Research Review
DOI: https://doi.org/10.52868/RR/2022-3-3-5
RRJ 3 (3), 789-805 (2022)
Received 15 Nov 2022 | Revised 28 Nov 2022 | Accepted 07 Dec 2022 | Online Available 18 Dec 2022

OPEN ACCESS ISSN (O) 2693-5007

ARTICLE

A Mindfulness-Based Eating Intervention Approach to Weight Loss in Overweight and Obese Adults

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Abstract:
Intuitive eating (IE), or a mindfulness-based intervention approach to eating, teaches individuals to focus on their experience and sensual awareness of food. Despite the primary objective of the practices not being weight-related, interest in mindfulness or IE practices for weight loss has continued to grow as following these practices has elicited weight changes in participants. This review aims to examine if mindfulness-based interventions in overweight or obese adults effectively elicit weight loss, maintain weight loss efforts long-term, and improve eating behaviors and diet quality. A systematic search of several databases using specific search terms resulted in twenty-one articles. Of the studies selected, twelve studies demonstrated significant weight loss and weight maintenance results ($p < 0.05$). Three studies examined the diet quality of individuals following a mindfulness-based eating intervention (MBEI), with two studies revealing statistically significant improvements ($p < 0.05$). The eating behaviors of participants measured by five studies indicated improvement in intuitive eating scores and long-term maintenance of intuitive eating practices. However, the studies used several different MBEIs and tools to measure diet quality and eating behaviors, which may impact results. Future studies, including standardized MBEI protocols and tools, are needed to determine the effectiveness of MBEI in weight reduction and maintenance, diet quality, and eating behavior improvement.
Keywords: Mindfulness eating, Intuitive eating, Obesity, Weight loss, Diet Quality, Eating Behavior

1 | INTRODUCTION

Overweight and obesity are multifactorial medical conditions on the rise worldwide. In the United States, nearly one in three adults (30.7%) is overweight, and more than two in five adults (42.4%) are considered obese. [1] Overweight and obesity are defined as a proportion of body weight composed of adipose tissue that exceeds a range considered healthy. [2] The current methods for management of overweight and obesity in adults consist of nutrition counseling, behavioral changes, increases in physical activity, as well as pharmacotherapy, and/or surgery. [3] The traditional approach to nutrition counseling involves calorie restriction and self-monitoring of weight-related behaviors. [4] However, in terms of adherence long-term, studies suggest individuals following calorie restricted diets often are unable to adhere to the diet and may ultimately regain the lost weight. [1, 5, 6] A new weight paradigm has evolved that centers on healthy eating and physical activity. This non-diet approach is referred to as intuitive eating (IE), mindfulness, or Health at

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Every Size (HAES). The IE or mindfulness eating approach aims at having individuals develop a healthy relationship between food, mind, and body, and encourages the mindfulness of emotions and the pleasure derived from eating. [7] This intervention teaches individuals to make deliberate food choices, cultivate awareness of interoceptive cues related to food intake, attend to physical versus psychological cues to eat, and how to appropriately respond to these cues. [8] Growing research surrounding the topic of mindfulness-based interventions (MBI) suggests this approach may aid in maintaining long-term weight loss efforts, improve metabolic health, physiological factors such as blood lipid or blood pressure, psychological health including self-esteem and/or depression, and behavioral outcomes. [8, 9] However, intuitive eaters are encouraged to eat in accordance to their personal desires so questions have emerged on whether this is an effective treatment for weight loss adherence and if the individuals end up with a lower diet quality. [7] Current studies on MBI and the impact of facilitating weight loss have also been found to be inconsistent and the strength of existing evidence has come into question [3, 10, 11] The purpose of this review is to examine if mindfulness-based interventions for weight loss in overweight or obese adults are more effective than the traditional cognitive behavioral therapy and calorie-restricted weight loss nutrition interventions in eliciting weight loss, maintaining weight loss efforts long-term, improving eating behaviors, and diet quality.

2 | METHODS

The criteria for conducting this literature review is outlined in the following section. The search process of databases to retrieve relevant articles for inclusion are described, with reasoning provided for articles that did not meet the eligibility criteria outlined. Each selected article was then subject to undergo a quality assessment.

Protocol and Registration

To complete this review the Preferred Reporting Items for Systematic Reviews and Meta-Analyses was used. [12] Per PRISMA Protocol, the systematic review was registered with PROSPERO under the registration number (CRD42022363883).

Search strategy

A literature search was conducted using the following databases PubMed, CINAHL, AGRICOLA, and EMBASE. The articles included in the review were peer-reviewed original research articles published between 2012 to 2022. Table 1 includes the search terms utilized for each database to retrieve relevant articles. The search was limited to studies published or translated to English and with full text available without subscription or purchase. The primary author used citation searching to acquire further related literature from articles meeting all inclusion criteria.

Table 1. Key Words to Describe Topic Elements

Population		Intervention		Outcome
Adults	Overweight, Obese, BMI	Intuitive Eating, Mindful, Eating Health at Every Size, Mindfulness, Self-Regulation, Size Acceptance, Mindfulness Based Cognitive Behavior Therapy, Acceptance Based Practices, Weight Neutral	Calorie Restriction, Self- Monitoring Behavioral, Weight Program	Weight Loss, Eating Behaviors, Diet Quality

Eligibility criteria

The eligibility criteria are outlined in Table 2. Articles included were limited to original research of randomized controlled trials, quasi-experimental designs, or clinical trials. The primary age group was healthy adults ages 18 years or older. Adults

with a diagnosis of bulimia nervosa, anorexia nervosa, or those in recovery from an eating disorder were excluded. Individuals receiving prenatal or postnatal nutrition therapy, with a diagnosis of diabetes, or who had undergone and were in recovery from weight loss surgery were also excluded. The treatment settings included outpatient, clinical, or community settings. The publication year range was extended as there was limited availability of original research on this topic within a five-year range.

