptom over the previous two weeks, ranging from 0 “not at all” to 3 “nearly every day.” Scores are calculated by adding items 1–9 together to create a total score. Higher scores indicate higher levels of depressive symptoms, with a cutoff of 10 or more indicating moderate to severe levels of depression. The PHQ-9 is often used to screen for depressive disorders in non-psychiatric settings (Manea, Gilbody, & McMillan, 2015). In a study using 3000 participants seeking care at a primary care facility, the PHQ-9 demonstrated high test-retest reliability ( $r = 0.84$ ) and good internal consistency ( $\alpha = 0.83$ ; Kroenke et al., 2001). Additionally, the PHQ-9 has been shown to effectively discriminate between patients with and without moderate to severe depressive symptoms in randomized controlled trials (Titov et al., 2011) and in bariatric surgery assessments (Cassin et al., 2013). In the present study, adequate internal consistency was shown for the PHQ-9 ( $\alpha = 0.75$ ).

### 2.3. Procedures

The parent study (Braden et al., 2022) was approved by Bowling Green State University’s Institutional Review Board (Protocol #: 879234). Participants gave informed consent at the orientation session after receiving a description of the program. After completing initial appointments (e.g., phone screen, orientation), participants were then asked to attend a baseline assessment appointment to complete a sequence of self-report measures, including the measures in the present study. At the end of the treatment, a post-treatment and six-month follow-up assessment were administered, but only baseline data were analyzed in the present secondary analysis. Participants were compensated with a \$25 gift card at the end of the baseline assessment. Additional details of the Live FREE study design and procedures are included in a recently published manuscript describing the results of an open trial examining the program’s feasibility, acceptability, and initial efficacy (Braden et al., 2022).

### 2.4. Analytic plan

First, missingness and descriptive statistics were examined across primary study variables. Next, correlational analyses examined associations between self-reported emotional eating types (i.e., EE-depression, EE-anger/anxiety, EE-boredom, EE-positive) and psychological correlates (i.e., disordered eating, binge eating severity, emotion dysregulation, and depression symptoms). Next, frequencies of self-reported emotional eating types were examined. More specifically, scores  $\geq 4$  (i.e., “a strong urge to eat”) on the EES-R were used to calculate elevated self-reported EE-depression, EE-anger/anxiety, and EE-boredom (Koball et al., 2012). Furthermore, mean scores  $\geq 6$  (i.e., eat “much more” than usual) on the EMAQ were used to calculate elevated levels of self-reported EE-positive (Geliebter & Aversa, 2003). Before examining multiple linear regressions, assumptions of multiple regression and collinearity diagnostics were examined. Then, to examine our primary study aim and hypothesis, four multiple linear regressions examined self-reported emotional eating types (i.e., EE-depression, EE-anger/anxiety, EE-boredom, EE-positive) as predictors of psychological correlates (i.e., disordered eating, binge eating severity, emotion dysregulation, and depression symptoms). Lastly, significant relationships between emotional eating types (i.e., EE-depression, EE-anger/anxiety, EE-boredom, EE-positive) and psychological correlates (i.e., disordered eating, binge eating severity, and depression symptoms) were further examined with exploratory regression models that included

emotion regulation difficulties as a moderator. Models were determined based on results from bivariate correlations. That is, if significant correlations were observed between emotional eating types and disordered eating, binge eating severity, or depression symptoms, these relationships were further examined with emotion regulation difficulties as a moderating variable.

### 3. Results

#### 3.1. Preliminary results

See Table 1 for descriptive statistics and bivariate correlations across primary study variables. EE-depression was significantly, positively related to disordered eating symptoms, binge eating severity, emotion regulation difficulties, and depressive symptoms. EE-anger/anxiety was positively associated with emotion regulation difficulties and depression symptoms. A positive bivariate relationship was also observed between EE-boredom and disordered eating. Lastly, higher EE-positive was significantly associated with lower depressive symptoms.

