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Emotional expression and eating in overweight and obesity

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ABSTRACT

Objectives: To explore psychological factors associated with emotional eating and obesity in a sample of overweight and obese adults attending a weight management programme.

Design: A cross-sectional quantitative research design.

Methods: Participants ($n=97$) completed the Emotional Eating Subscale of the Dutch Eating Behaviour Questionnaire, the Attitude towards Emotional Expression (AEE) scale and the mindful awareness *observe* subscale of the Kentucky Inventory of Mindfulness Skills scale. Clinical measures of body mass index (BMI) were also recorded.

Results: Regression analyses revealed that AEE was a significant predictor of emotional eating ($\beta=0.59$, $p=.000$). Control, the belief that emotions should be controlled ($\beta=0.39$, $p=.026$) and the response to eat to diffuse emotion ($\beta=0.37$, $p=.045$) were statistically significant predictors of BMI. Mediation analyses revealed that mindful awareness skills had a significant indirect effect on the relationship between AEE and emotional eating.

Conclusions: Findings highlight the influence of AEE on emotional eating and body weight, thereby helping to validate recent developments in an affect phobia model of emotional eating. The authors highlight the prevalence of emotional eating in overweight and obese adults. The potential preventative role of mindful awareness skills may be limited. Validation of the model may be a useful framework for the development and implementation of future weight management interventions.

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Emotional eating in obesity

Obesity is a leading public health concern (Ipsos, 2015). The development of overweight and obese populations is increasing worldwide (Non-Communicable Disease Risk Factor Collaboration, 2016). Obesity is a heterogeneous condition in terms of its aetiology and treatment (Marcus & Wildes, 2009). Behaviours central to diet and exercise are fundamental to the development of obesity (Martinez, 2000). Research suggests that rising levels of obesity are more likely to result from calorie consumption than calorie expenditure (Bleich, Cutler, Murray, & Adams, 2008; Cutler, Glaeser, & Shapiro, 2003; Swinburn,

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Sacks, & Ravussin, 2009). Indeed, eating behaviour is dependent on a number of variables irrespective of physiological needs (Canetti, Bachar, & Berry, 2002; Cleobury & Tapper, 2014). NCD Risk Factor Collaboration (2016) indicates that factors related to disordered eating are more likely to be psychological and environmental than genetic or metabolic. Given the increasing prevalence of disordered eating and obesity, further research is needed to understand these factors and how they impact on clinical practice (Grace, 2011).

Emotional eating

Disordered eating behaviour is common in overweight and obese populations, emotional eating in particular. A recent study reported that 57% of overweight adults self-report frequent emotional eating (Péneau, Ménard, Méjean, Bellisle, & Hercberg, 2013). Emotional eating is an abnormal response to affect in particular negative emotional states including anger, fear or anxiety (Van Strien et al., 2013; Van Strien & Ouwens, 2007).

Affect phobia theory stems from learning theory and how defensive behaviours are learned in the family of origin. It addresses how compulsive behaviours and defences are employed to regulate distress (McCullough, 2003). The theory has its theoretical foundations in Malan's (1979) triangles of conflict and person and the schematic propositional analogical associative representation system (SPAARS) model which emphasises the role of psychosocial factors in childhood in the development of maladaptive eating behaviours (Fox & Power, 2009). The SPAARS model has previously found negative emotions to be triggers for emotional eating in obesity (Leehr et al., 2015).

Furthermore, the affect phobia theory posits that future emotional eating episodes are likely to occur via the negative feedback loop of secondary emotions of guilt or shame towards the self, following emotional eating.

The theory has received recent support in understanding emotional eating. Structural modelling has suggested that negative attitudes towards emotion and its expression originate from invalidating emotional environments (Finnegan, Egan, & Gibbons, 2014). Eating can then become a defensive and compulsive behaviour which replaces the child's need to consciously assert their experience and expression of emotion. In effect children learn to 'swallow their emotions' (Haslam, Arcelus, Farrow, & Meyer, 2012; Meyer, Leung, Barry, & De Feo, 2010). This maladaptive eating behaviour may be used to distract from the experience of negative affect and that defensive emotional eating may then alleviate these feelings by providing comfort to the individual (Haedt-Matt & Keel, 2011).