Table 2. Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Age	>/=18 years old	<18 years old
Gender	Male & Female	None
Setting / Country	Outpatient or Clinical or Community	Acute inpatient medical, nutritional rehabilitation
Health Status / Problem / Condition	Overweight or Obese	Eating Disorder Diagnosis or Rehabilitation, Type 1 or 2 diabetes, Prenatal or Postnatal Nutrition Therapy, Weight Loss Surgery
Intervention / Exposure	Intuitive eating or Traditional calorie-restricted weight loss nutrition therapy	N/A
Outcome	diet quality, weight management, eating behaviors	Outcomes that had no mention of the impact on weight, diet quality, or eating behaviors
Study Design Preferences	Randomized control trial Clinical Trial	Meta-analyses, Systematic Reviews, Case Studies
Size of Study Groups: Typically, at least 10 in each study group.	>/=10	<10
Language Indicate if limited to articles in English	Studies published or translated to English	Non-Anglophone
Publication Year Range	</=10 years	> 10 years
OTHER	Full-Text Availability	N/A

Data extraction and Quality assessment

The selection process for articles is outlined in Figure 1 PRISMA Flow Chart and was conducted by the primary author. The articles identified through the original search were reviewed and duplicates were removed. Articles were then assessed by title and abstract producing the final articles which were examined in full to assess for inclusion criteria. The Cochrane data extraction template was used to process the finalized articles and capture relevant information. [13] The minimum standards required following this template include: Author, title of publication, date published, DOI, study design, purpose, number of participants, age range, gender breakdown, methods, intervention, measured outcomes, risk of bias, results, and conclusion. [13] The Academy of Nutrition and Dietetics Quality Criteria Checklist for primary research was utilized to perform the quality assessment of each article. [14] The parameters assessed to determine article quality include the research question and aim, the process of subject selection and bias, study design, outcomes, statistical analysis, confounders, documentation of methods and withdrawals, and more. Each article was assigned a final grade of either positive, neutral, or negative based on the quality criteria. [14]

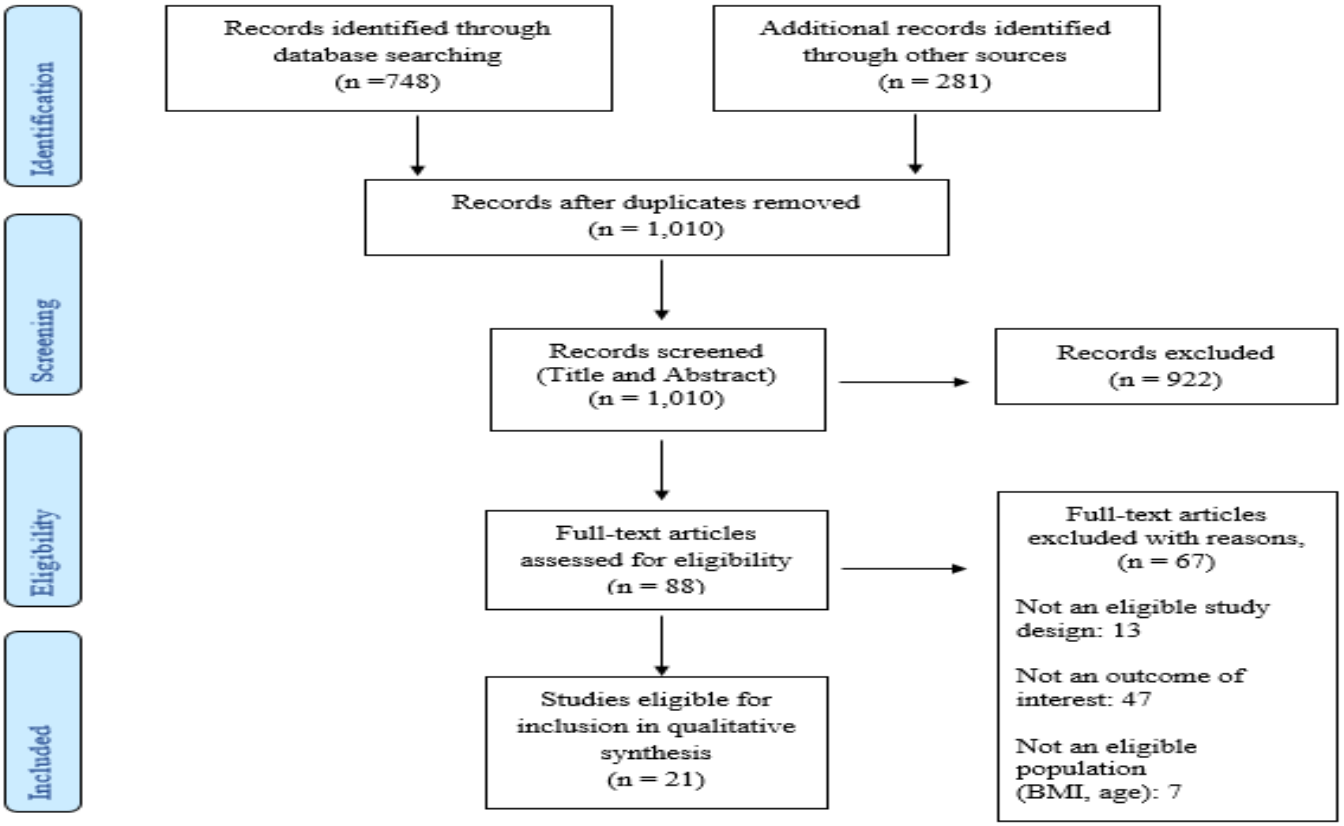

Figure 1. PRISMA Flow Chart

3 | RESULTS

A total of 1,010 articles were retrieved from the databases via the literature search and additional sourcing through the identified article reference lists. Of these articles, twenty-one studies met the inclusion criteria for this review. Figure 1 Prisma Flow Chart provides further details on articles excluded from this review. All analyses were either randomized controlled trials (n=10), clinical trials (n=6), quasi-experimental (n=3), or pilot studies (n=2). Samples sizes ranged from 21 to 326 participants. Study locations included the United States (n=11), Brazil (n=3), Canada (n=2), Iran (n=2), Finland (n=1), and the United Kingdom (n=1). Quality appraisal of the twenty-one identified studies indicated fourteen studies of positive quality and seven of neutral quality.