Using mean scores  $\geq 4$  on the EES-R (i.e., EE-depression, EE-anger/anxiety, EE-boredom) and  $\geq 6$  on the EMAQ (EE-positive) to represent elevated self-reported emotional eating types, findings suggested approximately 44.4% ( $n = 28$ ) of adults with overweight/obesity endorsed elevated self-reported EE-depression, 20.6% ( $n = 13$ ) endorsed elevated self-reported EE-anger/anxiety, 17.5% ( $n = 11$ ) endorsed elevated self-reported EE-boredom, and 14.3% ( $n = 9$ ) endorsed elevated self-reported EE-positive.

#### 3.2. Multiple linear regressions

A series of regression analyses were conducted to examine our hypothesis, that EE-depression would be the type of emotional eating most closely associated with psychological correlates (i.e., disordered eating symptoms, binge eating severity, emotion regulation difficulties, and depressive symptoms; see Table 2). In regression models, tolerance (0.70 - 0.99) and VIF (1.02–1.43) values were within expected ranges, indicating minimal influence of multicollinearity. The first model was significant,  $F(4, 58) = 3.84, p = .01$ , and explained 21% of the variance in disordered eating. In this model, self-reported EE-depression was positively, significantly associated with disordered eating. The second model was significant,  $F(4, 58) = 2.64, p = .04$ , and explained 15% of the variance in binge eating severity. In this model, self-reported EE-depression was positively, significantly associated with binge eating severity. Furthermore, the third model was significant,  $F(4, 58) = 3.72, p = .01$ , and explained 20% of the variance in emotion regulation difficulties. In this model, self-reported EE-anger/anxiety was positively, significantly associated with emotion regulation difficulties. The fourth model was also significant,  $F(4, 58) = 7.01, p < .001$ , and explained 33% of the variance in depressive symptoms. In this model, higher self-reported EE-depression and lower self-reported EE-positive were

**Table 1**  
Descriptive statistics of and bivariate correlations between constructs of interest.

Variable	M	SD	1	2	3	4	5	6	7	8
1. EE-depression	3.64	.75	–	.35**	.42***	–.06	.42***	.38**	.35**	.48***
2. EE-boredom	3.19	.71	–	–	.02	.08	.28*	.08	.12	.14
3. EE-anger/anxiety	3.18	.79	–	–	–	–.01	.20	.20	.40***	.34**
4. EE-positive	4.76	1.38	–	–	–	–	.10	.06	–.04	–.29**
5. EDEQ	3.24	.95	–	–	–	–	–	.52***	.27*	.35**
6. BES	23.29	6.72	–	–	–	–	–	–	.28*	.27*
7. DERS	96.51	22.1	–	–	–	–	–	–	–	.36**
8. PHQ-9	8.48	3.81	–	–	–	–	–	–	–	–

Notes:  $N = 63$ . EE-depression = Emotional Eating Scale-Revised, Depression Subscale; EE-boredom = Emotional Eating Scale-Revised, Boredom Subscale; EE-anger/anxiety = Emotional Eating Scale-Revised, Anxiety/Anger Subscale; EE-Positive = Emotional Appetite Questionnaire, Positive Emotions Subscale; EDEQ = Eating Disorder Examination-Questionnaire; BES= Binge Eating Scale; DERS = Difficulties in Emotional Regulation Scale; PHQ-9 = 9 Question Patient Health Questionnaire. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

