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PSYCHOLOGICAL ISSUES (V DRAPEAU AND S SOGG, SECTION EDITORS)

Mindfulness Approaches and Weight Loss, Weight Maintenance, and Weight Regain

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Abstract

Purpose of Review There is an urgent need for effective weight management techniques, as more than one third of US adults are overweight or obese. Recommendations for weight loss include a combination of reducing caloric intake, increasing physical activity, and behavior modification. Behavior modification includes mindful eating or eating with awareness. The purpose of this review was to summarize the literature and examine the impact of mindful eating on weight management.

Recent Findings The practice of mindful eating has been applied to the reduction of food cravings, portion control, body mass index, and body weight. Past reviews evaluating the relationship between mindfulness and weight management did not focus on change in mindful eating as the primary outcome or mindful eating as a measured variable.

Summary This review demonstrates strong support for inclusion of mindful eating as a component of weight management programs and may provide substantial benefit to the treatment of overweight and obesity.

Keywords Mindful eating · Weight · Weight loss · Weight maintenance · Weight regain · Obesity · Overweight · Mindfulness · Awareness · Meditation · Acceptance-based behavior therapy (ABBT) · Mindfulness-based stress reduction · Literature review

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Introduction

The USA has experienced a steady rise in the prevalence of obesity during the past 30 years with more than one third of the adult population now considered overweight or obese [1]. Obesity is the second leading cause of preventable death and is associated with increased risk of chronic illness including hypertension, type 2 diabetes, and cardiovascular disease [2, 3]. In addition, obesity has been shown to effect psychological health and is associated with increased rates of depression, anxiety, and reduced quality of life [4, 5]. These psychological states can negatively impact weight loss and weight management attempts [6, 7]. There is an urgent need for effective weight management techniques, as obesity continues to contribute negatively to social, economic, and personal consequences [8].

Evidence suggests that weight loss in individuals who are overweight or obese may prevent or reduce many of the risk factors for chronic illness [9–15]. Various strategies may be used to address weight loss including caloric restriction, physical activity, pharmacotherapy, or bariatric surgery. Recommendations for weight loss include a combination of reducing caloric intake, increasing physical activity, and

behavior modification [16]. As a part of behavior modification, mindfulness-based practices have been introduced as a potential strategy for weight management interventions.

Mindfulness and Obesity

In recent years, there has been an increase in the literature associating mindfulness and obesity [17]. Mindfulness refers to the learned ability to be open, accepting, and present in the moment [18]. The practice of mindfulness includes being consciously aware of habitual patterns of thoughts, emotions, and behaviors and thus allowing for adaptive responses [19]. Being consciously aware of habitual patterns allows an individual to have the ability to better control emotional reactions and adapt as needed [20]. In addition, mindful individuals demonstrate more self-compassion, self-regulation, self-control, and emotional regulation [21–25].

Mindfulness vs. Mindful Eating

An increase in mindfulness allows an individual to modify responses rather than continue habitual behavioral patterns to lose or maintain weight [26]. The practice of mindfulness has been applied to the reduction of food cravings, [27, 28], portion control [29], body mass index (BMI) [30–34], and body weight [30, 31, 33, 34]. Mindful eating refers to an individual maintaining a "non-judgmental awareness of [one's] physical and emotional sensations while eating or in a food-related environment" (p.1439) [18]. Mindful eating increases an individual's sensitivity to the physical signs of hunger, satiety cues, pace of eating, the food environment, and food characteristics [18, 29, 35]. These cues are fundamental to self-regulation, which controls the urge to consume high-calorie foods [36]. In addition, research has found that individuals practicing mindful eating also have lower problematic eating behaviors [27] and consume smaller serving sizes of energy dense foods [29].

Past reviews have summarized studies evaluating the relationship between mindfulness and weight management [26, 37, 38]. O'Reilley and colleagues [37] reviewed mindfulness-based interventions for obesity-related eating behavior and determined an improvement in binge eating and emotional eating. Katterman and colleagues [38] also reviewed mindfulness interventions for binge eating and emotional eating, and they too found a positive correlation; however, neither review focused on change in mindfulness as the primary outcome or mindful eating as a measured variable. Olson and colleagues [26] reported significant weight loss across most of the studies included in their review; however, evidence of a relationship between change in mindfulness and weight loss was limited. Articles included in this review came from various sources opposed to strictly peer-reviewed journals. We found no prior review that focused on change in mindfulness, specifically mindful eating, as it relates to weight loss, weight maintenance, or weight regain.

The purpose of this review was to conduct an integrative review of the literature and examine the impact of mindful eating on weight loss, weight maintenance, and weight regain.

Methods

Search Strategy

Studies were identified through a literature search of the electronic university library and Google Scholar. The initial search included the keywords *mindfulness*, *mindful eating*, and *weight loss.* Keywords were chosen based on our interest in mindfulness in general and mindful eating specifically and their relation to weight. Articles from the university library and Google Scholar were assessed to determine if mindfulness and weight were measured.

