

Obesity Treatment

Mindfulness-based interventions for obesity-related eating behaviours: a literature review

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Summary

Mindfulness-based interventions (MBIs) targeting eating behaviours have gained popularity in recent years. A literature review was conducted to determine the effectiveness of MBIs for treating obesity-related eating behaviours, such as binge eating, emotional eating and external eating. A search protocol was conducted using the online databases Google Scholar, PubMed, PsycINFO and Ovid Healthstar. Papers were required to meet the following criteria to be included in this review: (i) describe a MBI or the use of mindfulness exercises as part of an intervention; (ii) include at least one obesity-related eating behaviour as an outcome; (iii) include quantitative outcomes; and (iv) be published in English in a peer-reviewed journal. A total of **N = 21 papers** were included in this review. Interventions used a variety of approaches to implement mindfulness training, including combined mindfulness and cognitive behavioural therapies, mindfulness-based stress reduction, acceptance-based therapies, mindful eating programmes, and combinations of mindfulness exercises. Targeted eating behaviour outcomes included binge eating, emotional eating, external eating and dietary intake. Eighteen (86%) of the reviewed studies reported improvements in the targeted eating behaviours. Overall, the results of this first review on the topic support the efficacy of MBIs for changing obesity-related eating behaviours, specifically binge eating, emotional eating and external eating.

Keywords: Eating behaviour, literature review, mindfulness, obesity.

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Introduction

Obesity has become one of the most pressing health issues in the United States. According to the 2007–2008 National Health and Nutrition Examination Study (NHANES), 33.8% of adults in the United States are obese (1). The prevalence of obesity has more than doubled over the past three decades (2), and recent evidence indicates that this trend could continue if weight control interventions do not become consistently successful (3). The gravity of this problem is underscored by the fact that obesity is linked with chronic diseases (4–6) and decreased life expectancy (7). The growth of the obesity epidemic has been met with

attempts to intervene at many levels; however, most interventions for weight loss do not have successful long-term outcomes (8). Obese individuals who lose weight typically regain approximately one-half of the weight within the first year after weight loss (9), and an estimated 80% of individuals who lose weight return to or exceed their initial weight within three to five years (9).

Binge eating (10,11), emotional eating (10,12,13), external eating (13–15) and eating in response to food cravings (16,17) have been linked to weight gain and weight regain after successful weight loss. Binge eating is characterized by consumption of large amounts of food and loss of control over eating. Although prevalence estimates for binge eating

among obese individuals vary (11), evidence indicates that binge eating is a substantial issue among obese individuals. A recent study of binge eating in a community sample found that nearly 70% of individuals who engaged in binge eating were obese (18). Emotional eating is characterized by consumption of food in response to emotional arousal (19), and external eating is characterized by eating in response to external food-related cues (i.e. the sight, smell and taste of food) (20). Although there are no prevalence estimates for emotional and external eating behaviours, there is evidence that they are more common among obese individuals than normal-weight individuals (21). Food cravings have been shown to lead to obsessive thoughts about food and impulsive consumption of craved foods in some individuals, which increases the risk for weight gain (22). These eating behaviours are not typically addressed in weight loss interventions and may contribute to the lack of long-term intervention success (23,24).

Several hypotheses provide plausible explanations for how these eating behaviours are associated with weight gain. According to escape theory (25) and affect regulation models (26,27), individuals may use emotional eating or binge eating as maladaptive coping mechanisms in response to psychological distress and negative self-assessments (28). Obesity-related eating behaviours have been linked with depression, stress and anxiety (29), lending support to this explanation. The dysregulation model of obesity proposes that poor recognition of physical hunger and satiety cues can give rise to the inability to self-regulate eating behaviour (30,31). Psychosomatic theory posits that over-eating in response to emotions is caused by an inability to distinguish between emotional arousal and physical hunger (32). According to externality theory, individuals who engage in external eating over-eat because of a heightened sensitivity to external food cues (33). A commonality between these theoretical models is that they suggest problematic eating behaviours are associated with maladaptive responses to internal and external cues and with dysregulation of eating behaviours. Such issues are not addressed in conventional dietary weight loss interventions, which typically focus on restriction of caloric intake and food types (23).