**Table 2**  
Multiple regression analyses examining emotional eating types as correlates of psychological outcomes.

	B	SE <sub>B</sub>	$\beta$	t	p
<b>EDE - Q</b>					
Constant	.43	.80	–	.54	.59
EE-depression	.44	.18	.35	2.47	.02
EE-boredom	.20	.17	.15	1.21	.23
EE-anger/anxiety	.07	.16	.06	.43	.67
EE-positive	.08	.08	.11	.95	.35
<b>BES</b>					
Constant	9.63	5.82	–	1.65	.10
EE-depression	3.50	1.29	.39	2.72	.01
EE-boredom	–.66	1.24	–.07	–.53	.60
EE-anger/anxiety	.28	1.14	.03	.25	.80
EE-positive	.44	.59	.09	.75	.46
<b>DERS</b>					
Constant	44.56	18.57	–	2.40	.02
EE-depression	6.09	4.11	.21	1.48	.14
EE-boredom	1.36	3.94	.04	.35	.73
EE-anger/anxiety	8.69	3.64	.31	2.39	.02
EE-positive	–.46	1.89	–.03	–.24	.81
<b>PHQ-9</b>					
Constant	1.88	2.95	–	.64	.53
EE-depression	1.96	.65	.39	3.01	.004
EE-boredom	.10	.63	.02	.16	.87
EE-anger/anxiety	.84	.58	.17	1.45	.15
EE-positive	–.74	.30	–.27	–2.48	.02

Notes. **EE-depression** = Emotional Eating Scale-Revised, Depression Subscale; **EE-boredom** = Emotional Eating Scale-Revised, Boredom Subscale; **EE-anger/anxiety** = Emotional Eating Scale-Revised, Anger/Anxiety Subscale; **EE-positive** = Emotional Appetite Questionnaire, Positive Emotions Subscale; **EDE - Q** = Eating Disorder Examination-Questionnaire; **BES**= Binge Eating Scale; **DERS** = Difficulties in Emotional Regulation Scale; **PHQ-9** = 9 Question Patient Health Questionnaire (depression symptoms).

significantly associated with depressive symptoms.

#### 3.3. Exploratory moderation analyses

Six moderation models examined emotion regulation difficulties as a moderator of significant bivariate relationships between EE types and psychological correlates. Given that EE-depression was significantly related to greater disordered eating, binge eating, and depression in correlation analyses, three models examined emotion regulation difficulties as a moderator of those relationships. Next, EE-anger/anxiety was significantly related to higher depression symptoms in correlational analyses, so one model examined emotion regulation difficulties as a moderator of that relationship. EE-boredom was significantly correlated with higher levels of disordered eating, and this relationship was further examined with emotion regulation difficulties as a moderator. Finally, given that EE-positive was significantly related to less depressive symptoms, one model examined emotion regulation difficulties as a moderator of that relationship. Overall, all six models were significant,

suggesting that EE types and emotion regulation difficulties were associated with significant variance in psychological correlates. Only one interaction term was significant in the model examining EE-positive, emotion regulation difficulties, and depressive symptoms ( $b = -.03$ ,  $t = -2.37$ ,  $p = .02$ ). Specifically, at low levels of EE-positive, average ( $b = -0.71$ ,  $t = -2.32$ ,  $p = .02$ ) and higher emotion regulation difficulties (e. g., +1 SD above average;  $b = -1.45$ ,  $t = -3.44$ ,  $p = .001$ ) were associated with higher depressive symptoms (see Fig. 1). At high levels of EE-positive this interaction was attenuated.

#### 4. Discussion

The current study was an extension of our previous study (Braden et al., 2018) that examined unique relationships between eating in response to distinct emotions and psychosocial correlates. In contrast to the previous study that used an online sample of 189 adults with self-reported overweight/obesity, the present study was conducted in a sample of 63 adults with self-reported emotional eating who were interested in a weight loss treatment. Results from the current study showed that eating in response to depression was the most frequently endorsed emotional eating type. Consistent with our hypothesis, eating in response to depression was the emotional eating type most closely associated with disordered eating and binge eating. Partially consistent with our hypothesis, greater eating in response to depression and less eating in response to positive emotions were significantly related to depressive symptoms. Contrary to our hypothesis, eating in response to anxiety/anger (as opposed to depression) was the emotional eating type most closely related to emotion regulation difficulties. Exploratory analyses showed that among people with more emotion regulation difficulties, less eating in response to positive emotions was associated with higher depressive symptoms. The present study adds to our understanding of nuanced relationships between discrete emotions and psychological correlates. Furthermore, findings are largely in line with previous results (Braden et al., 2018) indicating that eating in response to depressed mood may be the most problematic emotional eating type.