After completing the broad search, duplicates were removed, and the remaining study titles and abstracts were screened for possible inclusion. Articles were then excluded to only include those examining mindful eating and weight management. Eligible studies were read in full and those meeting specific inclusion criteria were included in the review. The last database search was completed 14 September 2017. The authors continued to hand search the reference lists of relevant studies and literature reviews to identify additional articles. The last hand search was performed on 28 September 2017.

Inclusion and Exclusion Criteria

This integrative review assessed various studies focused on mindful eating as it relates to weight management. For a study to be included in the review, it must be written in English and published in a peer-reviewed journal from 2012 to present. Each study must focus on adult participants (≥ 18 years old). Previous systematic reviews have demonstrated the significant effects mindfulness practices can have on overall health, including stress reduction [39], blood pressure [40, 41], and diabetes [42, 43]. To determine how mindful eating directly affects body weight, each study included must include an outcome of weight loss, weight maintenance, or weight gain in relation to mindful eating. Mindfulness as a general practice was excluded if mindful eating behaviors were not discussed and if the measurements did not include body weight or body mass index (BMI). Studies focusing on mindfulness and eating disorders were excluded, as ample research has demonstrated the impact of mindfulness on eating disorder treatment [27, 44, 45]. Review articles were excluded from this review; however, individual articles that met our inclusion criteria were pulled for further examination.

Literature Selection Process

A literature search was conducted using an electronic university library database and Google Scholar. The initial search included the keywords *mindfulness*, *mindful eating*, and *weight loss*, which generated more than 50,000 articles in both databases. The list was then narrowed down to only those with a publication date after 2012 and excluded dissertations, book reviews, and newspaper articles. Intervention design was not limited to randomized control trials (RCTs). After including these criteria, 5135 studies remained. Studies were then narrowed to only include those with *mindfulness* in the title, which yielded 256 results. Of the 256 results, 27 were examined in further detail as they discussed mindful eating and closely aligned with the inclusion criteria. During the review of the 27 articles, authors continued to hand search the reference list of relevant studies to identify additional articles, which resulted in a total of 34 studies. An evaluation for the quality of evidence was not completed on these studies. A thorough review of these articles excluded additional studies for the following reasons: body weight outcomes were not reported, study was a theoretical framework and did not include an intervention, or if mindful eating strategies were not an integral part of the intervention. Upon further examination and the determination of discussed exclusion criteria, 12 studies remained (Fig. 1). Articles that were included were the consensus of all authors.

Article Characteristics

Table 1 provides a summary of the most pertinent characteristics for each included mindful eating article included in this review. Summarized information was grouped by (1) year, lead author, and title, (2) study purpose, (3) participant characteristics, (4) study design including how mindful eating or mindfulness was addressed, (5) tool(s) used to measure mindful eating or mindfulness, (6) results, and (7) conclusion. Summarized articles from this literature review included randomized control trials, pre-post study, single-group study, cross-sectional study, and mixed-method study designs.

Results

Results of this literature review produced published results of mindfulness-based interventions that focused on how mindful eating affects weight loss, weight maintenance, or weight gain. The primary components used to deliver mindful eating through these interventions include acceptance-based behavioral therapy, meditation, mindfulness-based stress reduction, and group mindful eating intervention. Study designs included RCTs, mixed methods, single-group interventions, and pre-post interventions with no control group. In addition, there was one *cross-sectional study* that examined the association between mindful eating and weight in the general population.

Acceptance-Based Behavioral Therapy

Acceptance-based behavior therapy (ABBT) is a group of cognitive based therapies that focus on increasing awareness of internal experiences and emotions and identifying ways to accept those emotions and experiences as temporary and not fixed character traits. A key component of ABBT is using mindfulness strategies to identify emotions rather than avoid them. Four studies [27, 46–48] investigated the effect of ABBT on weight loss. Goodwin and colleagues [46] tested the initial effectiveness of ABBT in a pilot study designed to increase adherence to behavioral recommendations among cardiac patients. The focus was on adapting acceptance commitment therapy (ACT), which promotes mindful acceptance of one's feelings and thoughts (e.g., disliking physical activity), while engaging in activities that are consistent with one's goals (e.g., goal of increasing physical activity) [46]. Participants were enrolled in four, 90-min group sessions that focused on mindfulness and distress tolerance skills. Mindfulness was incorporated in the intervention through the practice of distress tolerance and was measured by multiple scales. Participants were then asked to identify previous attempts to adopt a heart-healthy lifestyle (increased physical activity, decreased caloric, fat, and sodium intake) to demonstrate that control-based strategies (e.g., distraction from thoughts, attempts to change feelings about exercising) are ineffective. Instead, participants should try an acceptance-based approach. Participants monitored their weekly goals and willingness to experience distressing thoughts and feelings related to incorporating these healthy lifestyle changes. To increase distress tolerance, participants were encouraged to recognize that the distress associated with healthy eating and physical activity is expected and cannot be suppressed without producing more distress. Strategies to promote defusion (e.g., distancing oneself from unhelpful thoughts, feelings, and beliefs) were used to promote the return of their thoughts to the present moment. Defusion was also introduced as a strategy to help participants increase their ability to experience distressing thoughts, feelings, and sensations to engage in difficult behavior change, such as adopting heart-healthy behaviors. Participants reported high treatment satisfaction and made positive changes in diet and physical activity. This study concluded that ABBT appears to be promising as a novel approach for improving healthy behaviors [46].

