Title: Exploring the association between self-compassion, mindfulness and mindful eating with eating behaviours amongst patients with obesity.

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Abstract

Background: People who have obesity often experience problematic eating behaviours, contributing towards their excessive weight gain. **Aims:** Understanding problematic eating behaviours and their association to self-compassion, mindfulness and mindful eating is important for the development of future interventions that improve weight-loss and weight-regulation. **Methods:** One hundred and one participants attending their first session of a 6-session dietetic programme within a Tier 3 medical weight management service in the West Midlands, UK were recruited to complete questionnaires on self-compassion, mindfulness, mindful eating and eating behaviours, such as, emotional, restrained, external, fat and sugar consumption and grazing. **Results:** The findings suggested all three constructs, self-compassion, mindfulness and mindful eating were significantly and negatively associated with grazing and emotional eating, but mindful eating was the only construct that also displayed a significant and negative association with other eating behaviours that are often barriers to successful weight regulation, such as external eating and fat consumption. Further investigation suggested mindful eating had an indirect effect on fat consumption and grazing via external eating. **Conclusion:** Whilst, self-compassion, mindfulness and mindful eating displayed a negative relationship with grazing and emotional eating, mindful eating also displayed a negative relationship with fat consumption and external eating. Possible explanations and directions for future work are discussed with an emphasis on the need for more empirical work.

Keywords: Eating Behaviours; Mindfulness; Mindful Eating; Obesity; Self-Compassion

The increased prevalence of obesity over the past few decades has become one of the most pressing public health issues within the Western world (Agha & Agha, 2017; Inoue et al., 2018). Whilst many lifestyle interventions have displayed initial success (Jolly et al., 2011), long-term outcomes have frequently been ineffective (e.g., Funk et al., 2019; Montesi et al., 2011), and substantially contributed towards the fiscal deficit of healthcare providers (Revels et al., 2017). Therefore, identifying associations between specific eating behaviours may be an essential step towards eventually establishing appropriate interventions for weight loss and weight regulation.

People who have obesity often experience problematic eating behaviours, contributing towards their excessive weight gain (De Carter & Jansen, 2012; Ridder et al., 2012). Specifically, behaviours such as emotional eating, eating in response to external cues and restrained eating have been associated with weight gain and in the aetiology of obesity (e.g., van Strien et al., 2012). Emotional eating occurs in response to negative emotions, for example, a person may turn to food when experiencing loneliness or sadness (Frayn & Knauper, 2018; van Strien, 2018). External eating is characterised by eating in response to external cues, such as the sight, smell or taste of food (van Strien et al., 2020). Restrained eating is the act of consciously restricting food intake in order to control for one's weight (Polivy et al., 2020). Research on the association between restrained eating and BMI has been contradictory, whereby some researchers suggest restrained eating can result in lower body weight and healthier eating patterns, others have suggested when restrained eating is unsuccessful, it could lead to overeating (e.g., Lowe et al., 2012; Konttinen et al., 2018). Similarly, studies investigating emotional eating and external eating have found these eating tendencies to be inconsistent in relation to overeating and obesity (e.g., Brogan & Hevey, 2013; Snoek et al., 2013). Whilst some literature has highlighted their key role (Kakoschke et al., 2015), other findings suggested a more relevant association to emotional, rather than external eating (van Strien et al., 2020). Thus, exploring such behavioural eating patterns to understand their association with obesity, and addressing them within weight loss interventions may contribute towards effective and long term success.

Grazing, which is the repetitive intake of small amounts of food, is another eating behaviour which has received attention in recent years (e.g., Lane & Szabo, 2013). The tendency to graze is

