

Emotional Eating and Weight in Adults: a Review

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Abstract Emotional eating is the tendency to overeat in response to negative emotions and has shown to be associated with weight outcomes, both in respect to weight gain over time and difficulties with weight loss and weight loss maintenance. It is thus important to develop treatments to improve weight loss outcomes in emotional eaters. The purpose of this review is to explore adults' relationship between emotional eating and weight by: (1) describing self-report measures used to assess emotional eating such as the Dutch Eating Behavior Questionnaire (DEBQ), the Three Factor Eating Questionnaire (TFEQ), and the Emotional Eating Scale (EES), (2) exploring the relationship between emotional eating and weight outcomes, namely examining weight gain in longitudinal studies and difficulties with weight loss and weight loss maintenance in intervention studies, and (3) reviewing current interventions that target emotional eating, using techniques such as mindfulness, Acceptance and Commitment Therapy (ACT), Cognitive Behavior Therapy (CBT), and Dialectical Behavior Therapy (DBT). A better understanding of adults' emotional eating and its impact on weight is important to develop interventions that effectively target weight loss struggles unique to emotional eaters and improve weight outcomes for this population.

Keywords Emotional eating · Weight · Weight loss · Review

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Introduction

Emotional eating is defined as the "tendency to overeat in response to negative emotions, such as anxiety or irritability" (van Strien et al. 2007, p. 106). It is a highly prevalent concern for those who struggle with their weight; it is suggested that 60% or more of individuals who are overweight or obese are also emotional eaters (Ganley 1989). Emotional eaters are particularly likely to consume foods high in fat, sugar, and calories in response to negative emotions (Elfhag and Rossner 2005). These eating habits in combination with increased body weight place emotional eaters at higher risk for developing diabetes and heart disease (e.g., Melanson 2007; Wang et al. 2010). This population also struggles with weight loss; emotional eaters are half as likely as non-emotional eaters to achieve the 10% weight loss goal of standard behavioral weight loss treatment (López-Guimerà et al. 2014). Emotional eating is important to study because of its negative effects on weight and overall health. Thus far very few interventions have incorporated the treatment of emotional eating into weight loss interventions.

The purpose of this paper is to review the relationship between emotional eating and body weight in adults and to explore the current treatment options used to address these concerns. To our knowledge, no such review exists. Other reviews have outlined theoretical perspectives on emotional eating (e.g., Canetti et al. 2002), have examined the prevalence of emotional eating in a variety of samples (e.g., Gibson 2012), and have reviewed studies using a certain treatment approach, namely mindfulness interventions, for emotional eating (e.g., Katterman et al. 2014; O'Reilly et al. 2014). However, none of these reviews have attempted to explicate the relationship between emotional eating and weight, nor have they thoroughly evaluated treatment options for overweight or obese emotional eaters. This review seeks to fill these gaps in the existing

literature to help establish better treatment protocols for emotional eating.

Currently, research in this area is still burgeoning and there is significant heterogeneity in the measures and methodologies used to study the effects of emotional eating on weight and treatment efficacy. For these reasons, we did not conduct a systematic review or meta-analysis; this review is instead a comprehensive narrative that describes the key findings that together help to elucidate the relationship between emotional eating and weight in adults in order to obtain possible solutions for effective treatments of emotional eating.

Studies included in this review are those that have examined the relationship between emotional eating and weight in a variety of contexts, including longitudinal studies in naturalistic settings (examining normal weight, overweight, and obese individuals) and behavioral weight loss interventions (examining overweight and obese individuals). In reviewing the literature we searched the PsycINFO database using the key words “emotional eating”, “emotional eaters”, “weight”, “weight gain”, “weight loss”, “weight loss intervention”, “weight maintenance”, “BMI”, and “longitudinal.” We also thoroughly examined the references cited in the studies found through the database to ensure we completed an exhaustive search of the literature. We included studies that: (1) used a self-report measure to quantitatively assess emotional eating, (2) included weight as a primary outcome variable, and (3) examined emotional eating in overweight and/or obese individuals. Studies were excluded from this review if they did not adhere to all three criteria listed above. Thus the studies described in this review highlight this relationship between emotional eating and weight. Gaining a better understanding of emotional eating has implications for the treatment of overweight and obesity, as it will allow for the refinement of behavioral weight loss programs to target emotional eating.