Niemeier and colleagues [47] tested the preliminary acceptability and efficacy of a 24-week ABBT for weight loss among overweight and obese adults who reported difficulty with eating in response to emotions and thoughts. Behavioral skills were taught in the context of how it may relate to

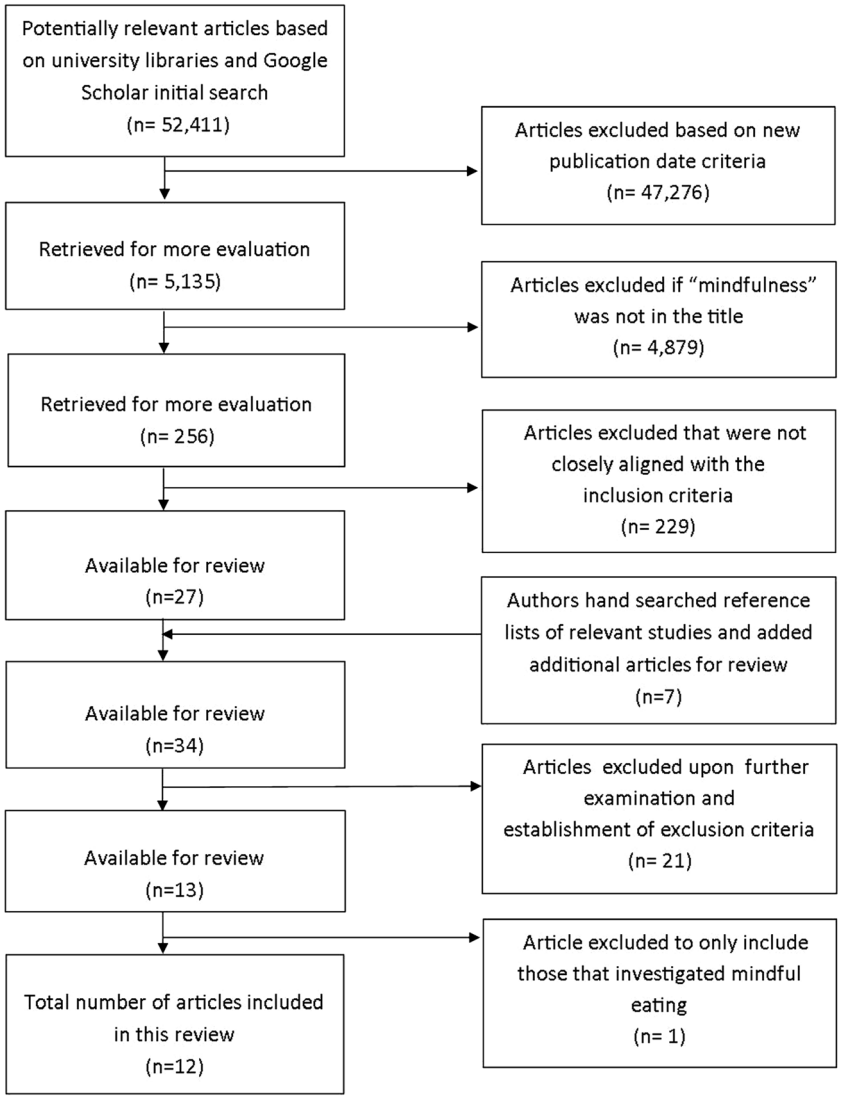

Fig. 1 Flow diagram of the literature search process. This flow diagram shows the search results and study selection process. Transitions, →. *n* number

thoughts, emotions, and ultimately greater valued living. Behavioral skills to increase mindful eating included problem-solving barriers to accurate food monitoring, such as a discussion around specific thoughts and feelings that may lead participants not to complete their food diary. Additionally, acceptance-based skills, such as mindfulness and defusion, were continually expanded upon and consistently incorporated into later lessons. Participants had significant weight loss at the end of the intervention (− 12.0 kg, $p < .0001$) and were able to maintain the weight loss at the 3-month follow-up (− 12.1 kg, $p < .0001$) [47].

Forman and colleagues [48] conducted a randomized controlled trial (RCT) including overweight participants to assess whether ABBT would result in greater weight loss compared to a control group. The standard behavioral treatment group (SBT) followed a standard weight loss protocol that included healthy eating and physical activity. The ABBT group focused on acceptance- and commitment-based strategies designed to improve adherence to healthy eating and physical activity goals. The strategies included three key factors of non-compliance, including erosion of commitment, distress intolerance, and mindless eating. Mindful eating was addressed in this intervention to help participants be more aware of their moment-to-moment behavior choices and to focus more on their ultimate goals (e.g., healthy eating and physical activity adherence) instead of an immediate need to decrease an unpleasant situation (e.g., deprivation of unhealthy foods and discomfort exercising). Both groups had significant weight loss. Weight loss was significantly higher in ABBT than SBT at post-treatment and 6-month follow-up. This study concluded that these results offer strong support for the inclusion of acceptance-based skills into behavioral weight loss treatments [48].