considered problematic and common amongst those who have obesity, and interventions directed towards weight loss may benefit by focusing on grazing (e.g., Heriseanu et al., 2017; Heriseanu et al., 2020). Grazing has been positively associated with external and emotional eating, but not restrained eating (Lane & Szabo, 2013), and in a more recent study, Mantzios, Egan, Keyte et al. (2018) found grazing to also be positively associated with motives to eat palatable foods and fat and sugar consumption. The typical diet within the Western world is often characterised with foods that are high in fat and sugar (e.g., Rakhra et al., 2020), and whilst dietary guidelines do emphasise on limiting the intake of such foods, research indicates that this is normally not the case (e.g., Park et al., 2012), especially amongst those who have obesity (Te Morenga et al., 2012). In fact, despite the WHO recommendation of consuming a minimum of five portions of fruit and vegetables a day (WHO, 2003), studies have suggested that people often consume significantly less (Casagrande et al., 2007; Hall et al., 2009; Sachdeva et al., 2013). Focusing on limiting the consumption of foods high in fat and sugar, whilst also encouraging the intake of fruit and vegetables is important for weight regulation and obesity prevention (Akers et al, 2012; de Oliveira et al., 2018). Food cravings, particularly for foods high in fat and sugar, are associated with external eating behaviours (Muller et al., 2008; Rodriguez-Martin & Muele, 2015). The elements of mindfulness, mindful eating and self-compassion have been suggested to facilitate more adaptive eating behaviours and to promote healthier practices (e.g., Mantzios & Wilson, 2015a). For example, both grazing and fat and sugar consumption behaviours have been negatively associated with traits of mindfulness, mindful eating and self-compassion amongst a student population (Mantzios, Egan, Bahia, et al., 2018; Mantzios, Egan, Hussain, et al., 2018). However, these findings have not yet been replicated amongst patients who have clinical obesity, and such trait aspects may be predictive elements of weight loss interventions that can be utilised in future research and inform practical applications of nutritional advice.

Mindfulness has been characterised as purposefully paying attention to the present moment and being aware of all mental states with a non-judgmental attitude (Kabat-Zinn, 1990). Although mindfulness is often described and discussed as a trait, it can be developed through practicing meditation (Kiken et al., 2015; Tang, 2017), and other practices, such as mindful yoga, the mindful raisin eating task, and MCD (Sauer-Zavala et al., 2012; Mantzios & Wilson, 2014; Mantzios &

Giannou, 2019). The construct of mindfulness is suggested to elevate a person's observation of their internal state, consequently improving internal regulatory processes (Analayo, 2019), which assists with distinguishing hunger from emotions, reducing emotional eating and placing less focus on external cues and more on internal cues, such as hunger and satiety, which is vital in overcoming eating in response to external cues (e.g., Ouwens et al., 2015). Research has reported the positive results of trait mindfulness and MBIs with improved reactions to cravings, impulsivity, emotional and external eating behaviours (Alberts et al., 2010; Dutt et al., 2019; Gouveia et al., 2019; O'Reilly et al., 2014; Peters et al., 2011), which may explain reduced food intake and better weight regulation (Mantzios et al., 2015). However, not all results have found positive changes between mindfulness and healthier eating practices (Kearney et al., 2012). For example, Kearney et al. (2012) found participating in a MBSR programme did not improve emotional eating behaviour, and research on the association between mindfulness and grazing has also been rather inconsistent (Levin et al., 2014). In a review by Mantzios and Wilson (2015a), it was suggested that mindfulness interventions relevant to weight regulation should be specific to eating by adapting the fundamental mindfulness elements towards food and eating related experiences. This can assist people to become more accustomed to the concept of mindful eating, which could otherwise take longer to achieve through generic practices of mindfulness (Hong et al., 2014; Mantzios, 2021; Mantzios & Wilson, 2014). Research on mindfulness interventions specifically aimed at eating behaviours have been found to assist participants with weight loss, increase in cognitive restraint around food, enable healthier eating choices through reduced intake of fat and sugar and show improvements in binge eating, grazing and external eating behaviours (Allirot et al., 2018; Dalen et al., 2010; Felske et al., 2019; Kristeller & Wolever, 2010; Mantzios et al., 2019; Mantzios et al., 2020; Mason et al., 2016; Miller et al., 2012; Timmerman & Brown, 2012). Exploring both mindfulness and mindful eating constructs with eating behaviours amongst patients who have clinical obesity may assist in establishing interrelationships that are suggesting healthier and more regulated eating practices.