In recent years, mindfulness has gained attention as an avenue through which problematic eating behaviours can be modified. Mindfulness is a quality of consciousness that is characterized by continually attending to one's moment-by-moment experiences, thoughts and emotions with an open, non-judgmental approach (34,35). Although it is considered to be an inherent quality, mindfulness can be cultivated through systematic training that involves practising various forms of mindfulness meditations and exercises (23). Interventions for health issues ranging from anxiety to substance use relapse have employed mindfulness practices (30,36). Several formal mindfulness programmes have been developed for clinical

treatments, including mindfulness-based stress reduction (MBSR) for pain management and stress-related disorders, mindfulness-based cognitive therapy (MBCT) for prevention of major depression relapse, and dialectical behaviour therapy to treat borderline personality disorder (36). The skills that mindfulness practices cultivate enhanced self-regulation by improving awareness of emotional and sensory cues (24,30,37,38), which may be important for altering one's relationship with food.

Mindfulness-based interventions (MBIs) have recently become a focus for the treatment of obesity-related eating behaviours. Previous systematic reviews have focused on MBIs for chronic pain (39,40), depression (41,42), anxiety disorders (43), stress reduction (44), cancer care (45–48), general psychological health (49), psychiatric disorders (50), speech pathologies (51), anorexia and bulimia (52), and substance use disorders (53). A recent integrative review provides a general overview on current trends in the field of mindfulness research for the treatment of obesity and eating disorders (54). It presents information from literature reviews on related topics, state of science reports, quantitative studies and qualitative studies, but does not present a synthesized assessment of intervention studies. The current review provides a systematic evaluation of the effectiveness of MBIs for obesity-related eating behaviours, assessing the types of mindfulness practices that have been employed, the outcomes the MBIs have targeted, and their effectiveness. This review is a systematic assessment of MBI studies for obesity-related eating behaviours that aims to answer the following question: are MBIs effective for changing obesity-related eating behaviours?

Methods

Data sources and search strategies

A systematic search was conducted to identify studies that describe the use of MBIs for obesity-related eating behaviours. Literature searches were conducted for papers published up to July 3, 2013. Papers were identified from the databases Google Scholar, PubMed, PsycINFO and Ovid Healthstar, as well as from references cited in reviewed papers. The search strategy was based on using combinations of the following keywords in the search databases: mindfulness, mindful, mindfulness meditation, eating, over-eating, binge eating, emotional eating, external eating, weight-related eating behaviours, obese, weight, intervention, and programme. Mindfulness interventions were defined as those that employed mindfulness exercises, including mindful eating, mindfulness meditation, mindful body scan or acceptance-based practices. Obesity-related eating behaviours were defined as eating behaviours for which there is evidence of an association with weight gain or obesity (binge eating, emotional eating, external eating,

eating in response to food cravings and unhealthy dietary intake) (55).

Inclusion and exclusion criteria

To be considered for full review, papers were required to meet the following inclusion criteria: (i) describe a MBI or the use of mindfulness exercises as part of an intervention; (ii) include at least one obesity-related eating behaviour as an outcome; (iii) include quantitative outcomes; and (iv) be published in English in a peer-reviewed journal. Papers that did not include eating behaviours associated with weight gain as outcomes were excluded. Papers that described MBIs for anorexia and bulimia were also excluded because these eating disorders are not typically related to obesity and weight gain. Additionally, papers that described single-participant case studies were not considered for review because of their limited generalizability.

Identification of relevant studies and data extraction

One author conducted paper screenings from September 2012 to July 2013. Potential papers were first identified by screening the paper title and then by screening the abstract. Papers that were considered relevant after title and abstract screenings were reviewed in full for final consideration of inclusion in the review. One author extracted study details from the reviewed papers. For studies that described statistically significant outcomes, a *P*-value of less than 0.05 was considered statistically significant.