Alberts and colleagues [26] explored the effects of a mindfulness-based intervention on eating behavior, food cravings, dichotomous thinking, and body image. This RCT

Table 1 Characteristics of included mindful eating articles

Year, lead author, reference	Study purpose	Participant characteristics	Study design	How mindful eating or mindfulness was addressed	How mindful eating or mindfulness was measured	Results	Conclusion
Acceptance-based behavior therapies (ABBT)							
2012, Goodwin, [46].	To test the feasibility, acceptability, and preliminary effectiveness of an acceptance based behavior therapy (ABBT) program and to gather preliminary evidence regarding potential mechanisms of action of the intervention, including mindfulness, distress tolerance, and values clarity	10 female and 6 male outpatient cardiac participants aged 32–73 who experienced a myocardial infarction or had unstable angina and a BMI > 25 ($n = 16$)	Pre-post with no control group; participants attended four, 90-min group sessions.	Mindfulness is a component of ABBT. Mindfulness is a psychological factor measured in ABBT along with values clarity and intolerance of discomfort.	Food Acceptance & Action Questionnaire (FAAQ) and Philadelphia Mindfulness Scale (PHLMS)	Participants made positive changes from pre- to post- treatment in diet, weight (− 4.85 lb, $p < .0001$), BMI (− 0.74, $p = .10$), and modest improvements in physical activity (8451 METS, $p = 0.22$).	Results show that participants reported high treatment satisfaction and made positive changes in diet and physical activity. ABBT seems promising as a novel approach for improving healthy behaviors.
2012, Niemeier, [47].	To examine the preliminary acceptability and efficacy of a 24-week acceptance-based behavioral intervention, which is a form of ABBT, for weight loss	Female and male participants with a mean age of 52.2, mean BMI of 32.8, and a minimum of a 5 on the internal disinhibition score of the Eating Inventory ($n = 21$)	Single-group design with 2 simultaneous cohorts; 24 week group intervention that included assessments at baseline, end of intervention, and 3-month follow-up.	Acceptance-based strategies included mindfulness-based cognitive therapy. Lessons incorporated mindfulness concepts.	Eating Inventory, Acceptance and Action Questionnaire for Weight-Related Difficulties, and Distress Tolerance Scale	Participants who experienced greater decreases in weight-related experiential avoidance were associated with greater weight loss at the end of the program (− 12.0 kg, $p < .0001$) and at 3-month follow-up (− 12.1 kg, $p < .0001$). BMI was also reduced (− 4.4, $p < .0001$) and maintained at 3-month follow-up.	Results show using acceptance-based treatment may enhance overall weight-loss outcomes in behavioral programs and provide a substantial benefit to the treatment of obesity.
2013, Forman, [48].	To determine whether acceptance-based behavioral treatment (ABBT) would result in greater weight loss than standard behavioral treatment (SBT)	Female and male participants with mean age of 46.9, mean BMI of 34.1, and the ability to participate in physical activity ($n = 128$)	RCT randomly assigned participants to either ABBT or SBT intervention; participants attended 30 or 75-min group based sessions over 40 weeks. Assessments were conducted at baseline, 10, 20, 40 weeks, and 6-month follow-up.	The intervention incorporated mindfulness training designed to help individuals increase awareness of their perceptual, cognitive, and affective experiences.	Mindful Attention and Awareness Scale, Barratt Impulsivity Scale, Cognitive-Behavioral Avoidance Scale	Participants in both groups had significant weight loss. Weight loss was significantly higher in ABBT than SBT at post (13.17 vs. 7.54%, $p = 0.01$) and 6-month follow-up (10.98 vs. 4.83%, $p < 0.01$).	Results offer strong support for the inclusion of acceptance-based skills into behavioral weight loss interventions and higher success at 6-month follow-up.
2012, Alberts, [27].	To explore the efficacy of a mindfulness-based intervention for	Female participants with a mean age of 48.5, mean BMI of 32.7 who	RCT with an intervention group (n-12) and wait-listed control	The program curriculum consisted of five core components: mindful	Kentucky Inventory Mindfulness Skills Extended, Dutch Eating	The intervention group had significantly greater decreases in food	Results show that practicing mindfulness can be an effective way

Table 1 (continued)