Recent research has also identified the added value of self-compassion as a pertinent construct within mindfulness in enabling healthier eating behaviours (e.g., Mantzios, Egan, Keyte, et al, 2018; Mantzios, Egan, Hussain, et al, 2018). Self-compassion consists of three main elements,

self-kindness, common humanity and mindfulness, and it is defined as taking a kinder approach to oneself with a mindful awareness, and consideration of personal difficulties as being part of a shared humanity that everyone experiences (Neff, 2003a, b). In an earlier study, Adams and Leary (2007) explored the tendency of overeating after breaking a diet (Bryant et al., 2019; Tomiyama et al., 2009), and showed that participants who were exposed to a self-compassionate induction after breaking their diet did not increase their subsequent food intake. Since then, research on self-compassion in the context of eating behaviours and weight loss has been prominent, with findings suggesting self-compassion to be beneficial towards nutritional behaviours, positive body image, emotional eating and weight loss (Gouveia et al., 2019; Rahimi-Ardabili et al., 2018). Furthermore, self-compassion and mindfulness appear to be interrelated, for example, Birnie et al. (2010) found self-compassion to increase the effectiveness of mindfulness training, and Neff and Germer (2013) developed a MBI referred to as the mindful self-compassionate programme to enhance well-being. Later, Mantzios and Wilson (2015b) investigated the effect of a mindfulness and self-compassion centred intervention for weight loss, and findings showed participants continued to successfully lose weight up to 6 months after completing the intervention, suggesting both mindfulness and self-compassion may be promising for weight loss interventions. Their research was with normal weight participants, which is common amongst mindfulness-based constructs and eating behaviours, indicating the need for further research with patients who have clinical obesity.

Previous research has not yet directly explored self-compassion, mindfulness and mindful eating with problematic eating behaviours amongst patients who have clinical obesity. There is a timely imperative to understand the association between such theoretical concepts and eating behaviours to eventually develop lifestyle interventions that can aid patients with weight loss and weight regulation. Therefore, the aim of the present research is to directly explore the associations between self-compassion, mindfulness and mindful eating with eating behaviours, such as emotional, external, restrained, fat and sugar consumption and grazing amongst patients who have clinical obesity in the United Kingdom. Given that previous research has found emotional eating and external eating to be associated with grazing and consumption of high-calorie sweet and saturated fat foods, as well as mindfulness, mindful eating and self-compassion (e.g., Gouveia et al., 2019; Lane & Szabao,

2013; Ouwens et al., 2015); it is hypothesised that emotional eating and external eating will mediate the association between self-compassion, mindfulness and mindful eating, and fat and sugar consumption, and grazing.

Methods

Participants

One hundred and one participants were voluntarily recruited at their first group session appointment at a Tier 3 medical weight management service (see Procedure for further details). Participants did not receive any compensation for their participation. The sample consisted of 82 females, 18 males, and one not-specified. Participants' educational background consisted of a university degree (n = 33), A level or BTEC (n = 21), GCSE (n = 37), and not-specified (n = 10), and they were employed (n = 60), self-employed (n = 1), unemployed (n = 33), retired (n = 5), and not-specified (n = 2). Participants' self-identified ethnicities were: White or White British (n = 75), Black African or Caribbean (n = 8), South Asian (n = 12), Mixed Ethnicity (n = 2), and not-specified (n = 4).

Eligibility. The exclusion criteria in the current study included any patients under the age of 18 years, those who lacked capacity (identified by their consultant), those who had been diagnosed with an eating disorder and non-English speakers.

Measures

Participant demographics form. Participants were asked to self-report their age, gender, height, weight, ethnicity, education and employment status in order to assess their background information.

Self-compassion scale (SCS; Neff, 2003b). The SCS is a 26 item measure, with scores ranging from 1 (*almost never*) to 5 (*almost always*), and total scores varying from 26 to 130 (Neff, 2003). Sample items include "I try to be loving towards myself when I'm feeling emotional pain" and "When I think about my inadequacies, it tends to make me feel more separate and cut off from the rest of the world". The scale is composed of six subscales: self-kindness, self-judgment, common humanity, isolation, mindfulness and over-identification. The present study produced an alpha of (α =.87) for the overall score.

Five-facet mindfulness questionnaire: Short form (FFMQ-SF; Bohlmeijer, Klooster, Fledderus, Veehof, & Baer, 2011). The FFMQ-SF is a 24 item scale originating from the five-facet mindfulness questionnaire (Baer et al., 2004). Sample items include "I'm good at finding the words to describe my feelings" and "when I have distressing thoughts or images, I don't let myself be carried away by them". Each item is scored from 1 (*never or very rarely true*) to 5 (*very often or always true*), with overall scores range from 24 to 120. All items reflect on different facets of mindfulness: observing, describing, non-reactivity, acting with awareness and non-judging. The present study produced an alpha of (α = .80) for the overall score.