Studies in laboratory settings have explored the relationship between emotions and eating behavior by inducing negative moods and measuring subsequent food consumption (e.g., van Strien et al. 2013; Werthmann et al. 2014). These studies have been done in normal weight university student populations (e.g., van Strien et al. 2013; Wallis and Hetherington 2009; Werthmann et al. 2014). Of the mood induction laboratory studies that have been conducted with overweight and obese individuals, they have focused on binge eating, rather than emotional eating (e.g., Chua et al. 2004; Laessle and Schulz 2009). A recent meta-analysis found that the induction of a negative food state increases food consumption in binge eaters (Cardi et al. 2015). However, the results of these studies on binge eating are not directly applicable to emotional eating in the context of behavioral weight loss interventions targeted towards overweight and obese populations such as those we will be reviewing. Laboratory studies

are also not included in this review because they examine emotional eating at a single time point, making it difficult to determine the long term relationship between emotional eating, food consumption, and weight. This review will instead focus on studies in natural settings to examine the relationship between emotional eating and weight in overweight and obese individuals, namely examining weight gain and difficulties with weight loss over time.

Conceptualizations for eating in response to positive emotions will not be reviewed because there is evidence that it is a different construct than eating in response to negative emotions. For example, eating in response to positive emotions has shown to be negatively correlated with eating in response to negative emotions (e.g., Nolan et al. 2010; van Strien et al. 2016). There is also currently no conclusive evidence that eating in response to positive emotions is associated with being overweight or obese (e.g., van Strien et al. 2016; van Strien et al. 2013), whereas eating in response to negative emotions is negatively associated with weight outcomes (e.g., Delahanty et al. 2013; Koenders and van Strien 2011; Teixeira et al. 2010). Additionally, it has been observed that eating in response to positive emotions is associated with partaking in social situations (Patel and Schlundt 2001). Because food is often consumed socially in positive emotional contexts such as celebrations, it is difficult to determine whether emotional eating truly occurs in response to internal positive emotions or if increased consumption is more attributable to the external social context. This review therefore focuses on eating in response to negative emotions and the impact it has on weight outcomes.

This review is structured along three aims. First, we will describe the various ways in which emotional eating is assessed in research concerned with weight outcomes. Second, we will review the literature to see how emotional eating is related to weight and to weight loss success in intervention contexts. Using this information, the third aim is to explore and discuss ideal methods for targeting and treating emotional eating in weight loss interventions.

Aim 1: Self-Report Measures of Emotional Eating

Several self-report measures exist to assess emotional eating and the related construct of internal disinhibition, as introduced below. The Dutch Eating Behavior Questionnaire (DEBQ; van Strien et al. 1986), the Three Factor Eating Questionnaire (TFEQ; Stunkard and Messick 1985), and the Emotional Eating Scale (EES) are the three most frequently used, based on a cited reference search conducted using the Scopus database. The measures have been cited 1248, 2418, and 287 times, respectively. Other measures of emotional eating are outlined in Table 1.

Table 1 Other self-report measures of emotional eating

Name	Authors & year	Number of times cited	Number of items	Emotions assessed (-/+)	Contributions	Limitations
-	Blair et al. 1990	94	10	(-)	Assesses actual frequency of emotional eating episodes	Assesses only 5 categories of emotions
Canetti's emotional eating scale (EE)	Canetti et al. 2009	55	7	(-)	Brief and succinct measure of emotional eating	Assesses only 7 emotions
Emotional appetite questionnaire (EMAQ)	Geliebter and Aversa 2003; Nolan et al. 2010	128	22	(-/+)	Assesses eating in response to both positive and negative emotions and emotional situations	Difficult to differentiate between eating in response to an emotional situation vs. an actual emotion
Emotional overeating questionnaire (EOQ)	Masheb and Grilo 2006	115	6	(-/+)	Assesses frequency and specifies emotional "overeating" episodes	Assesses a limited scope of emotions, 5 negative and only 1 positive
The eating and appraisal due to emotions and stress (EADES) questionnaire	Ozier et al. 2007	33	54	(-/+)	Assesses both emotional eating and one's appraisal of their ability to cope with emotions and stress	Long and time-consuming to complete, requires personal insight to assess one's coping abilities

The Dutch Eating Behavior Questionnaire (DEBQ)