Weight Outcomes: Intuitive Eating, Mindfulness or Weight Neutral Intervention

Of the twenty-one articles included in this study, nineteen assessed for weight parameters. [3-6, 9, 15-28] Eleven studies reported weight outcomes following an IE, mindfulness-based eating intervention (MBEI), or weight-neutral approach for weight loss in overweight or obese individuals. [3, 4, 5, 6, 9, 16-18, 26-28] Of these studies, only four resulted in statistically significant ($p \leq 0.05$) weight loss or maintenance findings, with the remaining articles indicating non-significant weight changes. [3, 5, 16, 26] The findings of Alamount et al. (2020) and Asadollahi et al. (2015) suggest implementing mindfulness training based on cognitive therapy alone and, when implemented with a dietary regime, significantly impact weight loss. Alamount and colleagues (2020) saw a considerable difference in the mean scores of body weight and BMI in the mindfulness-based cognitive therapy (MBCT) group ($p \leq 0.01$) with energy restiriction and the weight-loss diet therapy group ($p \leq 0.01$) when compared to the control group. The MBCT group demonstrated an overall higher reduction in weight and BMI than the weight-loss diet therapy group ($p \leq 0.01$). Asadollahi et al. (2015) study participants demonstrated significant weight loss in the mindfulness training, dietary regime, and

mindfulness training with dietary regime groups (mindfulness training p=0.000, effect size= 95%; dietary regime p=0.000, effect= 43%; mindfulness training with dietary regime p=0.000, effect size=97%). Although the dietary regime intervention provided alone demonstrated weight loss effects, the effect value (effect= 43%) was significantly lower when compared to the mindfulness intervention groups. At the two-month follow-up, individuals in the dietary regime had significant weight gain after loss (p=0.002), suggesting dietary regime alone does not have durability. Participants of the mindfulness training with a dietary regime at the two-month follow-up period, did not experience weight gain $p > 0.05$ (p=0.309). [5]

A modest amount of weight loss following the implementation of a mindfulness intervention was observed by Carpenter and colleagues (2019). The mindfulness participants experienced a 2.7% weight loss from baseline to six-month follow-up compared to the control group participants, who lost 3.1% (p = 0.57; effect size −0.15 (−0.64, 0.35)). Palmeira and colleagues (2017) implemented a Kg-free intervention based on mindfulness, acceptance and commitment therapy (ACT), and compassion approaches. Participants in the Kg-free group experienced a significant decrease in BMI (p=0.001; Cohen D= 0.12) as revealed by within-group testing however, the effect size was small. This group achieved a greater weight loss of 1.15 kg compared to the control group post-treatment. [26] The between-group measurements of this study revealed although there were reported changes in BMI, the significant effect was shallow (p=0.022; Cohen's d = 0.09). [26]

Seven studies measuring weight outcomes following an IE, MBEI, or weight-neutral intervention approach did not find significant weight changes ($p > 0.05$) and are illustrated in Table 3 [4, 6, 9, 17, 18, 27, 28] The overall findings of eleven studies measuring weight outcomes following an IE, MBEI, or weight-neutral approach demonstrated participants might accomplish modest short-term weight loss. However, it is unlikely for weight changes to occur, given seven studies reported no significant weight changes.

Weight Outcomes: Health at Every Size (HAES) Mindfulness Intervention

Three studies following the HAES approach to IE measured weight outcomes in overweight or obese individuals. [15, 19, 23] HAES participants experienced modest weight loss ($p < 0.05$) in the first three months of the Borkoles et al. study (2016). In terms of long-term weight maintenance, statistical significance was not found, suggesting participants maintained their weight loss over the twelve-month follow-up period (time main effect p=0.15, interaction effect, p=0.11). [15] Weight loss was achieved by nine participants in Dimitrov and colleagus' (2018) HAES intervention group and one of the participants from the control group of ≥ 5% weight loss; however, the differences did not meet statistical significance (p=0.246). Leblanc and colleagues observed a significant decrease in body weight within the HAES group (weight loss: 1.4 kg; p=0.0008) compared to the social support (SS) or control groups (SS p=0.42; Control p=0.91). Despite changes in body weight of the HAES group, no between-group differences were observed for body weight at four months ($p > 0.05$). [23]

Weight Outcomes: Acceptance-Based and Acceptance-Commitment behavioral therapy

Five studies followed an acceptance-based therapy (ABT) or ACT approach to IE for weight loss. [20-22, 24, 25] Participants of the expert-administered ABT intervention group of Forman and colleagues (2013) experienced significantly more weight loss at post-treatment 13.17% (95% CI: 9.59, 16.75) and the six-month follow-up 10.98% weight loss (95% CI: 7.54, 14.42) versus the standard behavioral treatment control group (SBT) (post-treatment: 7.54%; follow-up: 4.83%). At the six-month follow-up, 64% of ABT participants maintained at least a 10% weight loss compared to 46% of SBT participants. [20] In a similar study by Forman and colleagues (2016), participants in the ABT group demonstrated significantly more weight loss at mid-treatment and post-treatment

(mid-treatment: 12.9%; post-treatment: 13.3%, p= 0.005) than the SBT group (mid-treatment: 10.3%; post-treatment: 9.8% loss, p=0.005). The ABT participants had a one-third greater likelihood of maintaining a 10% weight loss at twelve- months (p=0.04) than the SBT group. [21] Hawkins and colleagues (2021) found with the use of an intent-to-treat analysis, the average weight loss of participants was 4.1% (p <0.001). Of the participants who completed the ABT intervention in Hawkins et al. study (2021), 19.4% achieved 10% or greater weight loss, and 38.9% achieved 5% or greater weight loss. In a study by Lillis and colleagues (2016), no significant mean weight loss was observed between the acceptance-based behavioral intervention (ABBI) and SBT groups (p >0.05). However, during the post-phase, ABBI participants experienced less weight regain than the SBT group (ABBI: 4.6 kg, SBT=7.1 kg; p=0.005). Individuals in this group also experienced clinically significant weight loss of >5% (p=0.038) at twenty-four months compared to the SBT group. [24] ABBI participants in the Niemeier et al. study (2012) experienced significant weight loss over time (p <0.0001), with the majority of weight loss occuring between baseline and six months (LSMD estimate = −12.0kg, SE=1.4, adjusted 95% CI = −15.5 to −8.5). The participants maintained weight loss between the six-month assessment and three-month follow-up (LSMD estimate = −0.1kg, SE=1.4, adjusted 95% CI = −3.7 to 3.4). [25]