Mindfulness eating scale (MES; Hulbert-Williams, Nicholls, Joy, & Hulbert-Williams, 2014). The MES is a 28 item scale with responses ranging from 1 (*never*) to 4 (*usually*) and scores varying from 28 to 112. Sample items include "I notice flavours and textures when I'm eating my food" and "I multi-task whilst eating". The MES consists of six subscales: acceptance, awareness, non-reactivity, routine, act with awareness and unstructured eating. The present study produced an alpha of (α = .84) for the overall score.

Dutch eating behaviour questionnaire (DEBQ; van Strien et al., 1986). The DEBQ is a 33 item scale with responses ranging from 1 (*never*) to 5 (*very often*), and overall scores varying from 33 to 165. Sample items include "Do you have a desire to eat when you are feeling lonely?" (i.e., emotional eating) and "Do you find it hard to resist eating delicious foods?" (i.e., external eating). The DEBQ is composed of three subscales and the current study produced alphas of: emotional eating (α = .94), external eating (α = .90), and restrained eating (α = .90).

Dietary fat and free sugar—Short questionnaire (DFS-SQ; Francis & Stevenson, 2013). The DFS-SQ is a 26 item scale measuring dietary fat and sugar intake. Sample items include "Fried chicken or chicken burgers" (i.e., fat) and "Cakes, cookies" (i.e., sugar). Responses range from "1 per month or less" to "5 + per week", and overall scores range from 26 to 130. The fat subscale produced an alpha of (α = .81) and sugar subscale (α = .59) within the current study.

Grazing scale (GS; Lane & Szabo, 2013). The GS consists of 8 items, with responses ranging from 1 (*rarely*) to 5 (*all of the time*) and scores range from 8 to 32. Sample items include "Have you ever felt compelled or driven to eat, even when not hungry?" and "Do you find yourself

picking at or nibbling food continuously?". The present study produced an alpha of (α = .91) for the overall score.

Procedure

A 6-session dietetic programme within a Tier 3 medical weight management service in the West Midlands, UK was used to approach participants to take part in a study investigating eating behaviours and wellbeing. The criteria for the Tier 3 medical weight management service involved patients to have a BMI of above 40 with no co-morbidities (37.5 for those from an Asian ethnic background) or above 35 with co-morbidities such as diabetes, hypertension, dyslipidaemia and obstructive sleep apnoea (32.5 for those from an Asian ethnic background). At the end of their first group session appointment, patients were approached by the researcher, who provided them with an overview of what the study entailed and asked if they would like to participate in the study. Those who verbally agreed to participate in the study were provided with an information sheet and consent form, and after providing informed consent, participants completed the demographics form and the questionnaires. The study took approximately 20 minutes to complete, and after completion, participants were provided with a debrief form illustrating the purpose and aim of the study, as well as the researchers' contact details for participants who may have wanted to withdraw or find out about the results at a later date. The study was approved by the NHS ethical committee (Reference number: 234447), and informed consent was gained from all participants.

Data Analysis

Pearson's bivariate correlations were conducted to assess the associations between self-compassion, mindfulness and mindful eating with eating behaviours, such as emotional, restrained, external, fat and sugar consumption and grazing. Next, external eating and emotional eating were tested as potential mediators between self-compassion, mindfulness, mindful eating and fat and sugar consumption and grazing. A mediation approach was chosen because it allowed the independent contribution of each mediator as part of an indirect pathway from variable A to variable B to be estimated. A significant indirect pathway is inferred if the lower and upper limit confidence intervals do not cross zero (Hayes, 2017). According to Baron and Kenny (1986), mediation analyses require