The Dutch Eating Behavior Questionnaire (DEBQ; van Strien et al. 1986) is a 33-item self-report measure that assesses different aspects of eating behavior on three subscales: (1) restrained eating, (2) emotional eating, and (3) external eating. In completing the DEBQ, participants are asked to rate their responses on a 5-point ordered rating scale from never (1) to very often (5). Responses are then summed separately for each subscale and divided by the total number of items on that subscale to derive a mean subscale score. Based on van Strien et al.'s (1986) initial validation study, the mean emotional eating subscale score averaged across normal weight and obese individuals was 1.92 ($SD = 0.68$). For obese individuals, this mean was slightly higher, $M = 2.11$ ($SD = 0.73$) than for their normal-weight counterparts, $M = 1.89$ ($SD = 0.67$). The DEBQ has been shown to have high internal consistency and factorial validity (e.g., Barrada et al. 2016; van Strien 2015; van Strien et al. 1986).

DEBQ emotional eating assesses an individual's desire to eat under negative emotional conditions like stress, anxiety, and depression. The DEBQ thus focuses on eating in response to negative, but not positive emotions. Examples of items on the emotional eating subscale include item 18, "Do you have a desire to eat when you are anxious, worried, or tense?" and item 23, "Do you have a desire to eat when you are bored or restless?" Van Strien et al. initially derived the emotional eating subscale items from the Eating Patterns Questionnaire (EPQ; Wollersheim 1970) based on face validity (van Strien et al. 1986). However, in validating the DEBQ, van Strien et al. revised and created new emotional eating subscale items as well as restrained and external eating subscale items to

ensure good dimensional validity for each of the three subscales (van Strien et al. 1986).

A cut-off score of 3.25 on the DEBQ emotional eating subscale is often used to classify emotional eaters in research contexts. The cut-off score is based on normative data from a Dutch sample (van Strien et al. 2012a). The score represents scores in the 80th percentile for this Dutch sample (van Strien et al. 2012a). Scores above the 80th percentile have also been used as the cut-off for categorizing emotional eaters in other studies (e.g., Bohon et al. 2009). In Aim 2, we review studies that examine emotional eating in overweight and/or obese individuals with weight as a primary outcome variable. Applying this criterion, all remaining studies examined emotional eating on a continuum rather than using a specific cut-off (e.g., Dohle et al. 2014; Koenders and van Strien 2011; Sung et al. 2009; van Strien et al. 2012b).

The Three Factor Eating Questionnaire (TFEQ)

Emotional eating can also be conceptualized as a form of disinhibition, where individuals feel compelled to eat in response to emotional cues and lack control over inhibiting this (Stunkard and Messick 1985). This disinhibition concept has been operationalized by Stunkard and Messick (1985) in their Three-Factor Eating Questionnaire (TFEQ). The authors later referred to the TFEQ as the "Eating Inventory" (EI; Stunkard and Messick 1988) and the publisher Pearson Education distributes it under this name. For consistency, we will refer to it as the TFEQ as is most commonly done in the literature. Similar to the DEBQ, the TFEQ is comprised of three subscales: (1) restraint, (2) disinhibition, and (3) hunger. The TFEQ was developed to expand upon Herman and

colleagues' restraint theory and its corresponding Restraint Scale (1975, 1980). Because the TFEQ was developed with a focus on restrained eating, the two remaining subscales are comprised of items that did not load onto the restraint factor. The disinhibition scale reflects loss of control over eating behaviors in response to either internal or external cues (Stunkard and Messick 1985).

Since the initial development of the TFEQ, studies have re-examined the factor structure of the measure, specifically in relation to the disinhibition scale. Many have found that disinhibition is comprised of an emotional component. Notably, Bond et al. (2001) found that disinhibition could be further reduced to emotional disinhibition, which was comprised of three TFEQ items (eating when lonely, blue, or anxious). Emotional disinhibition was found to have good test-retest reliability ($r = .70$).

More recent research administering the TFEQ has utilized factor analysis to introduce the construct of "internal disinhibition", which is more all encompassing than either emotional eating or emotional disinhibition (Niemeier et al. 2007). It has broadened the definition of disinhibition to include eating in response to internal cues other than emotions such as thoughts or cognitions. For example, the internal disinhibition subscale includes TFEQ items such as item 45, "Do you eat sensibly in front of others and splurge alone?" and item 49, "Do you go on eating binges even though you are not hungry?" both of which appear to target eating in response to internal states other than emotions such as impulsivity or hunger. More research is required to determine the differences in how internal disinhibition or emotional eating/disinhibition contribute to eating behaviors.