Results

Included and excluded papers

As of July 3, 2013, our search protocol yielded a total of 1,296 papers. After initial review of paper titles and abstracts, 1,201 papers were considered ineligible for review because they were not relevant to the current review topic. Additionally, 52 papers were found to be duplicates. A total of 43 papers were retained from the search results for full review, and an additional 3 papers were identified for review from the reference sections of the retained papers. A total of 46 papers were reviewed in full for consideration of inclusion in this review. Of the 46 papers retained for full review, 10 papers were excluded because they were not intervention studies, 4 were excluded because they did not explicitly describe the intervention as mindfulness-based or as including mindfulness exercises, 8 were excluded because they did not include eating behaviours associated with weight gain or obesity as outcomes, 2 were excluded because they described single-participant case studies, and 1 was excluded because it was a disserta-

tion (not published as a peer-reviewed paper). A final sample of 21 papers was included in this review. Paper selection is depicted in Fig. 1.

Intervention characteristics

Study characteristics, sample characteristics and findings are presented in Table S1. Obesity-related eating behaviours that were targeted in the interventions included emotional eating (8,23,37,56–60), external eating (8,23,35,37,56, 58–62), binge eating (8,29,30,37,58,60,63–68), reactivity to food cravings (68,69), restrained eating (29,56), mindless eating (70) and unhealthy dietary intake (8,59,71). Several interventions ($n = 8$) aimed to treat more than one of these eating behaviours concurrently, targeting combinations of emotional eating, external eating and binge eating (8,23,29,37,56,58–60). Weight-related outcomes were also measured in 10 of the 21 studies (8,23,30,37, 57–59,67,68,71). Despite the fact that these interventions aimed to manipulate levels of mindfulness to change the targeted behaviours, only 11 studies measured mindfulness prior to and after the intervention (8,23,29,30,56,60,62, 64–66,70).

Intervention designs included randomized controlled trial (38%) (23,56,58,61,67,68,71,72) and pre-test–post-test designs (62%) (8,29,30,37,57,60,62–66,69,70). Twelve studies (57%) included overweight and obese participants. The interventions used a variety of multimodal approaches to implement mindfulness training. These included combined mindfulness and cognitive behavioural therapies (29,37,56,60,63), MBSR (8,35,45,66), acceptance-based therapies (57,58,69), mindful eating programmes (30,35,59,67,71), and combinations of mindfulness exercises (35,61,62,64,68,70). Many of the interventions that were designed for binge eating combined mindfulness and cognitive behavioural therapy-based exercises (29,37,60,63,65). Binge-eating interventions may have been designed to include cognitive behavioural therapy exercises because binge-eating treatments have traditionally been based on cognitive behavioural therapy (73).

Intervention effects

Overall, 18 of the 21 studies (86%) reported positive change in eating behaviour outcomes (23,29,30,37,56,57, 59,60,62–69,71,74). Of the 12 studies that targeted binge eating, 11 reported improvements in binge eating frequency and/or severity (29,30,37,58,60,63–68). Reported effect sizes for binge eating ranged from small (Cohen's $d = 0.36$) (66) to large (Cohen's $d = 3.02$) (68), with the majority of effects being large in size. Improvements in binge-eating behaviours were seen in studies that employed combined mindfulness and cognitive behavioural therapies