the four following steps: (1) Variable A (i.e., self-compassion, mindfulness or mindful eating) is significantly associated with the mediator (i.e., external eating or emotional eating), (2) Variable A (i.e., self-compassion, mindfulness or mindful eating) is significantly associated with the variable B (i.e., fat and sugar consumption or grazing) (3) the mediator (emotional eating or external eating) is significantly associated with variable B (i.e., fat and sugar consumption or grazing) and (4) the relationship between variable A (i.e., self-compassion, mindfulness or mindful eating) and variable B (i.e., fat and sugar consumption or grazing) should be significantly reduced after controlling for the mediator (external eating or emotional eating). The Mediation models were tested using the SPSS PROCESS Macro v3.5 (Hayes, 2017). Furthermore, p values for multiple comparisons were corrected using the Benjamini-Hochberg correction (Benjamini & Hochberg, 1995) to allow for a more conservative interpretation of significance values and control the false discovery rate of 5% (Q = .05). This is a common percentage rate used in other similar research (e.g., Sagioglou & Greitemeyer, 2016; Trewern et al., 2022; Zerón-Rugerio et al., 2022) and was proposed in a recent editorial as being the appropriate method to report the false discovery rate (Geary & Higgs, 2022).

Results

Self-Compassion, Mindfulness, Mindful Eating and Eating Behaviours

Inter-correlations between self-compassion, mindfulness, mindful eating, emotional eating, external eating, restrained eating, fat and sugar consumption and grazing are presented in Table 1. Findings suggest a small significant and negative relationship between self-compassion and emotional eating (r = -.227, p = .04) and grazing (r = -.222, p = .05). A small significant and negative relationship is presented between mindfulness and grazing (r = -.288, p = .01), and a marginally non-significant and negative relationship with emotional eating (r = -.213, p = .053). There is also a large significant and negative relationship between mindful eating and emotional eating (r = -.592, p < .001) and external eating (r = -.576, p < .001). Furthermore, mindful eating displayed a moderate significant and negative relationship with fat consumption (r = -.466, p < .001) and grazing (r = -.497, p < .001), and a small non-significant and negative relationship with sugar consumption (r = -.213, p = .06). Correcting using the Benjamini and Hochberg (1995) procedure as described in the Data Analysis section showed that these relationships remained significant.

INSERT TABLE 1 HERE

Direct and Indirect Effects of External and Emotional Eating

The direct and indirect effects of mindful eating on fat consumption and grazing via external eating and emotional eating were examined using mediation analyses (see Table 2). Mindful eating had a significant direct effect on fat consumption (b = -.23, SE = .09, 95% CI: -.42, -.05) and a significant indirect effect via external eating (b = -.14, SE = .07, 95% CI: -.28, -.02). Similarly, mindful eating had a significant direct effect on grazing (b = -.15, SE = .07, 95% CI: -.29, -.01), and a significant indirect effect via external eating (b = -.17, SE = .05, 95% CI: -.27, -.08). The direct and indirect effects of mindful eating on fat consumption and grazing via emotional eating found mindful eating had a significant direct effect on fat consumption (b = -.28, SE = .09, 95% CI: -.47, -.09) and a significant direct effect on grazing (b = -.30, SE = .08, 95% CI: -.46, -.14), but no significant indirect effects via emotional eating were found for either measures.

Furthermore, the direct and indirect effects of mindfulness on grazing via emotional eating were explored (see Table 3). The findings suggested mindfulness had a significant direct effect on grazing (b = -.14, SE = .07, 95% CI: -.27, -.01), and when exploring this effect via emotional eating, the effect changed to non-significant (b = -.04, SE = .03, 95% CI: -.09, .00. There was no significant direct effect observed for self-compassion on grazing or via emotional eating (see Table 4). Thus suggesting external eating mediated the association between mindful eating and fat consumption and grazing, whilst, emotional eating resulted in the association between mindfulness and grazing becoming non-significant.

INSERT TABLE 2 HERE

INSERT TABLE 3 HERE

INSERT TABLE 4 HERE

Discussion

The aim of the current study was to explore the relationship between self-compassion, mindfulness and mindful eating with eating behaviours, such as emotional, external, restrained, fat and sugar consumption and grazing amongst patients who have clinical obesity. The results suggested that self-compassion, mindfulness and mindful eating displayed a negative relationship with grazing

and emotional eating, but mindful eating also displayed a negative association with fat consumption and external eating. Further investigation into the mediational effects suggested that self-compassion did not have a direct effect on grazing nor via emotional eating, whereas mindfulness had a direct effect on grazing, but this effect became non-significant when explored via emotional eating. In addition, mindful eating had a direct effect on fat consumption and grazing and an indirect effect through external eating.