Emotional eating and attitude towards emotional expression

The development of negative attitudes towards emotional expression is under-researched. It has been suggested that the invalidation of emotional needs in the childhood environment may contribute to the development of negative attitudes towards emotional expression (Finnegan et al., 2014; Topham et al., 2011). The literature states that this may arise from a discordance between the emotional needs of the child and provisions from key attachment figures. It is suggested that emotions perceived as negative may be discouraged and that emotions perceived as positive may be encouraged. Alternatively, the childhood environment may promote non-expression of emotion (Corstorphine, Mountford, Tomlinson, Waller, & Meyer, 2007). In each case, the childhood environment

may contribute to the development of negative attitudes to emotional expression, which may disrupt the cognitive processing of emotional information leading to impaired ability to regulate emotion (Joseph, Williams, Irwing, & Cammock, 1994). Finnegan et al. (2014) recently found that validation of a child's emotional needs influenced the development of attitudes towards emotional expression in adulthood and that negative attitudes to emotional expression modulated emotional eating in a large non-clinical adult population. Other research has reported similar findings (Espeset, Gulliksen, Nordbø, Skårderud, & Holte, 2012; Ford, Waller, & Mountford, 2011; Haslam et al., 2012).

Emotional eating and body weight

Eating in response to positive emotional states is not regarded to be an 'obese' eating style (van Strien, Donker, & Ouwens, 2016). However, emotional eating in response to negative emotional states has been associated with an increased consumption of energy-dense foods (Nguyen-Michel, Unger, & Spruijt-Metz, 2007; Torres & Nowson, 2007). However, it remains unclear if emotional eating directly impacts body weight. Previous studies have contended that emotional eating does not always result in weight gain (Allison & Heshka, 1993), and indeed, emotional eating is prevalent among populations with a healthy body mass index (BMI) (Fischer et al., 2007; Geliebter & Aversa, 2003). However, the consistency of these findings has been debated (Goldbacher, La Grotte, Komaroff, Vander Veur, & Foster, 2016); Nolan, Halperin, & Geliebter, 2010). A recent large-scale longitudinal study reported that emotional eating may play an important role in body weight (Keller & Siegrist, 2015) whereby high levels of emotional eating are associated with higher BMI. A large body of evidence has suggested that this behaviour may contribute to weight gain, and may prevent successful weight maintenance (Koenders & van Strien, 2011; Robbins & Fray, 1980; Torres & Nowson, 2007; Van Strien, Herman, & Verheijden, 2009). Further research is needed to determine whether or not there is a causal relationship between emotional eating and body weight.

Emotional eating has been associated with poorer weight loss outcomes and attrition in weight management interventions (Byrne, Cooper, & Fairburn, 2003; Canetti, Berry, & Elizur, 2009; Keränen et al., 2009). A number of studies have reported that behavioural weight management programmes are challenging and largely unsuccessful for individuals who engage in emotional eating (Cox, Zunker, Wingo, Jefferson, & Ard, 2011; Neve, Collins, & Morgan, 2010; Van Strien, Herman, & Verheijden, 2012). Such findings indicate that emotional eating may be a barrier to weight management success. A recent study found that three out of four overweight and obese adults enrolled in a weight management intervention self-reported emotional eating (Braden et al., 2016). However, few interventions assess the impact of emotional eating. This presents challenges to clinical practice.

Emotional eating and mindful awareness

Weight management interventions need to provide strategies to increase awareness of behavioural patterns and decrease emotional eating (Foster, Makris, & Bailer, 2005). A recent randomised controlled trial found that decreased emotional eating was associated with greater weight loss (Braden et al., 2016).

Recent reviews of mindfulness-based interventions (MBIs) for obesity-related behaviours found MBIs to be effective in the specific treatment of emotional eating (Katterman, Kleinman, Hood, Nackers, & Corsica, 2014; O'Reilly, Cook, Spruijt-Metz, & Black, 2014).

These interventions seek to challenge a person's willingness to confront negative affect (Hayes, Villatte, Levin, & Hildebrandt, 2011). A recent shift in perspective now proposes that mindfulness is an inherent trait (Brown, Ryan, & Creswell, 2007), with differences in levels of mindfulness prior to exposure to MBIs being reported (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Cordon & Finney, 2008; Thompson & Waltz, 2007). Recent reviews have found high trait mindfulness to be inversely related to prefrontal cortex and right amygdala responses, indicating that higher trait mindfulness may increase the ability to adaptively regulate emotional responses (Creswell, Way, Eisenberger, & Lieberman, 2007; Keng, Smoski, & Robins, 2011). Furthermore, researchers have suggested that MBIs may cultivate an awareness of a person's internal processes in facilitating compassion, acceptance, forgiveness and cognitive flexibility, thereby increasing the ability to cope adaptively with negative affect (Baer, Fischer, & Huss, 2005; Frewen, Evans, Maraj, Dozois, & Partridge, 2008; Godfrey, Gallo, & Afari, 2015; Kristeller, Baer, & Quillian-Wolever, 2006; Kristeller & Wolever, 2010).