It is important to emphasize that the TFEQ measures the construct of internal disinhibition and that this is not the same construct as emotional eating. We are including it in this review because, as will be seen in Aims 2 and 3, some researchers have used the TFEQ internal disinhibition measure inadequately as a measure of emotional eating. This has been done frequently enough that neglecting to review the TFEQ would exclude potentially useful information and empirical evidence about the relationship between internal disinhibition (and its related partner, emotional eating) and weight outcomes.

The Emotional Eating Scale (EES)

Another measure of emotional eating is the Emotional Eating Scale (EES; Arnow et al. 1995), which asks participants to identify the extent to which 25 emotions stimulate a desire to eat from no desire (1), to an overwhelming urge (5). Emotions listed include irritation, fury, worry, uneasiness, sadness, helplessness, and others. Item scores are grouped into three emotional eating subscales: anger/frustration, anxiety, and depression. Arnow et al. (1995) argued that the DEBQ

considers too narrow a range of negative emotions, excluding many that may trigger emotional eating. Because of this, the EES examines 25 negative emotions, almost double the number of items on the DEBQ emotional eating subscale. The EES was initially validated using a population of obese females undergoing treatment for binge eating and weight loss. It has shown good construct, criterion, and discriminant validity in this population (Arnow et al. 1995). Waller and Osman (1998) found that the EES also has high internal consistency and overall good validity in normal weight women who have no eating disorders.

Aim 1 Conclusions

Several measures exist to assess self-reported emotional eating and the related constructs of emotional and internal disinhibition, three of the most frequently cited being the DEBQ, TFEQ, and the EES. Emotional eating, as assessed by the measures described in Aim 1, has shown to have good construct validity. For example, eating in response to negative emotions as assessed by the Emotional Appetite Questionnaire (EAQ; see Table 1 for a description of the measure) has been shown to have good convergent validity with the DEBQ emotional eating subscale, whereas eating in response to EAQ positive emotions has been shown to have divergent validity with DEBQ emotional eating (e.g., Nolan et al. 2010). This suggests that overeating in response to negative emotions, as defined by van Strien et al. (2007), is a separate construct from eating in response to positive emotions. The assessment of emotional eating has also been shown to have convergent validity with disordered eating behaviors such as binge eating (e.g., Arnow et al. 1995; Duarte and Pinto-Gouveia 2015) while displaying divergent validity with other constructs such as cognitive restraint and mindfulness (e.g., Arnow et al. 1995; Duarte and Pinto-Gouveia 2015). To our knowledge, convergent validity between emotional eating and internal disinhibition has not been examined. However, Hyland et al. (1989) compared the factor structures of the TFEQ and DEBQ and found that the three TFEQ items assessing eating when anxious, blue, or lonely were highly correlated with the DEBQ emotional eating subscale. It would be beneficial to analyze whether or not there is convergent validity between emotional eating and internal disinhibition given that they are often used interchangeably in studies targeting weight loss for those who struggle with eating in response to negative emotions.

Aim 2: Emotional Eating and Weight

Recently there has been an increased interest in examining the relationship between emotional eating and weight outcomes such as weight gain, weight loss, and weight loss

maintenance. Research in this area can be divided into two categories: (1) longitudinal studies in which the DEBQ was administered to look at changes in weight, specifically weight gain over time, and (2) weight loss intervention studies in which mainly the TFEQ was administered to examine the effect of internal disinhibition on weight loss and weight loss maintenance.

Longitudinal Studies

Emotional Eating and Weight Gain Several longitudinal studies have assessed associations between DEBQ emotional eating, BMI, and weight gain. Koenders and van Strien (2011) studied a large sample of employees over two years. Approximately half of the sample gained weight while the other half either lost or maintained weight. Higher levels of emotional eating predicted greater weight gain ($B = 0.18$, $SE = 0.06$). Other lifestyle factors including smoking, dietary habits, or alcohol consumption were not significantly associated with weight gain, suggesting that emotional eating may have an independent effect on weight gain.

Van Strien et al. (2012b) conducted a prospective 2-year follow-up study of individuals identified as being highly susceptible to weight gain based on their overeating. They found that emotional eating was positively correlated with both change in BMI over two years ($r = .11$) and overeating ($r = .29$). Emotional eating was also found to moderate the relationship between overeating and weight gain over time ($B = 0.48$, $SE = 0.17$) such that overeating combined with emotional eating was related to weight gain.