In our sample of treatment-seeking adults, self-reported eating in response to depression was significantly associated with higher levels of disordered eating, binge eating, and depressive symptoms. Among studies that have examined the relationship between emotional eating and disordered eating, only a few measured emotional eating triggered by specific negative emotions (Barnhart et al., 2020; Reichenberger et al., 2021; Ricca et al., 2012). In addition to supporting results from our previous study (Braden et al., 2018), the current study is consistent with findings by Reichenberger et al. (2021) which showed that eating in response to sadness/a depressed mood (as opposed to anger and anxiety) was the most frequently reported trigger of emotional eating

among adults with anorexia-nervosa, binge purge subtype, bulimia nervosa, and binge eating disorder. Other studies did not simultaneously examine various emotions that prompt eating but found relationships between binge eating and eating in response to depression (Barnhart et al., 2020; Ricca et al., 2012). Furthermore, although eating in response to boredom was related to greater disordered eating in correlation analyses, boredom eating was not a significant correlate in regression analyses, when taking into account other types of negative emotional eating. Thus, adults with overweight/obesity who report frequently eating when feeling sad and unstimulated may be at risk for elevated disordered eating symptoms. On the other hand, adults with overweight/obesity who primarily engage in boredom eating, to the exclusion of eating when depressed, may be at less risk for experiencing concurrent disordered eating.

In addition to disordered eating, results of the current study suggest that emotional eating prompted by a depressed mood may be related to depressive symptoms among adults with overweight/obesity. Although previous studies have replicated significant associations between emotional eating and depression (Antonioniou et al., 2017; Konttinen et al., 2019; van Strien, Konttinen, Homberg, Engels, & Winkens, 2016), these studies have examined general negative emotional eating as opposed to eating in response to unique negative emotions. Results of the present study suggest that, when considering specific negative emotions, eating in response to sadness/depressed mood, as opposed to anxiety, boredom, or anger, may ultimately account for the relationship between emotional eating and depression. Eating in response to anxiety/anger was also associated with higher levels of depressive symptoms. However, eating in response to depression was the only negative emotional eating type that was significantly associated with depressive symptoms in the final regression model. Not surprisingly, among people with overweight/obesity who report regular emotional eating, those who specifically endorse eating in response to feelings of depression may be most likely to simultaneously experience significant depressive symptoms. The direction of this relationship is unknown and likely complex as depressive symptoms may prompt eating, and eating, especially overeating, may also elicit depressive symptoms (Vittengl, 2018).

In the present study, eating in response to depression was also related to emotion regulation difficulties. Yet, only eating in response to anxiety/anger, not depression, was uniquely related to emotion regulation difficulties in the regression model, which was inconsistent with our hypothesis. These findings diverge somewhat from our previous study (Braden et al., 2018). In that study, eating in response to depression and anxiety/anger were both individually related to emotion regulation difficulties, but when included in the same model, only eating in response to depression was related to emotion regulation difficulties. Differing findings are interpreted cautiously. Both samples included adults with overweight/obesity, but the present study included a smaller sample of adults seeking participation in a weight loss study for individuals with emotional eating. Nonetheless, it is possible that treatment-seeking adults with overweight/obesity who report regularly eating when feeling anxious or angry may be particularly susceptible to poor emotion regulation. Consequently, those individuals prone to eating when anxious/angry may especially benefit from learning healthy emotion regulation skills. Future research could investigate this further by examining whether emotion regulation difficulties differentially relates to eating in response to depression and anxiety/anger in treatment-seeking compared to non-treatment seeking samples of adults with obesity.