Literature on self-compassion and eating behaviours has been largely underexplored until more recently (Kelly & Carter, 2015; Turk & Waller, 2020), whereby findings have suggested that self-compassion is beneficial in reducing disordered eating symptoms, improved body image, weight loss, and better eating habits (Kelly & Carter, 2015; Kelly & Stephen, 2016; Turk & Waller, 2020; Rahimi-Ardabili, 2018). Findings between general mindfulness and eating behaviours, such as grazing and emotional eating have been mixed (e.g., Kearney et al., 2012; Levin et al., 2014; Mantzios & Wilson, 2015a; Ouwens et al., 2015). Although the present study did display a rather small association of self-compassion and mindfulness with grazing and emotional eating, the two theoretical concepts may indeed be beneficial for patients who have a tendency to graze and emotionally eat (Mantzios, Egan, Bahia et al., 2018; Gouveia et al., 2019). The identification of grazing as a contributing factor towards weight gain was established over a decade ago (Saunders, 2004), but direct attention towards this behaviour within weight loss interventions has been minimal (Parker & Brennan, 2015). If grazing is a common and problematic behaviour amongst those who have obesity, it may explain why mindfulness and/or self-compassion based interventions lead to weight loss (Mantzios & Wilson, 2015b; Rahimi-Ardabili et al., 2018), but it also highlights the demand for contemporary weight loss interventions to directly consider the element of grazing targeted interventions to overcome such problematic eating behaviours. Similarly, little research has been conducted on self-compassion and emotional eating, and previous findings in relation to mindfulness and emotional eating have been inconsistent (Kearney et al., 2012; Ouwens et al., 2015; Gouveia et al., 2019). However, the current findings are aligned with some previous research (Tak et al., 2015; Gouveia et al., 2019), suggesting that both self-compassion and mindfulness may also be beneficial for those who are emotional eaters. Although, self-compassion did display non-significant

relationships with other eating behaviours measured within the present study, such as external eating and sugar consumption, as well as a non-significant direct relationship with grazing when explored using mediation, this could potentially be attributed to the SCS not being specific to health behaviours, and the items may prescribe different behaviour within the context of eating (see Mantzios & Egan, 2017; Egan & Mantzios, 2018). Similarly, in the element of mindfulness, questions that explicitly associate mindfulness and eating may be more predictive of eating behaviours than mindfulness alone (Mantzios & Wilson, 2014), which could be one explanation for the non-significant association between mindfulness and other eating behaviours, such as external eating and sugar consumption. Another explanation could be one that aligns with previous research that suggests general mindfulness is not sufficient enough to improve eating behaviours because the fundamental concepts of mindfulness do not promote any intentions to do so (Mantzios & Wilson, 2015a). Therefore, a more direct solution would be to focus on combining the two concepts and create targeted mindful eating interventions.

The current findings in relation to mindful eating and eating behaviours, such as external, emotional, fat consumption and grazing are consistent with previous research (O'Reilly et al., 2014; Warren et al., 2017). For example, previous literature has suggested that mindful eating may be a prominent factor in promoting healthier eating behaviours, and weight loss interventions may be enhanced through the inclusion of specific mindful eating elements (Beshara et al., 2013; Pintado-Cucarella & Rodriguez-Salgado, 2016). Mindful eating can assist people to become aware of their internal sensations, such as hunger and satiety, which are important for healthy adaptive eating behaviours (Dalen et al., 2010; Kristeller & Wolever, 2010). For example, mindful eating has shown to successfully moderate intake of calorific foods despite desire to consume more, suggesting mindful eating can generate increased satiety (Mantzios et al., 2019; Warren et al., 2017). Restrained eating was not associated with mindful eating or mindfulness and self-compassion. Given that previous research and theories have suggested restrained eating may pose as a risk for maladaptive eating behaviours and weight gain (Fairburn, 2008; Schur et al., 2010), it may explain the non-association of restrained eating with the three positive psychological constructs, consistent with some previous research (Anderson et al., 2016). Surprisingly, a small and non-significant negative association