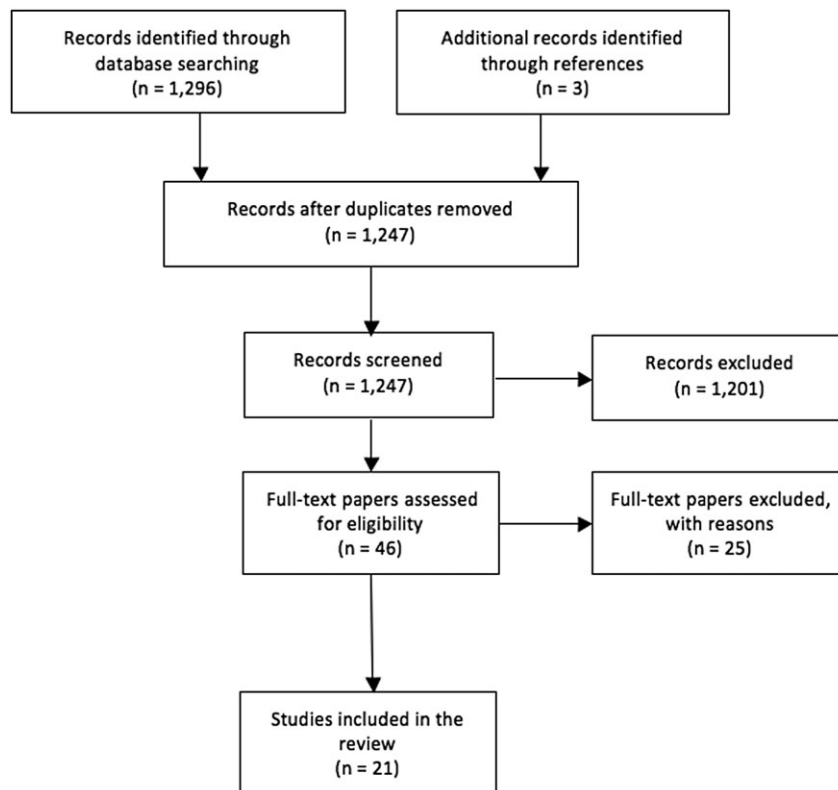


Figure 1 Process of paper selection.

(29,37,60,63), mindful eating programmes (30,67), acceptance-based practices (58) and combinations of mindfulness exercises (64,68). The only intervention that did not result in improved binge eating employed a general MBSR programme that focused exclusively on stress reduction and did not include content related to eating behaviours.

Emotional eating improved across the majority of studies that targeted this eating behaviour. Of the eight studies that included emotional eating as an outcome (8,23,37,56–60), five reported improvements in this eating behaviour (23,37,56,57,60). Reported effect sizes for emotional eating were moderate (Cohen's $d = 0.53$) (56) to large (Cohen's $d = 0.90$) (37). The interventions that resulted in positive emotional eating outcomes used combined cognitive and mindfulness therapies (37,56,60), mindfulness-based eating awareness training (MB-EAT) (23) and acceptance-based practices (57). Those that did not result in changes to emotional eating used MBSR (not modified to include mindful eating training) (8), mindful eating practices (59), and acceptance and commitment therapy (ACT) (58).

External eating improved across the majority of studies that aimed to improve this eating behaviour. Of the six studies that included external eating as an outcome (23,56,58,60–62), four reported improvements in external eating (23,56,60,62). Reported effect sizes for external eating ranged from moderate (Cohen's $d = 0.53$) (56) to

large (Cohen's $d = 0.70$) (23). Similar to binge eating and emotional eating, the interventions that used combined mindfulness and cognitive behavioural therapy approaches resulted in improved external eating (56,60). Two (23,62) of the three interventions that used combinations of mindfulness exercises (23,61,62) reported improvements in external eating. The studies that did not result in improved external eating included an intervention that employed ACT (58) and an intervention that employed a combination of mindfulness exercises (61). Of note is the fact that one of the interventions that did not result in external eating changes included only one intervention session (61), while the successful interventions included several sessions over periods of several weeks. The other intervention that was not successful in changing external eating did not include mindful eating training (58), while the successful interventions all included mindful eating components.

It is difficult to make any conclusions about the impact of MBIs on dietary intake because only three studies aimed to improve the diet of participants (8,59,71), and all three studies targeted different aspects of dietary intake. Of these, two resulted in positive dietary intake changes (59,71). Both of these studies employed mindful eating programmes, whereas the study that did not result in changes to diet employed a MBSR programme that was not adapted to include a mindful eating component (8).