Diet Quality

The diet quality of participants following an IE or MBEI approach to weight loss was measured by three studies. [7, 9, 29] Improvements in diet quality were identified in HAES participants at four months in the Carbonneau et al. study (2017) using the Healthy Eating Index (HEI). Participants decreased their intake of high-fat and high-sugar foods however these improvements were not maintained at the sixteen-month follow-up (HAES, 3.09 ± 2.50; Control, 4.48 ± 5.74). The overall HEI scores in the HAES group at the post-intervention and the one-year follow-up (post-intervention, r = 0.20, p = 0.0237; one-year, r = 0.22, p = 0.0359, respectively) were higher versus control group (post-intervention, r = 0.04, p= 0.70; the one-year follow-up, r= 0.15, p= 0.30, respectively). [7] Carbonneau et al. (2017) study demonstrated short term diet quality improvements following an MBEI but not long term. Measurement of diet quality by Mensinger and colleagues (2016) was conducted using The Dietary Risk Assessment tool and the Red Lotus Health and Well Being Questionnaire (RL-QOL). Participants in the intervention and control group exhibited improvements in fruit and vegetable consumption at post interventions (p < 0.001). At twenty-four months, increases in fruit and vegetable consumption (p < 0.001) remained significant. [9] Dietary Risk improvements were also observed in both the intervention and control group (p <0.001) however, the changes were not sustained at twenty-four months (p=0.625). [9] Järvelä-Reijonen et al. (2018) used the Index of Diet Quality (IDQ) validated tool to measure diet quality. In the face-to-face and mobile, IE groups, no statistically significant differences in diet quality were found between the groups (p > 0.05).

Eating Behaviors

A total of five studies in this review analyzed the eating behaviors of participants receiving MBEI. [6, 7, 9, 28, 29] Tools to analyze eating behaviors differed between studies. A Three-Factor Eating Questionnaire (TFEQ) used by Campos et al. (2022) assessed eating behavior dimensions through emotional eating, cognitive restriction, and uncontrolled eating measures. Intergroup evaluation of the intervention and control groups found no statistically significant (p >0.05) differences in eating behavior measures except for ‘cognitive restriction’. The IE group showed increased ‘cognitive restriction’ and moderate effect size (Cohen’s d = 0.53). [6]

The Dutch Eating Behavior Questionnaire (DEBQ), Mindful Eating Scale (MES), and Mindful Attention Awareness Scale (MAAS) tools were used by Salvo and colleagues (2022). Mindfulness-based Eating Awareness Training of Sao Paulo (MB-EAT-SP) participants had increased MES scores at post-intervention and the 3-month follow-up (p < 0.05) compared to the intervention group. The MB-EAT-SP intervention group demonstrated a superior improvement in overeating (p < 0.001) over time compared to the

Mindfulness-based Health Promotion (MBHP) intervention group. [28]

Three studies utilized an Intuitive Eating Scale to measure the eating behavior changes of participants following an MBEI. [7, 9, 29] Results of IES scores from Carbonneau et al. (2017) were significantly higher in the intervention group at four and sixteen months as compared to the control group (4 months: $p < 0.0001$; 16 months: $p < 0.0207$). Three intuitive subscales reflected the same pattern of group-by-time interactions revealing significant findings in the 'eating for physical rather than emotional reasons' ($p=0.0031$), 'unconditional permission to eat' ($p=0.0527$), and 'reliance on hunger and satiety cues' ($p=0.0065$). [7] Mensinger and colleagues (2016) observed improvements in intuitive eating in both their weight-neutral intervention group and the weight-loss group from baseline to post-intervention ($p< 0.05$) per the IES. However, the weight-neutral group demonstrated more significant improvements in intuitive eating scores ($p < 0.001$) versus the weight-loss group. Participants were able to maintain progress in intuitive eating behaviors at twenty-four months ($p=0.001$) compared to the weight-loss group ($p=0.310$). Järvelä-Reijonen and colleagues (2018) utilized the IES, TFEQ, Health and Taste Attitude Scales (HTAS), ecSatter Inventory 2.0 (ecSI 2.0), and Regulation Eating Behaviors Scale (REBS) to assess eating behaviors. Significant improvements ($p <0.05$) were seen across the eating behavior tools in both intervention groups, specifically in the categories of 'eating for physical rather than emotional reasons', 'uncontrolled eating', 'using food as a reward', 'food acceptance', 'integrated regulation', and 'identified regulation'. [29]

Impact of Mindfulness Interventions on Biochemical Markers

Current research indicates IE and MBEI may positively improve the blood pressure, serum cholesterol, blood glucose, and inflammatory markers of individuals. [30, 31] A total of seven studies measured biochemical markers following the implementation of an IE or MBEI. [3, 4, 9, 18, 26-28]

Biochemical Markers: Blood Pressure

Evaluation of blood pressure was conducted by five studies. [3, 9, 18, 27, 4] Of the studies measuring blood pressure, Alamount and colleagues (2020) were the only researchers to report significant blood pressure changes. Participants following a MBCT with energy-restricted diet therapy experienced lower systolic blood pressure (SBP) ($p \leq 0.01$) compared to the weight-loss diet therapy group and control group. Participants from the Raja-Khan et al. (2017) study following the health education group experienced significant ($p <0.05$) 5mm Hg reduction in SBP at eight weeks compared to the mindfulness-based stress reduction (MBSR) group who experienced a 3.2 mm Hg reduction in SBP. However, the blood pressure between-group differences were not found to be statistically significant ($p >0.05$). Multiple researchers did not find statistically significant ($p >0.05$) improvements in SBP or diastolic blood pressure with the implementation of IE or MBEI as illustrated in Table 3.