Previous research has explored the relationship between trait mindfulness and body weight. Findings indicate that higher trait mindfulness may be inversely associated with weight gain, in particular, the observation component of mindfulness (Camilleri, Méjean, Bellisle, Hercberg & Péneau, 2015; Liebman et al., 2003; Mantzios & Wilson, 2014; Mantzios, Wilson, Linnell, & Morris, 2015). Finnegan et al. (2014) reported that the mindful awareness, *observe* subscale of the Kentucky Inventory of Mindfulness Skills (KIMS) scale (Baer, Smith, & Allen, 2004) highly moderated levels of emotional eating and BMI. Although participants are more likely to over-report height and under-report weight when self-report data are used to compute BMI (Gorber, Tremblay, Moher, & Gorber, 2007), most research has employed self-report measures of BMI. These studies require replication using clinical measures of body weight.

The present study

Efforts to increase our understanding of eating behaviour in obese and overweight populations are both pertinent and timely, given the increasing rates of obesity internationally. The aim of this present study is to build upon the work of Finnegan et al. (2014) and to assess the relationship between attitudes to emotional expression, mindful awareness skills, emotional eating and body weight among clinically overweight and obese adults attending a weight management programme. Using a cross-sectional quantitative approach, the hypotheses were as follows: (a) emotional eating is directly linked and positively associated with BMI; (b) healthy attitudes towards emotional expression are directly and inversely associated with emotional eating, and mediate the relationship between emotional eating and BMI; (c) *Observe* mindful awareness skills will directly moderate both emotional eating and BMI.

Method

Participants

Participants were 101 adults attending a weight management programme at weight management clinics in Ireland. Adults clinically assessed as overweight or obese were recruited

on a voluntary basis. The mean age of participants was 47.01 (SD = 14.65) with a range of 18–72 years. Gender distribution was 29 males (29.7%) and 68 females (70.3%). No participants identified themselves as transgender. BMI calculations indicated that 4% of participants in the sample were normal weight, 50.5% were overweight and 45.5% participants were obese. Healthy weight participants who did not meet the inclusion criteria were excluded from analysis resulting in a final sample of 97 participants. Of the remaining 97 participants, no participant was excluded in the case of missing data.

Sample size calculation

The sample size was in line with recommendations, which stipulate that a sample should include an empirical estimate of 89 participants for power values in mediation analyses (Fritz & MacKinnon, 2007), and an empirical estimate of 74 for in multiple regression analyses (Green, 1991; Tabachnick & Fidell, 2013).

Design

The researchers utilised a cross-sectional quantitative design.

Clinical measures

Clinical measures of participant body weight were taken by researchers.

BMI

BMI was used to operationalise body weight. BMI was calculated using the Tanita Body Composition Analyser, a non-invasive procedure. The recommended categorisation system was used to classify participants into body weight categories based on BMI measurements: healthy weight = 18.5–24.9 kg/m²; overweight = 25–29.9 kg/m²; obesity ≥ 30 kg/m².

Self-report measures

Participants were asked to complete a questionnaire comprised of a number of validated measures and questions on demographics. The questionnaire was designed to be brief, as research has indicated that short questionnaires improve response rate (Edwards et al., 2002).

Emotional eating subscale of the Dutch eating behaviour questionnaire

The Emotional Eating Subscale of the Dutch Eating Behaviour Questionnaire (DEBQ-em) is a 13-item scale which uses a five-point Likert scale to operationalise emotional eating (Van Strien, Frijters, Bergers, & Defares, 1986). The subscale assesses two aspects to emotional eating. One assesses eating behaviour in response to the diffusion of emotion, and the other assesses eating behaviour in response to clearly defined emotions (Strien, 2002). The measure has been found to have strong factorial validity and convergent reliability across a variety of populations, including populations attending weight management programmes (Wardle, 1987). The DEBQ-em has demonstrated satisfactory psychometric properties (Barrada, Strien, & Cebolla, 2016), and high factorial validity (van

Strien, Herman, Anschutz, Engels, & de Weerth, 2012), and internal consistency with a Cronbach alpha coefficient value of 0.94 (Van Strien et al., 1986). Cronbach's alpha for the present study was 0.98 indicating good internal consistency.

Observe subscale of the KIMS scale

The *Observe* subscale of the KIMS is a 12-item scale which uses a five-point Likert scale to operationalise mindful awareness skills (Baer et al., 2004). Mindful awareness skills have been described in the literature as skills in internally and externally observing stimuli (Dimidjian & Linehan, 2003; Kabat-Zinn, 1990). These skills were of interest to the research given the inverse association between alexithymia, the sub-clinical inability to identify and describe emotions about the self, and mindful awareness (Baer et al., 2004; Baer et al., 2006). The *observe* scale has high content validity and adequate to good test-retest reliability with a Cronbach's alpha coefficient value of 0.91 reported (Baer et al., 2004). Cronbach's alpha for the present study was 0.93 indicating strong internal reliability.