Mindfulness improved across the majority of studies that measured mindfulness before and after the intervention. Of the 11 studies that measured mindfulness (8,23,29,30,56,60,62,64–66,70), 10 reported improvements in mindfulness measures (8,23,29,30,56,60,62,64–66). Reported effect sizes for change in mindfulness ranged from small ($\eta^2_p = 0.01$) (62) to large (Cohen's $d = 0.80$) (30). Mindfulness measures used in the studies that reported improved mindfulness included the Toronto Mindfulness Scale (62), the Philadelphia Mindfulness Scale (62), the Five Facet Mindfulness Questionnaire (8,62), the Kentucky Inventory of Mindfulness Skills (23,29,30), the Kentucky Inventory of Mindfulness Skills Extended (56), the Mindful Awareness Attention Scale (65,66), and the Cognitive and Affective Mindfulness Scale – Revised (60). The study that reported no improvements in mindfulness employed the Mindful Eating Questionnaire (70).

Several of the interventions had positive impacts on body weight outcomes. Of the 10 studies that included body weight outcomes (8,23,30,37,57–59,67,68,71), nine reported positive changes in body weight (i.e. weight loss or stabilized weight) among intervention participants (23,30,37,57–59,67,68,71). The average reported weight loss was 4.5 kg. Reported effect sizes for changes in body weight outcomes were small (Cohen's $d = 0.12$ (68) to 0.26 (23)). Studies reporting positive body weight results used a variety of mindfulness practices including combinations of mindfulness exercises (67,68), acceptance-based practices (57,58), mindful eating exercises (30,59), and programmes such as MBCT (23,37), MBSR (23) and MB-EAT (23,71), thus, not allowing us to make any firm conclusions about the comparative efficacy across MBIs on weight loss. No studies included follow-up periods for greater than 24 weeks, so longer-term maintenance of effects garnered from MBIs remain untested.

Discussion

This is the first review we know of that examines the use of MBIs for obesity-related eating behaviours. Findings synthesized by this review provide support for the use of MBIs to treat some obesity-related eating behaviours, including binge eating, emotional eating, and external eating, and to promote weight maintenance and weight loss.

Eleven out of the 12 studies that targeted binge eating (92%) reported improvements in binge eating frequency and/or severity, and the majority of reported effect sizes were large (average Cohen's $d = 1.39$). The importance of mitigating binge eating for the prevention and treatment of obesity is highlighted by the fact that binge eating is the most commonly reported problematic eating behaviour among obese individuals (75). Research shows that those who binge eat have poor responses to obesity interventions and tend to have rapid weight regain after successful weight

loss (75). The underlying cause of binge eating is explained by escape theory (25) and affect regulation models (26,27), which posit that binge eating is a maladaptive coping mechanism for psychological distress. Mindfulness training focuses on cultivating the skills necessary to be aware of and accept thoughts and emotions and to distinguish between emotional arousal and physical hunger cues. These skills target one's ability to cope with psychological distress in adaptive ways, ultimately leading to decreased binge eating (76). The results of this review support this, as they provide strong evidence for the efficacy of MBIs for the treatment of binge-eating frequency and severity.

Five out of the eight interventions that targeted emotional eating (63%) resulted in positive changes in emotional eating occurrence and/or the urge to emotionally over-eat, and reported effects from the successful interventions were moderate to large in size (average Cohen's $d = 0.67$). The involvement of emotional eating in weight gain is substantiated by the fact that it is linked with poor diet, including greater intake of energy-dense foods such as sweet and high-fat snacks (77), and lower fruit and vegetable consumption (78). There is also strong evidence that obese individuals engage in more emotional eating than non-obese individuals (79). Emotional eating is hypothesized to arise from a maladaptive emotion-regulation strategy that involves indulging in immediate impulses to eat in order to suppress negative feelings (80–82). Mindfulness training affords the skills to attend to negative feelings and accept them instead of acting on the impulse to immediately suppress them by eating, ultimately leading to decreased urges to emotionally over-eat. The findings synthesized by this review reflect this and provide moderate support for the use of MBIs to improve emotional eating urges and occurrence.