Biochemical Markers: Glucose

Out of the studies measuring biochemical markers, four measured fasting blood glucose. [9, 18, 27, 28] Daubenmier and colleagues (2016) observed improvements in fasting blood glucose at twelve months, 23.1 mg/dl (95% CI: 26.3, 0.1; $P = 0.06$), and at eighteen months, 24.1 mg/dl (95% CI: 27.3, 20.9; $P = 0.01$) in the MBSR group. In a similar study, the MBSR group highlighted significant reductions in fasting glucose at eight weeks (28.9 mg/dL, $p= 0.02$) and sixteen weeks (29.3 mg/dL, $p= 0.02$) follow-up periods compared to baseline measures. [27] However, the analysis of between-group fasting blood glucose measures of the MBSR and health education group did not reach statistical significance ($p >0.05$). [27] Fasting blood glucose changes were not observed to be significant ($p>0.05$) in the weight-neutral or weight-loss intervention groups. [9] Salvo and colleagues (2022) did not observe statistically significant changes ($p >0.05$) in blood glucose in the MBEI groups or the no-treatment control group throughout their ten-week study.

Biochemical Markers: Lipid Panel

Four of the seven studies measuring biomarkers evaluated the lipid panels of participants [9, 18, 26, 28] The group-difference measures of triglyceride/HDL ratio in the Dabenmier et al. (2016) study revealed significant improvements in the mindfulness arm at twelve months, -0.57 (95% CI: -0.95, -0.18; p = 0.004). However, differences were not maintained at the eighteen-month follow-up between the mindfulness group and the control arm. [18] Participants in the Mesinger et al. study (2016) following a weight-neutral program demonstrated significantly lowered LDL cholesterol at post-intervention (p = 0.010) and maintained this reduction at twenty-four months (p = 0.031) compared to baseline. The LDL cholesterol of participants in the weight-loss group was increased post-intervention (p = 0.074) and at twenty-four months (p = 0.824), compared to baseline. In the weight-neutral program, participants post-intervention significantly decreased their HDL levels (p=0.002). However, at the twenty-four-month follow-up, decreases in HDL were no longer evident (p=0.073). Participants in this group did experience decreases in total cholesterol at twenty-four months (p=0.026).

Between-group measures of total cholesterol in the Palmeira et al. Study (2017) demonstrated no differences (p=0.619; Cohen's d=0.29). Both the intervention and control groups displayed improvements in total cholesterol post-intervention. Throughout the Salvo et al. (2022) study, measures of cholesterol and triglycerides were not statistically significant (p >0.05) in the MBEI groups or the no-treatment control group.

Table 3. Major Findings of Included Studies

Author & Study Design	Intervention	Major Findings	Time of Follow-up Measures
Alamount et al., 2020, Quasi-expermental design	*Experimental Group 1*: MBCT with energy restriction *Experimental Group 2*: Weight-Loss Diet Therapy *Control Group*: No Intervention	**Weight Outcomes:** Compared to the control group, there were significant improvements ($p \leq 0.01$) in mean body weight and BMI scores in the MBCT and weight-loss diet therapy groups. The MBCT group had a higher weight and BMI reduction than the weight-loss diet therapy group ($p \leq 0.01$). **Biochemical Markers:** MBCT participants had lower SBP ($p \leq 0.01$) than the weight-loss diet therapy group and the control group.	Baseline, 8 weeks, 12 weeks
Asadollahi et al., 2015, Quasi-experimental design	*Experimental Group 1*: Only Dietary Regime *Experimental Group 2*: Only MBCT *Experimental Group 3*: MBCT & Dietary regime *Control Group*: No Treatment	**Weight Outcomes:** Significant weight loss was observed in the MBCT (p=0.000, effect size= 95%), dietary regime (p=0.000, effect= 43%), and MBCT with dietary regime (p=0.000, effect size=97%) groups. The dietary regime group had significant weight gain after loss (p=0.002) at the two-month follow-up. No weight gain was observed in the MBCT with a dietary regime group during the two-month follow-up period (p=0.309).	Baseline, 8 weeks
Borkoles et al., 2016, Randomized control trial	*Experimental Group*: Received three months of intensive non-dieting lifestyle intervention followed by nine months of maintenance. *Control Group*:	**Weight Outcomes:** In the first three months, HAES participants experienced modest weight loss (p <0.05). Over the twelve-month follow-up period, there was no statistical significance for HAES participants indicating they maintained their weight loss (time main effect p=0.15, interaction effect, p=0.11)	Baseline, 3 months, 9 months