Year, lead author, reference	Study purpose	Participant characteristics	Study design	How mindful eating or mindfulness was addressed	How mindful eating or mindfulness was measured	Results	Conclusion
	problematic eating behavior	experienced one or more of the following types of problematic eating: emotional eating, stress related eating, eating without awareness and/or overeating ($n = 26$)	group ($n = 14$); participants attended 8, 2.5 h sessions for 8 weeks and control group received the intervention after 10 weeks; Assessments were completed at baseline and post-intervention.	eating, awareness of physical sensations, awareness of thoughts and feelings related to eating, acceptance and non-judgment of sensations, thoughts, feelings and body, awareness and step-by-step change of daily patterns and habits of eating and physical activity.	Behavior Questionnaire, Body Shape Questionnaire, The Dichotomous Thinking Scale, General Food Craving Questionnaire Trait	cravings, dichotomous thinking, body image concern, emotional eating and external eating. The intervention group also had a significant increase in trait mindfulness than the control group. The control group had a significant reduction of BMI (-0.23, $p < 0.05$) while the intervention group only had a marginally significant BMI reduction (-0.38, $p = 0.07$).	to reduce factors associated with problematic eating.
Meditation 2014, Mantzios, [49•].	To determine the effectiveness of mindfulness and self-compassion by using food diaries that required the participant to focus on concrete (e.g., how they are eating) construals or abstract (e.g., why they are eating) construals.	Study 1: 119 female and 124 male students at a university in Greece with a mean BMI of 25.62 ($n = 243$) Study 2: 30 female and 42 male undergraduate students at a university in Greece with a mean age of 21 and a mean BMI of 25.5 ($n = 72$) Study 3: 41 female and 57 male undergraduate students at a university in Greece with a mean age of 23.3 and a mean BMI of 25.79 ($n = 98$)	Pre-Post with no control group; The study included three separate and independent interventions among college students in Greece.	Mindfulness and self-compassion were introduced by using food diaries that required the participant to either focus on concrete (e.g., how they are eating) construals or abstract (e.g., why they are eating) construals.	Self-compassion scale, Mindful Attention and Awareness Scale, Automatic Thoughts Questionnaire, and a Cognitive Behavioral Avoidance Scale	The first study found that mindfulness and self-compassion mediated an inverse relationship between negative thoughts and weight loss. The second study found that food diaries that focused on how a behavior happens (concrete construal) were significantly more likely to affect weight loss than diaries that focused on why a behavior happens (abstract construal). The third study found there was not a significant difference in weight loss between those who participated in meditation and those who only participated by writing in diaries but at 3 months those who	Follow-up results show that concrete construal diaries may promote mindfulness and self-compassion and potentially promote long-term weight loss.

Table 1 (continued)

Year, lead author, reference	Study purpose	Participant characteristics	Study design	How mindful eating or mindfulness was addressed	How mindful eating or mindfulness was measured	Results	Conclusion
						wrote in diaries performed better.	
2015, Mantzios, [50•].	To explore if mindfulness meditation vs. mindfulness with self-compassion meditation supports weight loss and maintenance	45 female and 43 Greek male military employees, with a mean age of 22.03, mean BMI of 26.6, and an intention and motivation to lose weight ($n = 63$)	RCT with participants assigned to either the mindful meditation, mindful self-compassion, or control group; the control group received no intervention, while the 2 groups received either a 2 or 3 day training followed by a 20–30 min guided meditation sessions 3 times a week for 5 weeks. Assessments were completed pre, week 5, 6-month follow-up and 12-month follow-up.	Meditation sessions offered only to intervention groups included topics such as "mindful hunger awareness", "mindful eating meditation," "troublesome foods' meditation."	Neither mindful eating nor mindfulness were measured.	The mindfulness with self-compassion group lost more cumulative weight (− 3.0 kg) at the 12-month follow-up than mindful meditation group (− 1.6 kg) or the control group (− 1.8 kg) but the difference was not statistically significant.	Results show that developing both mindfulness and self-compassion may be more promising for weight loss than developing mindfulness alone or simply dieting.
2012, Timmerman, [33].	To evaluate the effect of a mindful restaurant eating intervention on weight management	Females with a mean age of 4.6, mean BMI of 33.9, and eat out at least 3 times per week ($n = 35$)	RCT with an intervention group ($n = 19$) and control group (n = 16); the control group received no intervention; intervention included 6 weekly, 2-h small group sessions.	Intervention included six weekly topics on eating out and mindfulness meditations that included hunger, satiety, and emotional eating cues.	Neither mindful eating nor mindfulness were measured.	Participants in intervention lost more weight (− 0.38, $p = 0.03$ and had lower daily calorie intake (769 kcal, $p = 0.002$), increased diet-related self-efficacy, fewer barriers to weight management.	Results show that this particular mindfulness intervention showed positive change in behaviors related to weight management.
2012, Miller, [34].	To compare the impact of mindful eating (MB-EAT-D) to diabetes self-management education (Smart Choices)-based treatment on weight outcomes	Female and male participants with a mean age of 54, mean BMI of 36, have had diabetes for at least 1 year ($n = 52$)	RCT with parallel interventions using the MB-EAT-D ($n = 27$) and Smart Choices ($n = 25$) diabetes education curriculum; 10, 2.5 h sessions over 3 months; assessments were completed pre, post, and at the 3-month follow-up.	One arm of the study included mindful meditation, eating, and practice of physical activity and body awareness. Participants were encouraged to cultivate "inner wisdom" (i.e., mindful awareness related to eating).	Neither mindful eating nor mindfulness were measured.	Both groups showed weight loss. The weight change differences between MB-EAT-D (−1.53 kg.) and Smart Choices (−2.92 kg.) were not significant (p = 0.07) when measured at the 3-month follow-up.	Training in mindful eating and diabetes self-management education facilitated improvement in dietary intake, modest weight loss, and glycemic control.
Mindfulness-based stress reduction							
2016, Daubenmier, [52•].	To determine whether adding mindfulness-based	Female and male participants with a mean age of 47 and a	RCT with a mindfulness intervention group ($n = 100$) and control	The mindfulness intervention added mindfulness training for	Neither mindful eating nor mindfulness were measured.	The mindfulness group had more weight loss at 12-month follow-up	Results show that adding mindfulness to a diet and exercise program