between mindful eating and sugar consumption was found within the present study. Given that findings from previous research have suggested mindful eating may be a beneficial approach in reducing intake of sweet foods (Mason et al., 2016; Miller et al., 2012), the current findings based on the small and non-significant element are not as consistent. As such, more research specifically focusing on mindful eating and sugar intake may be required to establish a thorough understanding. Identifying and developing mindful eating strategies may be easier for people to adhere to than generic mindfulness practices as they are more relevant to a specific need (i.e., eating) (e.g., Hong et al., 2011; Kristeller et al., 2014; Mantzios & Wilson, 2014), and they often do not require intense training that is typically associated with general MBIs (Kabat-Zinn, 1990; Mantzios & Wilson, 2014). For example, a mobile based app using video lectures with animations and straightforward guidance on mindful eating principles found smartphone-delivered mindful eating training engaged participants and led to reduced craving related eating and associated weight loss (Mason et al., 2018). In addition, the mindful raisin-eating exercise, uses a 10 minute audio recording, instructing participants to be non-judgmental and fully aware of the present moment by attending to the colour, texture, smell and taste of the food, found the application of the mindful eating exercise enhanced eating experiences and reduced consumption of high energy dense foods (Kabat-Zinn, 2006; Hong et al., 2014; Mantzios et al., 2018). Furthermore, another mindful eating specific application, namely, Mindful Construal Diary (MCD) is a 10 item tool that combines concepts related to mindful eating, self-compassion and construal level theory (Mantzios & Wilson, 2014). Participants are encouraged to reflect on answers to the questions in the MCD whilst eating a meal or snack, and findings have shown the MCD to be successful in facilitating healthier eating behaviours (Hussain et al., 2021).

Limitations and Future Directions

There were a number of limitations identified within the present study. The first limitation is that the current study was conducted only using patients who have obesity and are participating in weight management treatment. Participants who have obesity, but are not participating in weight management treatment or participants who are awaiting or have undergone bariatric surgery may present different findings, as well as people with obesity who have not displayed a motivation to regulate their food intake and weight (Gloy et al., 2013). To draw stronger conclusions, future

research should replicate current findings amongst wider samples, such as clinical and non-clinical. Given the established association of bariatric patients and grazing within previous literature (Conceicao et al., 2017), the findings of such a population may enable the embedment of targeted interventions.

Moreover, the sample within the current study was a volunteer group of predominately white females, making it difficult to generalise the findings amongst those from different demographic backgrounds. For example, research has identified sex and ethnic differences in the prevalence of obesity, with South Asian women and men displaying the highest prevalence to obesity in comparison to White, Black African, Black Caribbean, and Chinese groups. In addition, Black African, Black Caribbean, and Chinese women have shown to display a higher risk to obesity compared to White women, but Black African and Black Caribbean men had the lower prevalence obesity compared to White men (Agyeman et al., 2011; Higgins & Browns, 2019). There are also notable differences amongst those from different socio-economic groups, with those from the lowest socio-economic backgrounds being associated with increased levels of obesity (Stafford et al., 2010). Future research should include a wider sample, including males and people from different ethnic and socio-economic backgrounds, which may help determine methods for individualised care and treatment for patients who have obesity.

Furthermore, the cross-sectional nature of the present study precludes conclusions along causal lines, on the nature of the observed associations. Conducting mediational analysis on cross-sectional data has been previously criticised in the absence of temporal precedence (Maxwell & Cole, 2007; Maxwell et al., 2009). Furthermore, it has been suggested that cross-sectional sample data can widely generate biases even under ideal conditions of mediations (Fairchild & McDaniel, 2017; Maxwell & Cole, 2007; Maxwell et al., 2009). Future research should utilise experimental and longitudinal designs to explore self-compassion, mindfulness and mindful eating constructs with an intention of altering eating behaviours.

Finally, although self-report measures are often applied within eating and diet related research, they may be problematic, with the possibility of socially desirable responding. Future

research should use physiological measurements that can be quantified in the amount of food consumed either through observations or naturalistic experiments.

Conclusion

The findings from the present study suggest that self-compassion, mindfulness and mindful eating are negatively associated with grazing and emotional eating, but the concept of mindful eating appears to have a particularly significant and negative association with external eating and fat consumption. In addition, mindful eating has an indirect effect on both fat consumption and grazing via external eating. The findings contribute towards the current literature on positive psychological constructs (i.e, self-compassion, mindfulness, and mindful eating) and eating behaviours amongst people with obesity. However, future research should explore such constructs amongst wider demographics, such as those from diverse ethnic and socio-economic backgrounds, which may potentially lead to important implications for weight loss and weight regulation interventions.