Dohle et al. (2014) studied a Swiss sample of participants enrolled in an eating and activity behavior survey and found that emotional eating was linked to heightened BMI over one year ($\beta = .28$). They also found that increased levels of physical activity helped to reduce the negative impact of emotional eating on BMI, such that higher levels of emotional eating and physical activity were associated with lower BMI than higher levels of emotional eating and lower physical activity ($\beta = -.07$). Higher emotional eating and physical activity was also associated with more fruit and vegetable consumption than higher emotional eating and lower physical activity ($\beta = .06$). Higher levels of emotional eating were linked to increased consumption of high fat, high sugar foods ($\beta = .06$) but there were no differences between high active and low active individuals in their consumption of these foods. This suggests that highly active emotional eaters may still consume “unhealthy” foods when emotional but this may be offset by physical activity and heightened consumption of “healthier” foods such as fruits and vegetables.

Longitudinal studies that used the DEBQ to examine eating behaviors have consistently found that emotional eating contributes to weight outcomes more so than external eating. van Strien et al. (2009) found that both restraint and emotional

eating moderated the relationship between overconsumption of food and being overweight. The presence of emotional but not external eating increased the likelihood that overeating led to being overweight ($B = 0.08$, $SE = 0.03$). Similarly, the Healthy Twin Study in Korea found that over time emotional eating but not external eating was positively associated with both weight gain ($B = 0.83$, $SE = 0.28$) and current BMI ($B = 0.35$, $SE = 0.10$) (Sung et al. 2009). These results suggest that internal cues such as anxiety or stress may be more detrimental in eliciting the desire to eat than external cues, such as exposure to highly palatable food in one’s environment, thus increasing food consumption and leading to weight gain.

Intervention Studies

Internal Disinhibition and Weight Loss Internal disinhibition as measured by the TFEQ has also been examined in the context of weight loss interventions. Niemeier et al. (2007) conducted a yearlong behavioral weight loss trial and found that higher baseline internal disinhibition significantly predicted less weight loss at 6 months ($B = 0.59$, $SE = 0.27$). External disinhibition was not related to weight loss. These findings suggest that internal disinhibition is an important factor to address in short-term weight loss.

Similarly, Butrym et al. (2009) found that internal disinhibition was related to weight loss outcomes in their intervention; reductions during the first three months were associated with greater weight loss from months 4 through 12 ($r = .36$). External disinhibition was not associated with weight outcomes ($r = .04$, ns).

More recently Braden et al. (2016) administered the TFEQ and examined the effect of emotional eating as assessed by the three items that measure eating when anxious, sad or blue, and lonely on weight loss. Decreased emotional eating was associated with increased weight loss success (7% decrease in initial body weight or higher) at both 6 months ($B = 0.30$) and 12 months ($B = 0.53$) post-intervention.

Emotional Eating and Weight Loss Teixeira et al. (2010) administered the DEBQ in the context of a weight loss intervention. Weight loss was assessed upon completion of the intervention at 12 months and weight maintenance was measured at the 24-month follow-up. Lower DEBQ emotional eating was associated with increased weight loss at 12 months ($r = .35$), but not 24 months ($r = .08$). At 24 months, higher exercise self-efficacy and exercise motivation were more predictive of successful weight loss than emotional eating.

Researchers have also used other measures than the DEBQ and TFEQ to assess the impact of emotional eating on weight in intervention settings. These studies have found that higher levels of emotional eating are predictive of less weight loss. For example, Canetti et al. (2009) examined psychosocial predictors of weight loss following bariatric surgery and a weight

loss program and found that higher levels of emotional eating (as assessed by the 7-item measure developed by Canetti called “Emotional Eating” or “EE” described in Table 1) were negatively correlated with weight loss ($r = -.42$ for surgery group and $r = -.46$ for weight loss program group).

Emotional eating has also been found to be associated with less weight loss in the Diabetes Prevention Program (DPP), a large-scale, manualized behavioral weight loss intervention (Delahanty et al. 2013). Participants who reported less frequent baseline emotional eating (measured by the Blair et al. questionnaire in Table 1) were more likely to achieve 7% weight loss at six months than those who reported more frequent emotional eating (odds ratio = 0.88). However, similar to the findings of Teixeira et al. (2010), baseline emotional eating was not predictive of weight loss upon completion of the intervention. The DPP encourages a low-fat diet and addresses barriers to achieving this diet, which may have helped mitigate the effect of emotional eating on consuming high fat, high calorie foods.