Table 1 (continued)

Year, lead author, reference	Study purpose	Participant characteristics	Study design	How mindful eating or mindfulness was addressed	How mindful eating or mindfulness was measured	Results	Conclusion
	eating and stress management practices to a diet-exercise program improves weight loss and metabolic syndrome components	mean BMI of 35 ($n = 194$)	group ($n = 94$). Both groups participated in a 5.5 month intervention; Assessments were completed pre, 3, 6, 12, and 18 months after the intervention started.	stress management, eating, and exercise.		(− 1.9 kg, $p = 0.17$) but it was not statistically significant. The difference was maintained at 18 month follow-up 9–1.7 kg, $p = 0.24$). There were significant changes in fasting blood glucose at 18 months.	did not show substantial weight loss benefit but may promote long-term improvements in some aspects of metabolic health.
2016, Mason, [53•].	To determine the effectiveness of mindfulness training on overcoming two barriers to long-term weight loss: (1) reward-driven eating and (2) psychological stress	Female and male participants with a mean age of 47 and a mean BMI of 35 ($n = 194$)	RCT with a mindfulness intervention group ($n = 100$) and control group ($n = 94$). Both groups participated in 12 weekly group sessions (2.5 h), 3 biweekly sessions, 1 follow-up sessions, and all day-weekend session over 5.5 months. Assessments were completed pre, 6, 12, and 18 months after the intervention started.	Mindfulness training was incorporated into one arm of the study to address lack of control over eating, a preoccupation with food, a lack of satiety, and psychological stress. Mindfulness training promoted awareness of hunger and satiety cues, self-regulatory control, and stress reduction.	Reward-based Eating Drive (RED) scale assessed three dimensions of the hedonic drive to eat: (1) loss of control, (2) lack of satiety, (3) preoccupation with food, containing two items from the Binge Eating Scale; four items from the Three Factor Eating Questionnaire; and three original items	Mindfulness (relative to control) participants had significant reductions in reward-driven eating at 6 months (post-intervention), which, in turn predicted weight loss at 12 months.	Results show that reducing reward-driven eating, achieved using a diet and exercise intervention that includes mindfulness training, may promote weight loss. Further, integrating mindfulness into weight loss interventions leads to greater reductions in reward-driven eating.
Group mindful eating							
2013, Kidd, [54].	To describe the effect of an 8-week mindful eating group intervention on mindful eating, self-efficacy for weight loss, depression, and biomarkers of weight, BMI, body fat, and blood pressure	Females from one inner city housing community and two urban clinics at least 30 years of age with a mean BMI of 44.7 ($n = 12$).	Mixed methods with one pre-test/post-test group; 8, 60–90 sessions followed by a semi-structured focus group	An 8-week mindful eating intervention, based on seven mindful eating principles described in the workbook *Eat, Drink, and Be Mindful*. Data was collected at baseline and 8 weeks followed by a focus group.	Weight Efficacy Lifestyle Questionnaire, Mindful Eating Questionnaire Center for Epidemiologic Studies-Depression Scale	Self-efficacy for weight loss increased significantly from baseline to 8 weeks. Participants reported higher self-efficacy for eating habits and no significant change in depression, mindful eating, weight (− 1.6 lb, $p = 0.56$), BMI (− 0.03, $p = 0.47$), body fat percentage (0.0, $p = 0.96$), or blood pressure – 4/8, $p = 0.33$). Qualitative findings of mindful eating supported quantitative findings.	Results reinforce the benefits of group support to induce behavioral change and indicate that nurses can help clients improve their physical and emotional health by helping increase awareness and mindful eating.

Table 1 (continued)

Year, lead author, reference	Study purpose	Participant characteristics	Study design	How mindful eating or mindfulness was addressed	How mindful eating or mindfulness was measured	Results	Conclusion
Cross-sectional analysis							
2015, Camilleri, [55•].	To examine the relationship between mindfulness scores and weight status in a large sample of the adult general population in France	Females ($n = 49,228$) and males ($n = 14,400$) with a mean age of 48.6 and a mean BMI of 24.1 ($n = 63,628$)	Cross-sectional analysis of participants in the NutriNet-Santé study, a population based ongoing prospective observational cohort study in France.	The association between mindfulness and weight status was assessed; however, no specific intervention was used.	Five Facet Mindfulness Questionnaire	Women with higher dispositional mindfulness were less likely to be overweight (OR quartile 4 vs. 1 = 0.84, 95% CI 0.79–0.90). In men, higher mindfulness was associated with lower odds of obesity (OR quartile 4 vs. 1 = 0.81 (0.69, 0.96).	These results support the use of mindfulness as a possible component to address obesity.