Declarations

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Author's contributions:

MH designed the study, collected data, conducted data analyses, and wrote the manuscript. HE, RK, RS, AT, and MM supported the study and reviewed the manuscript. MM supervised MH throughout this project. All authors gave their final approval of the manuscript.

Availability of data:

Data can be made available upon request to the corresponding author.

Conflict of interest:

The authors declare no potential conflicts of interest with respect to this study, the authorship and publication of this study.

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Consent for publication:

I, Misba Hussain, give my consent for the publication of this work to be published in this Journal and Article.

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Table 1

Bivariate Correlations Between Self-Compassion, Mindfulness, Mindful Eating, Emotional, External and Restrained Eating, Fat and Sugar Consumption and Grazing

	1	2	3	4	5	6	7	8	9
1. BMI									
2. SCS	-.105								
3. FFMQ	-.134	.642**							
4. MES	.064	.347**	.409**						
5. Emotional[a]	.116	-.227*	-.213	-.592**					
6. External[a]	.061	-.119	-.117	-.576**	.658**				
7. Restrained[a]	-.002	.053	.078	-.173	.198	.341**			
8. Fat[b]	-.195	-.070	-.089	-.466**	.410**	.480**	-.060		
9. Sugar[b]	-.119	-.039	-.176	-.213	.063	.186	-.026	.449**	
10. GS	-.061	-.222*	-.288**	-.497**	.314**	.576**	-.115	.588**	.446**

Note. SCS - Self-Compassion Scale; FFMQ – Five-Facet Mindfulness Questionnaire – Short Questionnaire; MES - Mindful Eating Scale; [a] – Subscales of the Dutch Eating Behaviour Questionnaire; [b] – Subscales of Fat and Sugar Scale; GS – Grazing Scale

**Correlation is significant at the .01 level.

*Correlation is significant at the .05 level.

Table 2

Mediation on the Effect of Mindful Eating on Fat Consumption and Grazing through External Eating and Emotional Eating

		External Eating			
		Std. β	*t*	*p*	95% *CI*
Fat Consumption	Total (*c*)	-.37	-4.71	.001	(-.53, -.22)
	Direct (c^1)	-.23	-2.48	.02	(-.42, -.05)
	Indirect (ab^1)	-.14			(-.28, -.02)
Grazing	Total (*c*)	-.32	-5.05	.001	(-.44, -.19)
	Direct (c^1)	-.15	-2.15	.04	(-.29, -.01)
	Indirect (ab^1)	-.17			(-.27, -.08)
		Emotional Eating			
		Std. β	*t*	*p*	95% *CI*
Fat Consumption	Total (*c*)	-.37	-4.71	.001	(-.53, -.22)
	Direct (c^1)	-.28	-2.89	.01	(-.47, -.09)
	Indirect (ab^2)	.09			(-.24, .04)
Grazing	Total (*c*)	-.32	-5.05	.001	(-.44, -.19)
	Direct (c^1)	-.30	-3.8345	.001	(-.46, -.14)
	Indirect (ab^2)	-.02			(-.12, 09)

Note. Total (*c*) = Direct (c^1) + Indirect External Eating (ab^1), Indirect Emotional Eating (ab^2)

Table 3

Mediation on the Effect of Mindfulness on Grazing through Emotional Eating

		Emotional Eating			
		Std. β	*t*	*p*	95% *CI*
Mindfulness	Total (*c*)	-.18	-2.66	.01	(-.31, -.04)
	Direct (c^1)	-.14	-2.12	.04	(-.27, -.01)
	Indirect (ab^2)	-.04			(-.09, .00)

Note. Total (*c*) = Direct (c^1) + Indirect Emotional Eating (ab^2)

Table 4

Mediation on the Effect of Self-Compassion on Grazing through Emotional Eating

		Emotional Eating			
		Std. β	*t*	*p*	95% *CI*
Self-Compassion	Total (*c*)	-.09	-2.01	.05	(-.17, -.00)
	Direct (c^1)	-.06	-1.52	.13	(-.15, 02)
	Indirect (ab^2)	-.02			(.07, .01)

Note. Total (*c*) = Direct (c^1) + Indirect Emotional Eating (ab^2)