Results of the present study showed that positive emotional eating was unrelated to binge eating, global disordered eating, and poor emotion regulation. Instead, results showed that eating triggered by positive emotions was significantly and uniquely associated with less depressive symptoms. These findings contribute to the mixed results that exist in the literature describing eating in response to positive emotions. Results from the current study are similar to our previous study (Braden et al., 2018) which showed that positive emotional eating was not

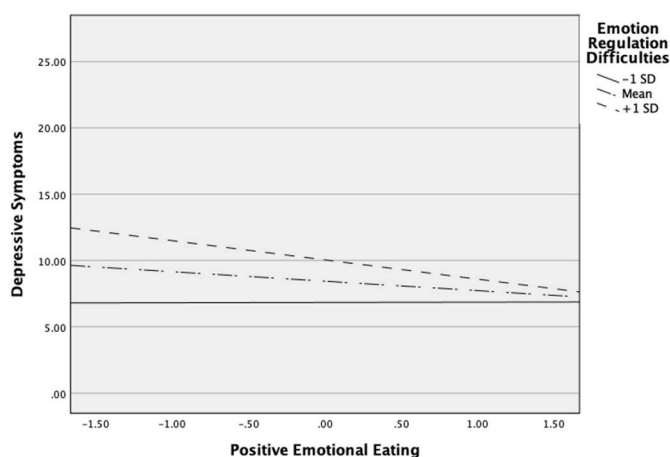


Fig. 1. Interaction of positive emotional eating and emotion regulation difficulties in relation to depressive symptoms.

significantly associated with emotion regulation difficulties, disordered eating, psychological well-being and self-reported physical health. However, results differ from previous studies conducted in non-clinical samples showing that eating prompted by positive emotions is associated with poor emotion regulation (Sultson et al., 2017) and binge eating (Barnhart et al., 2020; Sultson et al., 2017). Though speculative in nature, it may be the case that people who self-identify as emotional eaters may primarily identify as eating in response to negative, not positive, emotional triggers. Moreover, given the negative association between positive emotional eating and depressive symptoms, the reported experience of eating in response to positive emotions may actually be an indicator of a general positive mood among treatment-seeking adults. Furthermore, adults with overweight/obesity who primarily report positive emotional eating, in the absence of eating prompted by negative emotions, may be at less risk for related psychological difficulties that often present with overweight/obesity.

Consistent with this speculation, findings from the current study have other theoretical implications for the understanding of eating in response to discrete emotions. The theoretical mechanisms of eating in response to unique emotions may vary. A recent experimental study supported emotion regulation as a possible mechanism of eating in response to stress (Klatzkin, Nolan, & Kissileff, 2022). In this study, self-reported emotional eating was associated with food intake after a stressor when emotional reactivity and relief were high. Although this model may account for eating in response to certain emotions such as depression, anxiety, and anger, the mechanisms and correlates of emotional eating in response to boredom and positive emotions may differ. For example, in the present study, emotion regulation difficulties were not associated with more frequent boredom eating or eating in response to positive emotions. Moreover, results of exploratory analyses showed that less frequent eating in response to positive emotions interacted with emotion regulation difficulties in relation to higher levels of depressive symptoms. That is, lower, not higher, positive emotional eating was associated with depressive symptoms when emotion regulation difficulties were present. Consequently, the relationship between positive emotions and eating may not be accounted for by emotion regulation difficulties, but by social learning factors, as has been considered by other researchers (Evers, Adriaanse, de Ridder, & de Witt Huberts, 2013). For example, given the cultural association between positive emotions (e.g., celebrations, social gatherings) and food, positive events may trigger taste driven eating (Reichenberger et al., 2018), as opposed to eating because of physiological hunger. Additionally, despite not being measured in the present study, eating in response to boredom may be particularly influenced by cognitive variables (e.g., attentional deficits) compared to purely emotional factors (Ferrell et al., 2020). Although the current study illuminates unique relationships between specific emotions that prompt eating and psychological constructs, future research should carry out experimental paradigms to further investigate theoretical differences between emotional eating types.