RCT randomized control trial

focused on people with specific eating habits: emotional eating, stress-related eating, eating without awareness and/or overeating. Participants completed an adapted form of the mindfulness-based cognitive therapy (MBCT) protocol which is another form of ABBT Therapy. The MBCT program was adapted to increase its alignment with eating behaviors. Participants attended eight weekly sessions that lasted 2.5 h. Body scans, walking meditation, mindful eating skills, acceptance of self, and control activities were included. Participants were "invited" to practice these exercises for 45–60 min each day at home. Participants completed six different scales before and after the intervention. The intervention group had significantly greater decreases in food cravings, dichotomous thinking, body image concern, emotional eating and external eating. The intervention group also had a significant increase in trait mindfulness, or average mindfulness, compared to the control group. A marginally significant weight reduction was achieved with participants in the intervention group while the control group had a significant reduction in weight [46].

Meditation

Four studies [33, 34, 49•, 50•] investigated the effect of meditation, a mindfulness-based approach, on weight loss and/or weight maintenance.

Mantzios and colleagues [49•] compared the impact of developing mindfulness and self-compassion through meditation to support weight loss. The study included three separate and independent interventions among college students in Greece. The first study found that mindfulness and self-compassion mediated an inverse relationship between negative thoughts and weight loss. The second study found that food diaries that focused on how a behavior happens (concrete construal) were significantly more likely to affect weight loss than diaries that focused on why a behavior happens (abstract construal). The third study combined the concrete construal food diaries with meditation and mindful walking. A three-day training focused on specific meditation techniques and then participants engaged in guided meditation activities three times a day for 5 weeks. There was not a significant difference in weight loss between those who participated in meditation and those who only participated by writing in diaries. It is of worth to note that the act of recording a behavior in a diary in and of itself could potentially raise mindfulness of that behavior [49•].

A follow-up study completed by Mantzios and colleagues [50•] expanded on the principles of meditation, mindfulness, and self-compassion in their previous work. Mindfulness meditation was taught to both experimental groups that included sitting breath awareness practice to cultivate attention, non-reactivity, and non-judgment. Mindfulness walking meditation was also implemented and focused on body awareness, which illustrated how mindfulness can be applied to daily tasks. Mindful hunger awareness was also taught to both

experimental groups and participants were asked to assess how hungry they were on a scale of 0–10. Mindful eating meditation was taught by suggesting subjects take a breath before eating followed by an acknowledgement of hunger levels, emotions, thoughts, motivations, and the eating environment, with acceptance and non-judgment. While eating, the emphasis was placed on enjoying the food, including the taste and texture. Troublesome foods meditation was also incorporated into both experimental groups, which included allowing all foods to be part of participants' lives by mindfully choosing (e.g., observing hunger levels) and mindfully consuming (slow, purposeful eating meditation). Loving kindness meditation was only taught to the mindfulness with self-compassion group and involved the repetition of phrases invoking good will and benevolence for oneself and others. Results of this study showed that the mindfulness with self-compassion group lost more cumulative weight than the other groups (3.0 vs. 1.8 kg) and concluded that developing both mindfulness and self-compassion may be more promising for weight loss than developing mindfulness alone or simply dieting [50•].

Timmerman and colleagues [33] evaluated the effect of a mindful restaurant eating intervention, including mindful eating meditations, on weight management for healthy women in middle age. Weekly topics related to weight management when eating out, interactive skill-building activities to address barriers to managing intake when eating out, and mindful eating meditations were included. Mindful eating meditations are the "intentional, nonjudgmental focus on the present eating experience" [51]. Results of this study showed that participants in the intervention group lost more weight and had lower daily calorie intake, increased diet-related self-efficacy, and fewer barriers to weight management. Researchers concluded that this mindfulness intervention showed positive change in behaviors related to weight management [33].

Miller and colleagues [34] compared the impact of mindful eating (MB-EAT-D) to Smart Choices, a diabetes self-management education (DSME)-based treatment. The mindful eating intervention incorporated training in mindful meditation, eating, and practice of physical activity and body awareness. Participants were encouraged to "cultivate inner wisdom (e.g., mindful awareness related to eating) and outer wisdom (e.g., personal knowledge of food and diabetes needs)" [34]. A primary part of the intervention was mindful meditation and its application to eating. Each session included guided meditations toward the experiences and emotions associated with eating. Other components focused on the differences between physical and emotional hunger cues, social pressures to eat, and preferences regarding food choices. Even though there were not significant differences between groups related to weight, researchers concluded that training in mindful eating and DSME facilitated improvement in dietary intake, modest weight loss, and glycemic control [34].

Mindfulness-Based Stress Reduction

Two studies investigated the use of mindfulness-based stress reduction as it relates to weight management. Daubenmier and colleagues [52•] conducted a RCT including a 5.5-month diet-exercise intervention with an 18-month follow-up. The purpose of the study was to assess the effectiveness of adding both mindfulness-based stress reduction and mindfulness-based eating awareness training program components to a diet and exercise intervention. The intervention included 16 sessions lasting 2 to 2.5 h and one all-day session over the 5.5 months. Unlike previously discussed studies, this RCT chose biometric outcomes, specifically weight loss at 18 months as its primary outcome. Waist circumference, glucose, HOMA, HbA1c, and cholesterol levels were also measured throughout the intervention. Participants did not complete any eating or mindfulness scales before, during, or after the intervention. Daubenmier and colleagues [52•] concluded that there were no statistically significant weight loss differences between those participants who participated in mindfulness activities and those who did not. The authors noted that some of the differences in the groups could be clinically significant [52•].