Attitudes towards emotional expression scale

The Attitudes towards Emotional Expression (AEE) scale is a 20-item scale which uses a five-point Likert scale to operational attitudes towards emotional expression (Laghai & Joseph, 2000). The AEE assesses four dimensions to attitudes to emotional expression: the view that emotions should be controlled (*control*). The view that the expression of emotion is a sign of weakness (*weakness*); the tendency to hide the expression of emotions to others (*non-expression*); and the view that emotional expression will lead to rejection from others or damage others (*social*) (Joseph et al., 1994). The AEE scale has shown good internal consistency and convergent validity with a Cronbach alpha coefficient value of 0.93 reported (Joseph et al., 1994; Laghai & Joseph, 2000; Meyer et al., 2010). Cronbach's alpha for the present study was 0.97, indicating good internal consistency.

Ethical considerations

The research adhered to the British Psychological Society (BPS) code of ethical standards for human research (BPS, 2009).

Procedure

An online version of the questionnaire was developed using Survey Monkey (www.surveymonkey.com). The questionnaire was piloted at one weight management clinic, and adjusted to improve questionnaire readability. Recruitment took place in clinics in the Republic of Ireland. Participants were provided with written information detailing the nature of the study. Willing participants were asked to give written consent and complete the online questionnaire using the iPads provided. Administrators took measurements of participant BMI. Participants were later provided with debriefing information and thanked for their participation. Data were collected between 17 February 2016 and 16 June 2016. Data were stored securely online with Survey Monkey and later stored on an external hard drive. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Guidelines (Appendix) (Von Elm et al., 2007).

Data analysis

The data were analysed using the Statistical Package for the Social Science (SPSS), version 22 and PROCESS macro version 2.16 (Hayes, 2015). Little's missing completely at random test was executed to address missing data. Descriptive statistics were executed for all variables. Bivariate correlations were executing using Pearson's Product Moment correlation coefficient, to assess the relationship between all variables. A hierarchical regression was conducted to examine an affect phobia model of emotional eating. A mediation analysis tested the hypothesis that attitudes towards emotional expression mediate the relationship between emotional eating and body weight.

Results

Preliminary data analyses

The data were screened and preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. A reliability analysis was completed for each of the study's scales. A missing value analysis was completed. Little's missing completely at random test found no significance, indicating that data were missing at random $\chi^2 = 29.48$, $df = 41$, $p = .91$.

Descriptive statistics are presented in Table 1. The mean score for the emotional eating subscale DEBQ-em was 43.84 (SD = 15.18). Inspection of the distribution of scores indicated a skewness towards the higher end of the scale, suggesting higher than average scores of emotional eating. High scores suggested that the population were highly likely to emotionally eat. The mean score for the AEE scale was 58.89 (SD = 21.51). Visual analysis of the scale scores was quite flat, yet did not meet the assumptions of platykurtosis, indicating a

Table 1. Descriptive statistics for continuous and categorical variables.

Variable	Value
Age (18–72)	47.01 (14.65)
Age categories (%)	
18–25 years	15.0
26–35 years	8.0
36–45 years	24.0
46–55 years	20.0
56–65 years	23.0
65 + years	10.0
Gender (%)	
Male	29.7
Female	70.3
Transgender	0.0
BMI (25.0–46.2)	31.2 (5.6)
BMI categories (%)	
Underweight (≤ 18.5)	0.0
Normal weight (18.5–24.9)	4.0
Overweight (25–29.9)	50.5
Obese (≥ 30)	45.5
Emotional eating (13–65)	43.84 (15.18)
AEE (22–100)	58.89 (21.51)
Observe (15–55)	33.02 (9.83)

Notes: Values are reported as means (standard deviations) and percentages. Minimum and maximum values are outlined in brackets following variable names where relevant.

number of extreme cases. Overall, the distribution indicated neutral to negative attitudes to emotional expression. The mean score for the *Observe* subscale was 33.02 (SD = 9.83). This score indicated that the sample had normally distributed mindful awareness skills.

The relationship between all variables was assessed in a correlation matrix using Pearson's product-moment correlation coefficient (see Table 2). There was a strong negative correlation between AEE and *Observe* ($r = -0.56, p < .01$), and between the DEBQ-em and *Observe* ($r = -0.52, p < .01$). A strong positive correlation was also found between the DEBQ-em and AEE scales ($r = 0.69, p < .01$); however, multicollinearity was not observed. Gender, age and BMI scores were not strongly correlated with other variables.