Aim 2 Conclusions

Emotional eating and internal disinhibition have been found to negatively impact weight outcomes in longitudinal and intervention contexts. Not only are they associated with weight gain over time (e.g., Koenders and van Strien 2011; Sung et al. 2009; van Strien et al. 2012b), they are also associated with less weight loss (e.g., Butryn et al. 2009; Canetti et al. 2009; Delahanty et al. 2013; Niemeier et al. 2007; Teixeira et al. 2010). Despite impacting initial weight loss, emotional eating appears to be less related to weight loss maintenance. Other factors such as exercise more strongly predict weight maintenance (e.g., Delahanty et al. 2013; Teixeira et al. 2010). This finding has implications for developing interventions to target emotional eating: To maximize long term weight change, it may be useful to test if targeting emotional eating helps with initial weight loss while encouraging exercising later on might promote weight maintenance.

There is great heterogeneity in the effect sizes and regression coefficients in studies examining the relationship between emotional eating and weight. This is an indication that this research is still in the incipient stages and consistent methodology has not yet been established. It is worth noting that studies that have administered the DEBQ and TFEQ use and report results for all of the subscales on these measures. This reduces potential publication bias because it helps ensuring that emotional eating and internal disinhibition results are reported even if they are not significant. However, it does not eliminate the possibility of publication bias altogether. It could be that only the studies that find significant or mostly significant effects for these subscales are published. Overall the connections between emotions, eating, and weight warrant further investigation to establish adequate treatment protocols

to mitigate this relationship and help promote weight loss and weight maintenance.

Aim 3: Interventions to Target Emotional Eating and Weight Loss

Traditional forms of intervention, such as behavioral weight loss programs, have shown little efficacy in reducing emotional eating and internal disinhibition (e.g., Butryn et al. 2009; Delahanty et al. 2013; Niemeier et al. 2007). This is likely because they do not address weight loss challenges specific to emotional eaters, namely using food for emotion regulation. Several approaches have been proposed to address emotional eating and thus encourage weight loss. These include: mindfulness, Acceptance and Commitment Therapy (ACT), Cognitive Behavior Therapy (CBT), and Dialectical Behavior Therapy (DBT).

Mindfulness Interventions for Emotional Eating

Mindfulness is a technique that has been employed to target weight loss for emotional eaters and is defined as the act of paying attention to the present moment purposefully and non-judgmentally (Bishop et al. 2004). This includes attending to internal experiences such as emotions. Learning to nonjudgmentally focus one’s awareness on emotions may help emotional eaters to come to tolerate and accept their internal experiences, rather than feeling compelled to act on them by eating.

One of the most prevalent mindfulness-based eating interventions is the Mindfulness-Based Eating Awareness Training (MB-EAT) originally developed by Kristeller and Hallett to treat binge eating (Kristeller and Hallett 1999). MB-EAT is a group intervention that involves cultivating mindfulness, mindful eating, emotional balance, and self-acceptance (Kristeller and Wolever 2011). When delivered as an RCT MB-EAT was found to improve binge eating and other outcomes, such as weight loss, depression, and TFEQ disinhibition (Kristeller et al. 2014). Although emotional eating was not examined, many of the sessions in the MB-EAT program are relevant to emotional eaters (e.g., recognizing what triggers binge eating, learning hunger, taste satiety, and fullness cues, etc.). Future research could apply this program to emotional eaters.

A 2014 literature review by O’Reilly et al. found mindfulness-based interventions to be effective in reducing eating behaviors associated with obesity such as binge eating, external eating, and emotional eating. Of the studies reviewed, 63% were found to reduce emotional eating. The average weight loss in studies that reported this outcome was 4.5 kg. The effect sizes for changes in weight were small (Cohen’s $d = 0.12$ to 0.26). Similarly, Katterman et al. (2014) did a

systematic review of the literature on mindfulness meditation to treat binge eating, emotional eating, and weight loss. They found that although mindfulness produced reductions in emotional eating and binge eating, it did not consistently lead to weight loss post-intervention (Cohen's $d = -0.17$ to 0.04). Weight loss was greatest in interventions that focused on weight as a primary outcome; namely those that combined mindfulness with behavioral weight loss components like nutrition and exercise education, goal setting, and problem solving (Cohen's $d = -3.29$). This finding suggests that although mindfulness may help to reduce emotional eating, pairing it with a behavioral weight loss program may improve weight loss more.