	Delayed-start group was instructed to maintain their current lifestyle habits and scheduled to begin the intensive lifestyle intervention phase after three months.		
Campos et al., 2022, Randomized Clinical trial	*Experimental Group 1*: Intuitive eating intervention group (IEG) *Experimental Group 2*: Intuitive eating intervention combined with nutritional guidelines (IEGDG) *Control Group*: Received standard treatment for patients awaiting bariatric surgery.	**Weight Outcomes:** No significant intergroup or intragroup differences in weight or BMI ($p > 0.05$). **Eating Behaviors:** Intergroup evaluation of TFEQ results found no statistically significant ($p > 0.05$) differences in eating behavior measures in the control group. The IE group showed increased 'cognitive restriction' and moderate effect size (Cohen's $d = 0.53$) compared to the control group.	Baseline, 3 months, 6 months
Carbonneau et al., 2017, E., Quasi-experimental design	*Experimental Group*: HAES intervention *Control Group*: Women on waiting list for HAES program.	**Diet Quality:** The HAES and control groups decreased their intake of high-fat and high-sugar foods; however, at the sixteen-month follow-up, results were not maintained (HAES®, 3.09 ± 2.50; Control, 4.48 ± 5.74). HEI scores were higher in the HAES group at the post-intervention and the one-year follow-up (post-intervention, $r = 0.20$, $p = 0.0237$; one-year, $r = 0.22$, $p = 0.0359$, respectively) compared to the control group (post-intervention, $r = 0.04$, $p = 0.70$; the one-year follow-up, $r = 0.15$, $p = 0.30$, respectively). **Eating Behaviors:** The intervention group IES scores were significantly higher at four and sixteen months compared to the control group (4 months: $p < 0.0001$; 16 months: $p < 0.0207$). Group-by-time interactions revealed significant findings in the intervention group for 'unconditional permission to eat' ($p=0.0527$), 'eating for physical rather than emotional reasons' ($p=0.0031$), and 'reliance on hunger and satiety cues' ($p=0.0065$) compared to the control group.	Baseline, 4 months, 16 months
Carpenter et al., 2019, Randomized controlled pilot study	*Experimental Group*: Participants completed the Mind Your Weight (MYW) weight loss program *Control Group*: Participants completed the Weight Talk™ (WT) weight loss program.	**Weight Outcomes:** From baseline to six-month follow-up, the mindfulness participants had a 2.7% weight loss compared to the control group, who lost 3.1% ($p = 0.57$; effect size −0.15 (−0.64, 0.35)).	Baseline, 6 months
Corsica et al., 2014, Pilot study	*Experimental Group 1*: MBSR *Experimental Group 2*: Stress Eating Intervention (SEI) *Experimental Group 3*: MBSR + SEI	**Weight Outcomes:** No significant weight changes were observed ($p > 0.05$). The combination of MBSR + SEI demonstrated modest short term weight loss but this was not significant ($p=0.47$).	Baseline, 6 weeks, 12 weeks
Daubenmier et al., 2016,	*Experimental Group*: Mindfulness training intervention	**Weight Outcomes:** No statistically significant group difference in weight changes were observed ($p > 0.05$).	3 months, 6 months, 12 months,

Randomized controlled trial	*Control Group*: Excluded mindfulness activities and supplemented with alternative activities.	Mindfulness arm lost 1.7 kg at 18 months however not significant (p=0.24). **Biochemical Markers:** No statistically significant blood pressure findings (p >0.05). The MBSR group demonstrated improvements in fasting blood glucose at twelve months, 23.1 mg/dl (95% CI: 26.3, 0.1; P = 0.06), and at eighteen months, 24.1 mg/dl (95% CI: 27.3, 20.9; P = 0.01) Group-difference measures of triglyceride/HDL ratio showed significant improvements in the mindfulness arm at twelve months, -0.57 (95% CI: -0.95, -0.18; p = 0.004), but differences were not maintained at the eighteen-month follow-up.	18 months
Dimitrov et al., 2018, Prospective randomized controlled mixed-method clinical trial	*Experimental Group*: Intensified HAES®-based intervention comprising a physical activity program, nutrition counseling sessions, and philosophical workshops *Control Group*: Traditional HAES®-based intervention	**Weight Outcomes:** Nine HAES participants and one control group participant achieved ≥ 5% weight loss but did not meet statistical significance (p=0.246).	Baseline, 7 months
Forman et al., 2013, Randomized controlled trial	*Experimental Group*: ABT *Control Group*: SBT	**Weight Outcomes:** ABT participants experienced 13.17% weight loss at post-treatment (95% CI: 9.59, 16.75) and 10.98% weight loss at the six-month follow-up 10.98% (95% CI: 7.54, 14.42) The SBT group experienced 7.54% (95% CI: 4.66, 10.42) weight loss post-treatment and 4.83% (95% CI: 1.56, 6.99) at the six-month follow-up. At the six-month follow-up, 10% weight loss was maintained in 64% of ABT participants compared to 46% of SBT participants.	Baseline, 10 weeks, 20 weeks, 40 weeks, 6 months
Forman et al., 2016, Randomized Controlled Trial	*Experimental Group*: ABT *Control Group*: SBT	**Weight Outcomes:** At mid-treatment, ABT participants had a 12.9% weight loss versus the SBT group of 10.3%. Post-treatment ABT participants had a 13.3% weight loss versus SBT of 9.8% weight loss (p=0.005). At twelve months, 64.0% of ABT participants experienced a 10% weight loss compared to the SBT participants, who achieved 48.9% (p= 0.04; 95% CI: 1.04, 0.3.23).	Baseline, 6 months, 12 months
Hawkins et al., 2021, Pilot Trial	Acceptance-based behavioral treatment program	**Weight Outcomes:** The average weight loss experienced by participants was 4.1% (p <0.001). Of the ABT participants, 19.4% achieved 10% or greater weight loss, and 38.9% achieved 5% or greater loss.	Baseline, 6 months
Järvelä-Reijonen et al., 2018, Randomized controlled trial	*Experimental Group 1*: ACT via face-to-face *Experimental Group 2*: ACT via mobile app *Control Group*: No intervention	**Diet Quality:** No statistically significant differences in diet quality were found between both ACT groups (p > 0.05). **Eating Behaviors:** Significant improvements were seen across the eating behavior tools in both ACT groups in several categories: 'eating for physical rather than emotional reasons' (p=0.019), 'uncontrolled eating' (p=0.020),	Baseline, 10 weeks, 35 weeks