A hierarchical regression analysis was employed to evaluate how well age, gender, BMI, AEE and mindful awareness skills predicted emotional eating. Age and gender were controlled for in Step 1, explaining 8% of the variance in emotional eating. BMI was controlled for in Step 2, explaining 7% of the variance in emotional eating. AEE was entered in Step 3, explaining 39% of the variance. *Observe* was entered in Step 4, explaining 1% of the variance in emotional eating. The overall model was significant ($F(1, 88) = 14.25, p = .000, R^2 = 0.56, \text{Adj } R^2 = 0.53$). Only AEE was a statistically significant predictor of emotional eating ($\beta = 0.59, p = .000$). The regression analyses were then extended to evaluate how well each of the AEE subscales predicted emotional eating (see Table 3.). The model was significant ($F(1, 88) = 14.25, p = .000, R^2 = 0.56, \text{Adj } R^2 = 0.53$). The analysis revealed that only the subscale, weakness, the view that the expression of emotion is a sign of weakness, was a significant predictor of emotional eating ($\beta = 0.31, p = .048$).

A further hierarchical regression analysis was employed to evaluate how well age, gender, the AEE subscales, the DEBQ-em subscales and *Observe* skills predicted BMI

Table 2. Summary of Pearson's product correlations between dependent and independent variables.

Measure	1	2	3	4	5	6
1. Gender	–					
2. Age	–0.15	–				
3. BMI	0.18	0.02	–			
4. Observe	0.08	0.18	–0.26*	–		
5. AEE	–0.16	–0.23*	0.14	–0.56**	–	
6. Emotional eating	0.06	–0.26**	0.25*	–0.52**	0.69**	–

* $p \leq .5$.

** $p \leq .01$.

Table 3. Summary of enter regression analysis for variables predicting emotional eating, extended subscales.

Emotional eating	β	R^2	Adj R^2	F change
Step 1		0.08	0.06	4.20*
Age	0.14			
Gender	–0.11			
Step 2		0.15	0.13	7.95**
BMI	0.10			
Step 3		0.55	0.52	19.92***
Expression of emotion is a sign of weakness	0.31*			
Emotions should be kept under control	0.22			
Other people will be rejecting	0.17			
Tendency to express emotions	–0.03			
Step 4		0.56	0.53	2.15
Observe	–0.13			

Notes: Total $R^2 = 0.56$, Total Adj $R^2 = 0.53$. Significance level: * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4. Summary of enter regression analysis for variables predicting BMI, extended subscales.

Emotional eating	β	R^2	Adj R^2	F change
Step 1		0.03	0.01	1.33
Age	0.13			
Gender		0.14		
Step 2		0.14	0.09	3.04*
Expression of emotion is a sign of weakness	0.04			
Emotions should be kept under control	0.39*			
Other people will be rejecting	-0.10			
Tendency to express emotions	-0.30			
Step 3		0.20	0.12	2.94
Clearly labelled emotions	-0.15			
Diffuse emotions	-0.37			
Step 4		0.22	0.14	2.19
Observe	-0.18			

Notes: Total $R^2 = 0.56$, Total Adj $R^2 = 0.53$. Significance level: * $p < .05$, ** $p < .01$, *** $p < .001$.

(see Table 4.). Age and gender were controlled for in Step 1, explaining 2% of the variance in BMI. The four AEE subscales were controlled for in Step 2, explaining 11% of the variance in BMI. The two DEBQ-em subscales were entered in Step 3, explaining 5% of the variance. *Observe* was entered in Step 4, explaining 2% of the variance. The overall model was significant ($F(1, 87) = 2.68$, $p = .009$, $R^2 = 0.22$, Adj $R^2 = 0.14$). Only the AEE subscale, control ($\beta = 0.39$, $p = .026$), and the DEBQ-em subscale diffuse ($\beta = 0.37$, $p = .045$) were statistically significant predictors of BMI.

A mediation analysis was used to test the hypothesis that attitudes towards emotional expression mediate the relationship between emotional eating and BMI (see Figure 1). The assumptions of mediation analyses were violated and no significant indirect effect was found (see supplementary online material 1). A *post hoc* analysis revealed a significant mediation effect of AEE on emotional eating through *Observe* skills (see Figure 2), $b = 0.076$, BCa CI [0.002, 0.181] representing a medium effect size, $R^2 = 0.248$, 95% BCa [0.109, 0.398] (see supplementary online material 2).