Treating Emotional Eating with ACT

ACT has recently been proposed to reduce emotional eating, subsequently promoting weight loss and weight maintenance. ACT encourages tolerance of internal cues such as emotions and external cues such as food. Forman and Butrym (2014) proposed a theoretical basis for applying ACT strategies to help address weight loss challenges for emotional eaters. They argue that there are three psychological skills necessary for successful weight control: values clarification, mindfulness, and distress tolerance. It should be noted that mindfulness is a component of ACT. However, it is not the exclusive component, and this differentiates ACT interventions from the mindfulness interventions described above.

ACT and Weight Loss Interventions for Emotional Eaters

ACT has been integrated into several weight loss programs in recent years. The "Mind Your Health" Project was a recent RCT comparing ACT to standard behavioral treatment (SBT) that examined weight loss in 128 overweight and obese individuals (Forman et al. 2013). The acceptance strategies used in the ACT group targeted commitment to weight loss and values, distress tolerance, and mindless eating. Post hoc analyses found that emotional eaters in the ACT group ($n = 41$) lost over 4% more weight than emotional eaters in the SBT group ($n = 26$), both at the post-treatment (12.68% vs. 8.21%) and 6-month follow-up (10.51% vs. 6%) time points. Emotional eaters benefited more from ACT than non-emotional eaters. One limitation of this intervention is that timing of the follow-up (6 months) does not inform about weight loss maintenance in the long term. The 40-week program was also unusually long compared to other behavioral weight loss programs, so it may not be feasible to achieve such significant weight losses outside of a structured research setting, in fewer sessions.

ACT interventions have also been shown to reduce internal disinhibition as measured by the TFEQ (e.g., Lillis et al. 2015; Niemeier et al. 2012). Emotional eating has not been

examined in these interventions. It is therefore unclear whether reductions in weight are related to acceptance strategies that target emotional eating specifically or internal disinhibition more broadly. In order to determine this, it is important to administer a measure that exclusively examines emotional eating, and currently only a few studies have done so, using the EES to assess emotional eating (e.g., Forman et al. 2013; Hill et al. 2015).

CBT and DBT for Emotional Eating

Most of the research investigating the use of CBT and DBT to address eating behaviors has been with eating disorders, such as BED, anorexia nervosa, and bulimia nervosa (e.g., Lenz et al. 2014; Safer et al. 2010; Turner et al. 2016). More recently, both CBT and DBT have been proposed to target and reduce emotional eating (e.g., Glisenti and Strodl 2012). According to CBT, emotional eating and other problematic eating behaviors are maintained through maladaptive behavioral factors and maladaptive cognitions (Cooper et al. 2003). Both behaviors and cognitions must be targeted to alter the emotions that lead to eating. DBT, which was originally developed to treat borderline personality disorder (Linehan 1993a, 1993b), is also applicable to emotional eating because of the emphasis it places on affect regulation. Emotional eaters use food as a way to regulate negative emotions that they experience. DBT may work to mitigate this by encouraging alternative emotion regulation skills that do not involve eating.

Glisenti and Strodl (2012) performed case studies comparing CBT and DBT for treating obese emotional eaters. Two of the cases received 22 sessions of CBT while the other two received 22 sessions of DBT. The CBT intervention involved elements such as addressing barriers to weight loss, addressing goals, and providing information on healthy eating and increasing physical activity. The DBT intervention included emotion regulation and distress tolerance skills to help acknowledge and manage negative emotions that lead to eating. While the emotional eaters who received CBT lost less than 1% of their initial body weight and displayed no reductions in emotional eating at 8-weeks, the emotional eaters who received DBT did display significant improvements in both areas, losing between 7 and 10% of their initial body weight. These results suggest that DBT may be more effective than CBT in reducing emotional eating and improving weight loss for emotional eaters, likely because it actively focuses on emotion regulation. However, RCTs are required to test this possibility.