Mason and colleagues [53•] included participants in the Supporting Health by Integrating Nutrition and Exercise (SHINE) clinical trial and followed a similar protocol to that of Daubenmier and colleagues [52•]. The difference between the two studies is that Mason and colleagues included a 9-item Reward-based Eating Drive (RED) scale which assesses three dimensions of hedonic drive to eat (1) loss of control, (2) lack of satiety, and (3) preoccupation with food. Mason and colleagues found that the mindfulness activities had a significant effect on the RED score at 6 months and had a positive effect at 12 months; however, the mindfulness activities did not significantly affect weight loss at 6, 12, or 18 months [53•].

Group Mindful Eating

Kidd and Colleagues [54] conducted an 8-week mixed-methods study in women. Subjects participated in an 8-week intervention "Eat, Drink, and Be Mindful". A 20-item Weight Efficacy Lifestyle Questionnaire (WEL), a 28-item Mindful Eating Questionnaire (MEQ), and the 20-item Center for Epidemiologic Studies-Depression Scale was used for pre- and post-testing. Subjects also participated in a semi-structured interview at the end of the intervention. Researchers reported higher self-efficacy for eating habits associated with the 8-week group mindfulness intervention. No significant changes were reported in depression, mindful eating, weight, BMI, body fat percentage, or in systolic and diastolic blood pressure. During the focus group, the women described increased self-efficacy while eating, which mirrors the quantitative findings [54].

Cross-sectional Analysis

Camilleri and colleagues [55•] completed a large cross-sectional analysis to examine the association of mindfulness and weight. Participants provided self-reported height and weight and completed the Five Facet Mindfulness Questionnaire (FFMQ). This 39-item questionnaire focuses on five aspects of mindfulness: observing, describing, acting with awareness, non-judging, and non-reactivity. Women with higher overall mindfulness scores were significantly less likely to be overweight and even less likely to be obese, once scores were adjusted for sociodemographic and lifestyle confounding factors. For women, the only non-significant relationship was between those who were overweight and "non-judging". For men, the results differed. There was no statistically significant difference between the mindfulness score and being overweight. There was a small statistical difference between the mindfulness score and being obese, but the secondary analysis did not find a strong relationship [55•].

Limitations

This integrative review did not complete a formal evaluation of the quality of the evidence of the included studies and did not intend to compare outcomes across study designs. An approach such as GRADE was not used to determine the quality of the body of evidence included in this review; therefore, this may affect the strength of the conclusions drawn from the reviewed studies.

Discussion

The treatment of overweight and obesity has traditionally included multiple behavior change therapies related to eating and physical activity. Participants are encouraged to change eating habits to be consistent with those associated with a healthy weight, specifically, choose smaller portions, eat more fruits and vegetables, consume less calorie-dense foods, record daily food intake; all to decrease calories. Simultaneous to decreasing calorie intake, participants are encouraged to exercise to burn calories and build lean active tissue, to increase caloric need. Taken together, this will result in weight loss, as calories consumed are less than calories burned. While this may seem like a simple mathematical equation, the behaviors required to achieve this are not simple at all. In fact, changing eating and physical activity behaviors in a sustained manner is very difficult, especially considering the environment of ubiquitous unhealthy foods, loss of opportunity to move, internal cravings, emotions surrounding the eating experience, body image issues, and lack of self-efficacy. Considering that so many factors influence eating and physical activity behaviors, how can we as educators and clinicians move beyond just asking patients to eat healthy and exercise and also help them gain skills and insights to do this? Mindful eating has emerged as a promising strategy to bring heightened awareness to the totality of the eating experience (psychological and physiological). The question this review attempted to answer is, *does inclusion of mindful eating strategies have an impact on the overall success of a weight management program?*

Conclusion

Examining the totality of the work done around mindful eating, there is strong support for including mindfulness as either a component of a weight management program or as the focus of such and may provide substantial benefit for the treatment of overweight and obesity.

All studies showed weight loss results when mindful eating strategies were employed. Four out of the five studies that conducted a follow-up assessment showed continued weight loss. Only one study showed weight regain at follow-up assessment. While many of the studies reviewed saw only modest improvements when mindful eating strategies are employed compared to traditional treatment modalities, these skills may continue to enhance weight loss efforts over time and have an impact on long-term weight management. The sustainability of these skills may be the most promising aspect of employing these strategies in weight management interventions. Increasing mindful eating has been shown to be successful in helping participants gain awareness of their bodies, be more in tune to hunger and satiety, recognize external cues to eat, gain self-compassion, decrease food cravings, decrease factors associated with problematic eating, and decrease reward-driven eating. More work is needed as to the specific strategies, messages, and methodologies that should be included in weight management programs around mindful eating. Further, more work is needed in mindful eating and self-acceptance as it relates to healthy eating, as this combination was found to be even more effective than mindfulness alone [50•].

Compliance with Ethical Standards

Conflict of Interest Carolyn Dunn, Megan Haubenreiser, Madison Johnson, Kelly Nordby, Surabhi Aggarwal, Sarah Myer, and Cathy Thomas declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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