Discussion

The present study aimed to explore the direct and indirect effects of a number of previously identified variables on emotional eating and BMI (Finnegan et al., 2014) in a

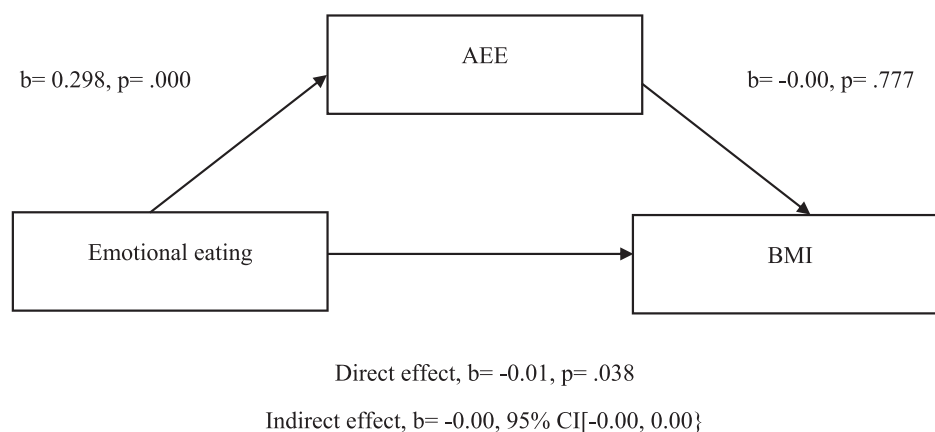


Figure 1. Mediation analysis between emotional eating, BMI and attitudes towards emotional expression.

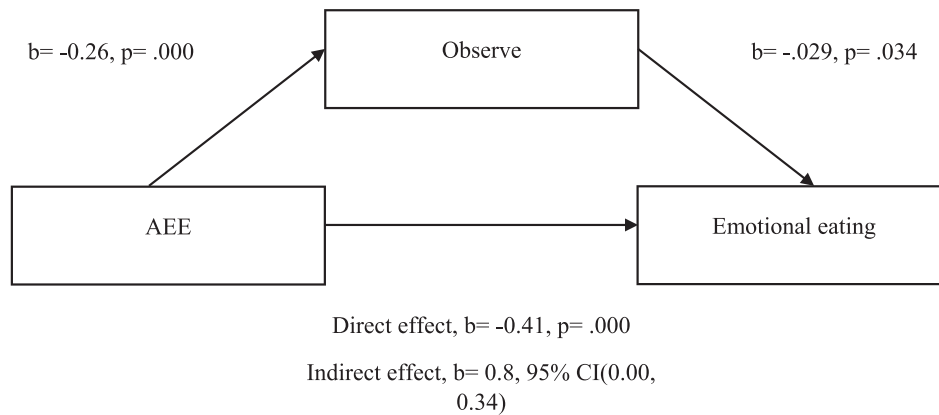


Figure 2. Mediation analysis between attitudes towards emotional expression emotional eating and mindful awareness

clinically overweight and obese population attending a weight management programme, using objective clinical measures of body weight.

Emotional eating and BMI were the principal outcome variables. As hypothesised, emotional eating directly, positively and significantly predicted BMI. The DEBQ-em subscale diffuse, where eating is used as a defence to diffuse negative emotions had a significant effect on BMI. As hypothesised, attitudes towards emotional expression were significantly, directly and positively associated with BMI, where highly negative attitudes predicted higher BMI. The subscale control had the most significant effect of all AEE subscales on BMI. As hypothesised, attitudes towards emotional expression significantly, directly and positively predicted emotional eating. The subscale weakness was the most significant predictor of emotional eating. Mindful awareness skills were not predictive of BMI or emotional eating. However, exploration of these skills on attitudes towards emotional expression had significant indirect effects on emotional eating. Exploration of attitude towards emotional expression (AEE) on emotional eating did not reveal a significant indirect effect on BMI, as had been hypothesised. Age and gender did not significantly predict emotional eating or BMI.

Findings in context

The finding that emotional eating had a significant positive effect on BMI supports previous findings that human emotion is central to eating and disordered eating behaviour (Canetti et al., 2002; Polivy & Herman, 2002). This supports the theory that emotional eating is an atypical response to autonomic nervous system arousal (Topham et al., 2011; Torres & Nowson, 2007; Van Strien et al., 2013), and adds credence to the growing body of evidence that stress may contribute to obesity (Holmes, Ekkekakis, & Eisenmann, 2010; Kupeli et al., 2017). Similar to previous research, high levels of emotional eating were associated with higher BMI (Goldbacher et al., 2016; Nolan et al., 2010). This supports the findings that emotional eating may be a causal factor in the development of obesity (Robbins & Fray, 1980; Van Strien et al., 2009), and therefore increase the risk of development of a number of chronic health conditions (WHO, 2015). Self-reported emotional eating was higher than average. However, participants were attending a cognitive behavioural therapy (CBT)-based weight management programme,

where an individual with disordered eating may be more likely to attend. This may explain some of the variance in this finding.