		'using food as a reward' (p=0.048), 'food acceptance'(p=0.048), 'integrated regulation' (p=0.003), and 'identified regulation' (p=0.023).	
Leblanc et al., 2012, Randomized parallel controlled trial	*Experimental Group 1*: HAES group *Experimental Group 2*: Social Support (SS) group *Control Group*: Waitlisted women were instructed to follow their usual lifestyle habits	**Weight Outcomes:** The HAES group, experienced a significant decrease in body weight (weight loss: 1.4 kg; p=0.0008) compared to the SS or control groups (SS p=0.42; Control p=0.91) based on within group testing. No between-group differences were observed at four months for body weight (p >0.05).	Baseline, 4 months
Lillis et al., 2016, Randomized controlled trial	*Experimental Group*: ABBI *Control Group*: SBT	**Weight Outcomes:** No significant mean weight loss was observed between the ABBI and SBT groups (p >0.05). ABBI participants experienced less weight regain than the SBT group (ABBI: 4.6 kg, SBT=7.1 kg; p=0.005) at the post-phase. At twenty-four months, ABBI participants achieved clinically significant weight loss of >5% (p=0.038) compared to the SBT group.	Baseline, 6 months, 12 months, 18 months, 24 months
Mensinger et al., 2016, Randomized controlled trial	*Experimental Group*: Weight-neutral program, HUGS Program for Better Health *Control Group*: Weight-loss program, LEARN Program for Weight Management	**Weight Outcomes:** In the weight neutral group no weight or BMI changes were evident post-intervention or at 24 months (all ps >0.447). No between-group differences were observed regarding BMI or weight. **Diet Quality:** Both the intervention and control groups experienced improvements in fruit and vegetable consumption at post interventions (p < 0.001), and increases remained significant at twenty-four months (p < 0.001). Dietary Risk scores improved in both the intervention and control groups (p <0.001). These changes, however, were not sustained at 24 months (p=0.625). **Eating Behaviors:** Intuitive eating scores improved in both groups from baseline to post-intervention (p< 0.05). The weight-neutral group demonstrated more significant improvements in intuitive eating scores (p < 0.001) and maintained these improvements at the twenty-four-month follow-up (p=0.001) compared to the control group (p=0.310). **Biochemical Markers:** No statistically significant blood pressure findings (p >0.05). Fasting blood glucose changes were not observed to be significant (p>0.05) in either group. Weight-neutral participants significantly lowered LDL cholesterol post-intervention (p = 0.010) and maintained this reduction at twenty-four months (p = 0.031) compared to baseline. LDL cholesterol of participants in the weight-loss group was increased post-intervention (p = 0.074) and at twenty-four months (p = 0.824), compared to baseline. Weight-neutral participants post-intervention significantly decreased their HDL levels (p=0.002)	Baseline, 6 months, 24 months

		but decreases in HDL were no longer evident (p=0.073) at the twenty-four-month follow-up. At twenty-four months, the weight-neutral group had decreases in total cholesterol (p=0.026).	
Niemeier et al., 2012, Pilot Study	Single group design where participants undergo 6-month ABBI weight loss program and 3-month follow-up.	**Weight Outcomes:** ABBI participants had significant weight loss over time (p <0.0001), with the majority of weight loss occurring between baseline and six months (LSMD estimate = −12.0kg, SE=1.4, adjusted 95% CI = −15.5 to −8.5). This weight loss was maintained between the six-month assessment and three-month follow-up (LSMD estimate = −0.1kg, SE=1.4, adjusted 95% CI = −3.7 to 3.4)	Baseline, 6 month treatment, 3 month follow-up
Palmeira et al., 2017, Randomized Controlled Trial	*Experimental Group*: Received Kg-Free while maintaining their Treatment As Usual (which includes medical and nutritional appointments). *Control Group*: Received only Treatment As Usual (TAU).	**Weight Outcomes:** Within-group testing of Kg-free participants revealed a significant decrease in BMI (p=0.001; Cohen D= 0.12), but the effect size was small. The KG-free group achieved a greater weight loss of 1.15 kg compared to the control group post-treatment. Between-group measures revealed that the reported changes in BMI had a significant shallow effect (p=0.022; Cohen's d = 0.09). **Biochemical Markers:** Between-group measures of total cholesterol illustrated no differences (p=0.619; Cohen's d=0.29), with the intervention and control groups experiencing improvements post-intervention.	Baseline, 10 weeks
Raja-Khan et al., 2017, Randomized Clinical Trial	*Experimental Group*: MBSR program *Control Group*: Health Education by Dietitian	**Weight Outcomes:** No significant changes in weight or BMI in the MBSR or health education group (p >0.05). **Biochemical Markers:** At eight weeks, the health education participants achieved a significant (p <0.05) 5mm Hg reduction in SBP compared to the MBSR group, who experienced a 3.2 mm Hg reduction. Between-group differences in blood pressure results were not statistically significant (p >0.05). The MBSR group experienced reductions in fasting glucose at eight weeks (28.9 mg/dL, p= 0.02) and sixteen weeks (29.3 mg/dL, p= 0.02) follow-up periods compared to baseline measures. Between-group fasting blood glucose measures did not reach statistical significance (p >0.05).	Baseline, 8 weeks, 16 weeks
Salvo et al., 2022, Randomized controlled pragmatic study	*Experimental Group 1*: MB-EAT-SP group *Experimental Group 2*: MBHP group *Control group*: Waiting list individuals	**Weight Outcomes:** No significant weight changes observed (p >0.05). **Eating Behaviors:** The MB-EAT-SP group increased MES scores at post-intervention and the 3-month follow-up (p < 0.05) compared to the MBHP group. Overeating scores of the MB-EAT-SP improved (p < 0.001) over time compared to the MBHP group. **Biochemical Markers:** Measures of blood glucose, cholesterol, and triglycerides were not statistically significant (p >0.05) in the experimental groups or control group.	Baseline, 10 weeks, 3 months
Webber et al., 2018,	*Experimental Group 1*: Intuitive eating-based	**Weight Outcomes:**	Baseline, 7 weeks,

Randomized Controlled Pilot Study	approach (IE) for weight loss *Experimental Group 2*: Emotional brain training (EBT) approach to weight loss	No significant weight changes between groups (p >0.05). EBT group lost total 4.4 lbs (p=0.05). No significant weight changes were seen in IE group (p >0.05). **Biochemical Markers:** No statistically significant blood pressure findings (p >0.05).	14 weeks

4 | DISCUSSION

To this authors' knowledge, this is one of the first literature reviews to examine the use of IE, MBEI, or ABT and ACT interventions on weight outcomes in healthy, overweight, or obese adults. Multiple literature reviews have examined diet quality and, or psychological effects in individuals following an IE intervention but have not focused on the specific population of overweight and obese adults or weight outcomes. [10, 11] Three literature reviews examined the use of IE or MBEI approach to weight loss in overweight or obese adults; however, their studies included individuals with eating disorders. [32-34] The Academy of Nutrition and Dietetics position paper for nutrition interventions in eating disorders suggests HAES and IE as prevention efforts to lessen disordered eating risk and promote body acceptance. The Academy encourages dietitians to support health-centered behaviors versus weight-centered dieting. [35] However, clinical guidelines for using IE or MBEI in overweight or obese individuals without eating disorders are currently lacking.