Roosen et al. (2012) also conducted a pilot study adapting group DBT for emotional eaters. They recruited 35 obese male and female emotional eaters and had them participate in 20 group sessions designed to target their emotional eating and promote weight loss. Sessions focused on teaching emotion regulation skills through mindfulness, emotion regulation (decreasing susceptibility to negative emotions and increasing

positive emotions), and distress tolerance, similar to the mindfulness and ACT interventions described above. Upon completion of the intervention and at the 6-month follow-up, significant reductions were found in both emotional eating scores and weight. However, the effect sizes were small. Participants lost an average 1.7% initial body weight post-treatment and 2.4% at 6 months, suggesting that DBT may assist more with weight maintenance. Another strength is that the intervention had a very low attrition rate; only 1/35 participants dropped out.

Aim 3 Conclusions

Overall, several approaches have shown promising results in reducing emotional eating and facilitating weight loss, including mindfulness, ACT, CBT, and DBT interventions. More standardized RCTs are needed to test the effect of these treatments on weight loss and weight maintenance in emotional eaters. Moving forward, it would be useful to administer both the DEBQ or EES and the TFEQ in the context of a weight loss intervention. This would allow for the comparison of the predictive validity of emotional eating and internal disinhibition in relation to weight outcomes to see which construct has a greater effect on weight loss and weight loss maintenance.

Conclusions

Despite emotional eating's significant, negative association with weight loss and weight loss maintenance and its popularity as an anecdotally reported social construct, this is the first review that outlines the relationship between emotional eating and weight outcomes. The purpose of this review was to: (1) review common self-report questionnaires of emotional eating, (2) evaluate its impact on weight in various contexts, and (3) importantly, examine ways in which this knowledge can be used to treat emotional eating to improve weight loss outcomes.

As reviewed in Aim 3, there are various perspectives on how to treat emotional eating. To our knowledge, there is currently a lack of research comparing various treatment methods for emotional eating; rather treatments are compared to standard behavioral weight loss treatments. More research is needed to determine which methods are most appropriate for specific individuals and contexts. It may also be beneficial to combine treatment methods such as CBT and mindfulness in order to teach both behavior modification and acceptance strategies to reduce emotional eating (e.g., Corsica et al. 2014; Goldbacher et al. 2016). Gaining this insight will help to tailor interventions such that they are best suited to the individual situations of emotional eaters and maximize their effectiveness in reducing emotional eating and improving weight loss.

As seen in Aims 2 and 3, studies employ a variety of measures to assess emotional eating, from the DEBQ to assess emotional eating to the TFEQ to assess internal disinhibition.

Future research could draw comparisons between the DEBQ and TFEQ to determine whether emotional eating or internal disinhibition is better at predicting weight outcomes. These distinctions influence treatment strategies, as researchers are required to choose whether to target emotional eating or internal disinhibition, rather than viewing them as synonymous.

This example reflects a larger concern that emotional eating is not a well-defined construct. Although van Strien et al.'s (2007) definition is frequently used, the definition itself is somewhat open to interpretation. For example, it is contingent on "overeating" in response to negative emotions but this term itself is not defined. When examining the DEBQ itself, questions only ask how often one experiences the desire to eat in response to a variety of negative emotions. It does not assess how much people eat when they experience this desire, so it is difficult to assess whether or not overeating is experienced. Even in questionnaires that assess emotional "overeating" (e.g., Masheb and Grilo 2006), "overeating" is not formally defined. The EOQ asks respondents to endorse how often they have eaten an "unusually large amount of food, given the circumstances" in response to various emotions in the past 28 days, but what this means in terms of concrete consumption is open to individual interpretation. The lack of clarity makes it difficult to pinpoint what constitutes emotional eating and determine the extent to which specific emotional eating behaviors are problematic for weight outcomes. The ultimate implication of this ambiguity is that it makes it more difficult to design interventions to target emotional eating and help improve weight loss outcomes.

A large proportion of the population is overweight or obese, and a significant subset of these individuals eats in response to negative emotions. Thus emotional eating cannot be ignored in the development of weight loss programs. Yet current standard behavioral treatment fails to target the specific needs of emotional eaters and is thus rendered ineffective for this population. Implementing mindfulness and ACT techniques are two promising interventions used to teach emotional eaters to cope with negative emotions without eating. They have shown efficacy in reducing emotional eating as well as promoting weight loss in preliminary studies. Further research is necessary, in the form of large-scale RCTs, to develop programs that effectively and efficiently target weight loss for emotional eaters. Combining this research with broad dissemination of the findings will aid in promoting effective weight loss for those who struggle with emotional eating.

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