Four out of the six studies that targeted external eating (67%) reported improvements in external eating frequency, and the reported effects from successful interventions were moderate to large in size (average Cohen's $d = 0.65$). The importance of mitigating external eating for obesity treatment and prevention is highlighted by the fact that external eating is linked with poor dietary intake and over-eating (14,20,83). Externality theory posits that individuals who engage in external eating over-eat because of a heightened attentional bias to external food cues (33). Mindfulness training can mitigate external eating by teaching skills that help one to acknowledge but not act upon impulses, such as impulses to eat in reaction to the sight and smell of food. Despite the small number of reviewed studies that targeted external eating and reported improvements, this review found moderate support for the use of MBIs to improve external eating.

Nine out of the 10 studies that included body weight outcomes (90%) reported weight loss or weight maintenance. Although the reported effects on body weight from

successful interventions were small in size (average Cohen's $d = 0.19$), the findings from this review indicate that mindfulness training provides a promising approach for weight loss and weight maintenance. Mindfulness training provides individuals with skills that allow them to mitigate maladaptive eating behaviours, helping them to develop positive relationships with food. More adaptive eating styles ultimately support weight loss and weight maintenance. The findings from this review reflect this and provide moderate support for the use of MBIs for weight loss and weight maintenance in individuals who engage in obesity-related eating behaviours.

This review found a lack of support for the ability of MBIs to affect positive change in dietary intake. This is due to the fact that few of the reviewed studies aimed to change dietary intake, and the dietary outcomes varied across the studies that did aim to change diet. Two of the three studies that targeted dietary intake reported improvements in unhealthy dietary intake after the MBIs, so the potential for mindfulness training to improve dietary patterns should not be discounted. Future research should aim to further study the impact of MBIs on dietary intake in order to determine if cultivation of mindfulness skills can reliably influence dietary intake, and which dietary outcomes are most modifiable by MBIs.

Similar to reviews on MBIs for other health outcomes, this review found a range of effect sizes of MBIs for obesity-related eating behaviours and weight outcomes. A review on the use of MBIs for the treatment of depression and the prevention of depression relapse found that effect sizes ranged from small to large (42). Similarly, a review of MBIs for substance use treatment found small to large effect sizes for substance use and relapse-related outcomes (53). One review that assessed MBIs for anorexia and bulimia did not report effect sizes, but concluded that findings from the review provided evidence to support the use of MBIs for clinical eating disorders (52). Results from these reviews indicate a similar range of effectiveness of MBIs for obesity-related eating behaviours and weight outcomes as for a variety of other health outcomes.

Overall, this review found positive results for obesity-related eating behaviour outcomes with a variety of mindfulness training implementations, including combinations of mindfulness and cognitive behavioural practices, mindful eating programmes, acceptance-based programmes, and programmes that used combinations of mindfulness exercises. The fact that many different types of mindfulness exercises were used in the reviewed studies for a number of different outcomes indicates that the cultivation of mindfulness skills by various mindfulness-based approaches can improve obesity-related eating behaviours. This suggests that mindfulness training can be accessible in many forms and tailored to the specific needs of obese individuals who could benefit from MBIs. Providing indi-

viduals with the skills to change their eating behaviours, develop more adaptive responses to emotional distress and improve their relationships with food through the cultivation of mindfulness skills poses a promising approach for obesity prevention and treatment.

Limitations

Despite the rigorous search criteria and study reviews conducted, there are limitations to this review that should be acknowledged. This review only included studies that were published in English in peer-reviewed journals. Thus, some relevant literature in other languages may have been excluded. As the literature on MBIs for obesity-related eating behaviours is relatively small, the conclusions made in this review are preliminary. More research is needed before definitive conclusions can be derived about their efficacy.