The finding that AEE had a significant effect on emotional eating and BMI helps validate a review of affect regulation theory in obesity, which suggests that negative emotions become triggers for eating (Lehr et al., 2015). This finding is in keeping with the findings of previous research (Espeset et al., 2012; Finnegan et al., 2014; Ford et al., 2011; Haslam et al., 2012; Meyer et al., 2010). The belief that emotion is a sign of weakness had the most significant effect of all AEE subscales on emotional eating. This was supported by the previous findings of similar studies with non-clinical samples of women (Haslam et al., 2012; Meyer et al., 2010). This finding further supports an affect phobia model of emotional eating, where emotions are invalidated in the childhood (Corstorphine, 2006). Interestingly, the belief that emotions should be controlled had the most significant effect on BMI. Previously, control has been associated with eating pathology and weight concern (Meyer et al., 2010).

Surprisingly, however, AEE did not mediate the relationship between emotional eating and BMI. This suggests that AEE does not explain the relationship between emotional eating and BMI. Other potential factors may mediate the relationship. For example, previous research highlights the role of negative emotional states (Van Strien et al., 2013), while others have highlighted the role of self-compassion (Mantzios & Wilson, 2015). Ubiquitously it is acknowledged that obesity is heterogeneous in its aetiology (Marcus & Wildes, 2009).

Unexpectedly, mindful awareness skills were not predictive of emotional eating. These skills have been linked with awareness in the experience of the here and now (Dimidjian & Linehan, 2003; Kabat-Zinn, 1990). The present study's finding is contrary to previous research, where greater mindful awareness skills have been associated with reduced automatic reactivity, and enhanced regulation in behaviour (Keng et al., 2011). However, these skills were found to mediate the relationship between attitudes towards emotional expression and emotional eating, indicating that mindfulness may have some role to play in emotional eating (Alberts, Thewissen, & Raes, 2012; Mason et al., 2016). This finding is similar to a recent study, which found that mindful observation modulates the link between motivational states and traits on eating behaviour in response to appetitive stimuli (Papies, Pronk, Keesman, & Barsalou, 2015). The present finding supports previous findings that mindful awareness skills may be inversely associated with alexithymia (Baer et al., 2004; Baer et al., 2006). Furthermore, the present study supports previous research, where alexithymia has previously been linked to emotional eating (Pinaquy, Chabrol, Simon, Louvet, & Barbe, 2003; Pink, Williams, & Lee, 2016; Van Strien & Ouwens, 2007), particularly in severe obesity (Noli et al., 2010). The finding that mindful awareness skills were not predictive of BMI score was unexpected. However, a small cohort of studies have also reported this (Finnegan et al., 2014; Kearney et al., 2012).

Age and gender did not appear as significant predictors of emotional eating or BMI, contrary to previous research. Prior research indicated that young adults and females have a greater tendency to emotionally eat (Cornelis et al., 2014; Finnegan et al., 2014; Gibson, 2012). In a similar vein, older adults and men tend to have higher BMI scores (Okorodudu et al., 2010). However, it is noted by the authors that the present findings

may be unique to a homogeneous sample of overweight and obese adults attending a CBT-based weight management programme.

Theoretical contribution: an affect phobia model of emotional eating

The current study's findings support an affect phobia model of emotional eating (Finnegan et al., 2014; McCullough, 2003). The model suggests that childhood environments lead to the development of negative attitudes to emotional expression, where negative emotions may be perceived negatively, and subsequently avoided or controlled. This experience may result in internal conflict in an individual, where defences such as emotional eating are adopted to decrease emotional distress. Such disruption to the development of emotions may lead to the sub-clinical inability to identify and describe emotions about the self, namely alexithymia (Pink et al., 2016). Eating in response to the internal experience of negative emotions may lead to increased body weight in the context of chronic stress.

Strengths and limitations

To the knowledge of the authors, this study was novel in that previous studies have not explored the variables of interest in clinically overweight and obese populations attending weight management programmes using clinical measures of body weight. The use of a clinical measure of BMI in operationalising body weight was a major strength in the study's design. A major methodological weakness of previous studies was the use of self-report for height and weight (Gorber et al., 2007). Another strength of the study was the adherence to the STROBE guidelines (Von Elm et al., 2007), which improved the study's rigour.