It is important to note that the present study is limited by a cross-sectional, non-experimental design; thus, issues related to temporal relationships or causality are purely speculation. Several other limitations also exist. For example, this study was a secondary, exploratory analysis of a parent study and hence may have been underpowered to identify significant relationships, especially interaction models. Furthermore, the demographic make-up of our sample should be acknowledged. Since participants had to be at least 22 years of age, the same pattern of findings may not be observed in children, adolescents, or adults under age 22. The sample was also primarily women. Karlsson et al. (2000) found that 38% of men (compared to 59% of women) with obesity reported high levels of emotional eating. Thus, our results may not translate to men who are still prone to emotional eating.

Additional concerns exist regarding the construct and measurement of emotional eating. For example, substantial concerns exist about the validity of self-report measures of emotional eating given that self-

reported emotional eating may not represent actual emotional eating behavior (Bongers & Jansen, 2016; Braden, Emley, Watford, Anderson, & Musher-Eizenman, 2020). Also of importance, emotional eating variables likely overlap to some degree which affects the ability to measure and identify precise relationships between specific emotions and related psychological constructs. Relatedly, the revised EES (Koball et al., 2012) combines anxiety and anger in the same subscale even though other studies (Schneider et al., 2010, 2012) have shown that anxiety, but not anger, is related to eating in behavioral laboratory paradigms. Consequently, the current study is unable to distinguish between the possible unique influences of anxiety and anger on eating behavior. A similar issue is noted with regard to the EMAQ (Nolan et al., 2010) given that positive emotions are measured simultaneously. It is possible that distinct positive emotions (e.g., calm, joy) are differentially related to eating behavior. In addition, the emotional eating self-report measures used in the current study vary in that the EES measures the self-reported urge to eat when experiencing emotions and the EMAQ measures the self-reported quantity of food typically consumed when experiencing positive emotions, and whether this deviates from the typical amount of food consumed. Thus, the aforementioned limitations of the use of self-report are further complicated by these distinct differences in measures. Future research in larger, more heterogeneous samples and real-world and laboratory settings is needed to further investigate emotional eating behavior among adults with overweight/obesity.

Despite these limitations, the present study extends previous work on emotional eating types in a clinical population. The current study adds to the conceptualization of emotional eating by showing unique relationships between eating in response to distinct emotions and psychological variables. Results add further support for the possibility that eating triggered by feelings such as depressed mood, sadness, upset, guilt, and loneliness may be the most problematic in terms of psychological correlates. Clinicians working in treatment settings with adults with overweight/obesity are encouraged to assess whether particular emotions prompt eating and consider possible interventions.

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## Conflicts of interest

No conflicts of interest declared.

There are no conflicts of interest to disclose among authors.

## Author Note

We have no conflicts of interest to disclose.

## Ethics approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of Bowling Green State University and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

## Ethical statement

This research was conducted in accordance with standard ethical and human research guidelines, and the rights of participants were protected. The manuscript contains original research that is not currently published or under review elsewhere. Each author has contributed significantly to the work and accept full responsibility for all aspects of the work. Upon request, original data will be provided for review. There are no conflicts of interest to disclose. Correspondence should be addressed to Abby L. Braden, Department of Psychology, 822 East Merry Avenue, Bowling Green, OH 43403. E-mail: [abbym@bgsu.edu](mailto:abbym@bgsu.edu).

## Availability of data and materials

Data are available from the corresponding author upon reasonable request.

## Authors' contributions

A.B. conceptualized the study, led the study design and results interpretation, conducted the statistical analyses, and drafted the manuscript. W.R.B. led the study results interpretation and helped draft the manuscript. M.K. helped draft the manuscript. R.R. helped with data collection and helped draft the manuscript. A.D. helped draft the manuscript. L.A. helped with data collection and helped draft the manuscript. E.L.T-F. helped with data collection and helped draft the manuscript. All authors approved the final version of the manuscript for submission.

## Data availability

Data will be made available on request.

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