The findings of this review analyzing the use of IE or MBEI on weight loss in overweight or obese adults are inconclusive. This result is similar to that of Warren and colleagues (2017), who observed mixed weight loss results in overweight or obese individuals and generally small effect sizes. In this review, seven of the nineteen studies reported non-significant weight outcomes in study participants. [4, 6, 9, 17, 18, 27, 28] Twelve articles reported weight loss and, or weight maintenance. [3, 5, 15, 16, 19, 20-26]. Of note, the findings of Alamount et al. (2020) and Asadollahi et al. (2015) demonstrated when mindfulness training and a dietary regime are combined, they may have a better impact on the weight loss of overweight or obese participants compared to participants who received mindfulness training or a dietary regime alone. Although several studies reported weight loss or weight maintenance, the effect size of these findings was shallow. [3, 5, 15, 16, 20- 26] A literature review by Carrière and colleagues (2018) found MBEI participants at follow-up demonstrated continued weight loss compared to participants in diet and exercise programs. Multiple studies in this review demonstrated similar findings as Carrière and colleagues as weight loss and maintenance were observed long-term in MBEI participants compared to participants in control groups. [20, 21, 24, 25] The findings of this systematized review cannot confirm nor deny that IE or MBEIs elicit weight loss or maintain weight loss efforts long-term in healthy, overweight, or obese adults. These findings coincide with current systematized literature reviews concerning this topic.

Diety quality, eating behaviors, and biochemical markers were only explored in a limited number of studies. Of the three studies examining diet quality, two demonstrated statistically significant results. [7, 9] In both studies, long-term maintenance of improved diet quality was not sustained (p >0.05). Multiple validated tools were used to assess diet quality, including HEI, Dietary Risk Assessment tool, RL-QOL, and IDQ, which may impact results. [7, 9, 29] The examination of eating behaviors was conducted by five studies. [6, 7, 9, 28, 29] The most common tools to assess eating behaviors across the studies were IES and TFEQ. Improvements in IES were observed in mindfulness groups in three studies with significant improvements in 'eating for physical rather than emotional reasons' (p<0.05). [7, 9, 29] Biochemical markers were measured in seven studies. [3, 4, 9, 18, 26-28]. The biochemical marker that was found to be improved across multiple studies was total cholesterol. [9, 26] Based on these results, little evidence supports the use of IE or MBEIs in overweight, or obese

adults for improving eating behaviors, diet quality, or biochemical markers.

Strengths and Limitations

This literature review included studies using mindfulness-based programs that varied in implementation and content, which can be seen as a limitation. Studies also included measured variables, such as diet quality and eating behaviors, using different tools, including self-report, which can impact the reliability of results. Further limitations of this study include article selection being limited to only include those published in English and with free, full-text availability. As a result, some resources were excluded due to inaccessibility. The authors were limited to the scope of the search strategy, which resulted in a broader timeframe being used to collect articles. The number of selected studies was small and demographic information indicates that samples were primarily Caucasian and predominantly women. [3, 4, 6, 7, 9, 15-18, 21-24, 26-29] The sample size of included studies was also generally small. These factors limit the generalizability of this study to larger populations. An identified strength of this review is several sources were used to obtain relevant articles that met inclusion criteria. The length of studies included in this review can be seen as a strength, as twenty studies were greater than two months, and thirteen studies were greater than five months. [3, 4, 6, 7, 9, 15-19, 20-29]

Application for Practitioners

A key finding of this research is the lack of standardized protocols for MBEI and IE interventions. IE and MBEI do not generally aim at initiating weight loss. [11] However, the principles of MBEI and IE have been known to elicit weight loss in individuals due to the emphasis on altering eating behaviors. [8, 10, 11] This was demonstrated in this review as twelve studies revealed weight loss results and long-term weight maintenance. A limited number of studies analyzed diet quality, with results indicating short-term benefits but a lack of long-term maintenance. [7, 9, 29] Improvements in eating behaviors were found in this review with an emphasis on improvements in 'eating for physical rather than emotional reasons.' However, because several different tools were used to measure both diet quality and eating behaviors in these studies, inconsistencies in improvements or lack thereof could be due to the tool used. Further research is required to standardize protocols for MBEI and IE as well as tools to measure diet quality and eating behaviors of participants.

5 | CONCLUSION

Overall, this review aimed to analyze if implementing an MBEI in overweight or obese individuals effectively reduced or maintained weight and improved eating behaviors and diet quality. Results of significant weight loss and long-term weight maintenance following the implementation of an MBEI were inconclusive. However, due to the lack of a standardized protocol for MBEI, implementation of MBEI varied between studies, likely impacting weight results. Limited data were available regarding the diet quality of MBEI participants. Improvements in diet quality were observed in two studies; however, several different tools were used to collect data which likely impacted results. [7, 9] The MBEI participants also exhibited improvements in eating behaviors. Tools measuring eating behavior data varied across studies, with two tools seemingly consistently used, the TFEQ and IES. The results of this review are difficult to generalize due to the sample sizes and lack of diversity included in these studies. Future studies, including standardized MBEI protocols and tools, a more diverse sample population, and larger sample sizes, are needed to determine the effectiveness of MBEI in weight reduction and maintenance, as well as diet quality and eating behavior improvement.

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How to cite this article: Brittany Paul and Kevin Haubrick, TA Mindfulness-Based Eating Intervention Approach to Weight Loss in Overweight and Obese Adults Research Review.2022;789-805. https://doi.org /10.52868/RR /2022-3-3-5