There are also limitations to many of the studies included in this review. Many of the studies did not report comprehensive sample characteristics such as participant ethnicity (29,56,58,60,61,63,65,66,68,69). Samples were predominantly homogenous. Nineteen of the 21 studies (90%) included samples that were comprised of either all female or mostly female participants (23,29,30,37,56–71). Additionally, of the 11 studies that reported participant ethnicities, 10 had samples that were comprised of mostly Caucasian participants (8,23,30,37,57,59,62,64,67,71). The fact that most of the samples were predominantly or all women may be explained by two reasons. First, the studies that included only female participants used the justification that the eating behaviours that were targeted have a higher prevalence among women than men. However, evidence shows that obesity-related eating behaviours such as binge eating, emotional eating, external eating, and poor dietary intake are prevalent among men as well as women (84). Second, women may be more likely to admit to and seek treatment for problematic eating behaviours than men (85). These limitations may compromise the generalizability of the findings from these studies to men and more diverse ethnic groups.

Few studies proposed a theoretical basis. Seventeen (81%) of the studies did not cite a theoretical framework. Among the four studies that did cite a theoretical framework (8,29,59,70), one study cited theoretical frameworks for mindfulness (8), and two studies applied theories to explain the origins of problematic eating behaviour (Expectancy Theory and Emotion Regulation Model (29) and self-regulation theory (70)). Only one study cited a theoretical model of behaviour change that was used to guide the intervention design, the Health Promotion Model (59,86). No other behavioural theories to guide intervention design were described. Half of the studies did not measure changes in mindfulness, despite the fact that

several measures have been created and validated for assessment of mindfulness, including the Kentucky Inventory of Mindfulness Skills (87), the Mindful Awareness and Attention Scale (34), and the Five Facet Mindfulness Questionnaire (88). These limitations make it difficult to determine whether improved mindfulness was a mechanism functioning on the observed outcomes in some of the studies.

Future directions

This review finds that MBIs are promising for the treatment of eating behaviours related to weight gain and obesity. However, this nascent field requires future research to fill several gaps. Future studies should implement these interventions in different populations than those that have been featured in the literature, which have been predominantly Caucasian female adults. Obesity-related eating behaviours are prevalent among men as well as women, but men often do not receive treatment (85). Not only would applying these interventions to male populations be informative for clarifying their overall efficacy, it would help determine whether MBIs are an appropriate and effective approach for men. Future studies should include samples with greater ethnic diversity to establish the generalizability of these interventions across different populations, and implement MBIs for obesity-related eating behaviours in childhood and adolescence. Assessing longer-term effects of MBIs with follow-up periods of 6 months or greater would help clarify maintenance effects of treatment. Future studies should also routinely measure changes in mindfulness to determine whether improved mindfulness is the mechanism for improved eating behaviour outcomes. Studies comparing MBIs with other treatments can illuminate the comparative efficacy of mindfulness training to other approaches for treatment of obesity-related eating behaviours.

Conclusions

MBIs are used to treat a variety of health-related issues, and have recently gained popularity for obesity-related eating behaviours. There is much to be examined in this field of research, but preliminary findings indicated in this review are promising. The outcomes from the reviewed studies provide evidence to support the use of MBIs for obesity-related eating behaviours, including binge eating, emotional eating and external eating. Given the extent of the obesity epidemic, novel approaches to support weight loss are needed. MBIs are poised to complement obesity prevention and treatment efforts. This review concludes that MBIs have growing empirical support as a promising psychoeducational and behaviour-based treatment for obesity-related eating behaviours.

Conflicts of interest statement

The authors have no conflicts of interest to disclose.

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Supporting information

Additional Supporting Information may be found in the online version of this article, <http://dx.doi.org/10.1111/obr.12156>

Table S1 Study characteristics, sample characteristics and empirical findings.

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