Despite its strengths, this study was limited by the use of a self-report measure of emotional eating which may not have truly reflect eating behaviour (Evers, Stok, & de Ridder, 2010). However, this limitation has been contested (van Strien, 2010). Another concern is that the study took place in the weight management clinic setting, which may have influenced participants' responses. In addition, the voluntary nature of recruitment must be acknowledged as it may reduce the generalisability of the study's findings due to a volunteer bias, where certain demographics are less likely to take part in voluntary studies (Heiman, 2002). Furthermore, participants were made aware of the nature of the study through its advertisement in clinics. Arguably the participants may have been self-selecting as interested in emotional eating as a factor related to their obesity. Moreover, participants were recruited from a CBT-based weight management programme, which may have increased the likelihood of a sampling bias. While the gender ratio was notably more balanced than in previous research, there exists a gender imbalance in participant recruitment. This is a limitation to the generalisability of the study's findings. This is a common phenomenon in the literature (Espeset et al., 2012; Finnegan et al., 2014; Ford et al., 2011; Haslam et al., 2012; Meyer et al., 2010). These potential biases are acknowledged as threats to the study's external validity.

Furthermore, while the variables of interest were grounded in the literature, it is highly likely that other underlying variables were present. The authors were aware that it remains unclear if emotional eating causally determines body weight, as it is highly considered that

a number of uncontrolled for variables occur simultaneously. Finally, the study employed a cross-sectional design, whereby the expected mediation effect would have been difficult to interpret as causality cannot be assumed and the findings are ultimately limited.

Clinical implications of findings

These limitations are unsurprising given the exploratory nature of the research. However, the findings may have important implications for clinical practice. Despite its limitations, the present study highlights the importance of challenging negative attitudes to emotional expression and the development of adaptive emotion regulation strategies in populations with high levels of disordered eating in clinical settings. Given the growing global obesity trend (NCD Risk Factor Collaboration, 2016) and the strong association between emotional eating and BMI, the present study may have implications for an increased risk of the development of a number of chronic health conditions (WHO, 2015). Future weight management interventions should assess disordered eating as part of evidence-based practice.

Emotional eating is an important risk factor for overweight and obese adults in general, and in the context of weight management interventions. Researchers and clinicians should acknowledge the vulnerable nature of this population. Findings call for the implementation of CBT for emotional eating and improved access to psychological therapies (Murphy, Straebl, Cooper, & Fairburn, 2010).

Future research

Emotional eating is an important area for further public health research. Replication of the present study's findings is recommended. In addition, it is recommended that future studies employ longitudinal research designs and explore gender balanced populations to increase the generalisability of findings. Future research using larger sample sizes could further examine the phenomenon by comparing differences between overweight and obese adults. Similarly, future research could refine the present model by exploring novel variables which may be likely to contribute to emotional eating (e.g. mental health, attitudes towards emotional eating and attitudes towards obesity in the obese). Furthermore, qualitative research would add to health psychology's understanding of the phenomena and perhaps identify lurking variables.

Summary and conclusions

The present study highlights the prevalence of emotional eating in overweight and obese populations. The authors found emotional eating to be an important contributing factor to body weight; however, it is acknowledged that causality cannot be assumed. The research indicated that attitudes towards emotional expression play are central to emotional eating, thereby helping to validate recent developments in the affect phobia model of emotional eating. Validation of the model may provide future researchers and clinicians with a framework for the development and implementation of weight management interventions. Mindful awareness skills were limited in their contribution to BMI and emotional eating, however, these skills did help explain the

relationship between AEE and emotional eating. This finding supports previous research investigating disordered eating and alexithymia and indicates that mindful awareness may have some contribution to interventions. It is important to emphasise that the findings reported require replication and validation.

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Appendix

STROBE statement – checklist of items that should be included in reports of observational studies.

	Item No.	Recommendation	Page No.
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3–6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7

(Continued)

Continued.

	Item No.	Recommendation	Page No.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7–9
Participants	6	(a) <i>Cohort study</i> – Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> – Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> – Give the eligibility criteria, and the sources and methods of selection of participants (b) <i>Cohort study</i> – For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> – For matched studies, give matching criteria and the number of controls per case	7 n/aa
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7–9
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7–9
Bias	9	Describe any efforts to address potential sources of bias	n/a
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) <i>Cohort study</i> – If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> – If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> – If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	9 9 9 n/a n/a
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study – e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram	Table 1. n/a n/a
Descriptive data	14*	(a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest (c) <i>Cohort study</i> – Summarise follow-up time (e.g. average and total amount)	Table 1. 9 n/a
Outcome data	15*	<i>Cohort study</i> – Report numbers of outcome events or summary measures over time <i>Case-control study</i> – Report numbers in each exposure category, or summary measures of exposure <i>Cross-sectional study</i> – Report numbers of outcome events or summary measures	9–11 and Tables 1–4

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Continued.

	Item No.	Recommendation	Page No.
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g. 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10–11
		(b) Report category boundaries when continuous variables were categorised	10–11
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done – e.g. analyses of subgroups and interactions, and sensitivity analyses	11 and figures 1 and 2
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12–17
Generalisability	21	Discuss the generalisability (external validity) of the study results	16–17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Title page

Notes: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.