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The Mindful Eating approach promotes changes in the eating behavior of overweight individuals? A systematic review

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ABSTRACT

Introduction: Energy restriction, associated with environmental, physiological, and psychological effects, is a challenge for controlling eating habits and disorders, in which Mindful Eating emerges as a relevant alternative, involving mindfulness of sensations and experiences related to food. **Objective:** To identify the effects of the Mindful Eating behavior therapy on the eating behavior of overweight individuals. **Methods:** This is a systematic review of the literature carried out from May to June 2022 in Google Scholar, PubMed, Web of Science, Lilacs, Scopus, and Embase databases. Articles in English and Portuguese were included, with no restriction on the year of publication. The eligibility criteria were structured according to the PICO strategy (Population, Intervention, Comparison, and Outcome). The methodological quality of the studies was assessed using the Amstar 2 and Joanna Briggs Institute tools. Data were synthesized and presented in charts and tables, and discussed narratively. **Results:** Thirteen articles were analyzed, distributed in systematic reviews, randomized and non-randomized clinical trials, and observational studies. The articles included in the review indicated that the groups treated with the Mindful Eating behavior therapy obtained significant improvements in eating behavior, with a decrease in binge eating and eating disorders, in addition to improvement in emotional eating, quality of food, and oral and cognitive control over food intake. **Conclusion:** Mindful Eating behavior therapy can positively modify the eating behavior of overweight and obese individuals.

Keywords: Mindful Eating; Mindfulness; Feeding Behavior; Obesity.

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INTRODUCTION

According to the World Health Organization[1], overweight and obesity are defined as an abnormal or excess accumulation of fat that can harm health. A high body mass index (BMI) is a risk factor for chronic non-communicable diseases[1].

Evidence points to an increase in the prevalence of overweight and obesity worldwide[2]. Obesity is a public health problem that requires priority action to prevent and combat it. It is common for strategies focused on calorie deficit associated with increased energy expenditure to be used for weight loss. However, these interventions fail in terms of long-term results, since after 5 years, at least half of the individuals return to their initial weight[3].

Traditional weight loss methods with conscious food restriction can cause emotional stress and dysfunctional eating behaviors, such as binge eating[4]. Although overweight individuals are reduced to having less eating discipline when compared to eutrophic individuals, it must be taken into account that they are more susceptible to being affected by the smell and appearance of food, as well as the greater emotional impulse to eat[5]. Approaches based on energy restriction associated with environmental, physiological, and psychological effects, such as increased appetite and binge eating, represent a challenge for the control of eating habits and disorders[6].

With this, Behavioral Approaches emerged, which proved to be effective in changing problematic eating behaviors in overweight and obese people, prioritizing the relationship with food and accepting aversive internal experiences, rather than imposing restrictive diets[7,8].

One of these strategies is Mindfulness, which consists of the innate ability of human beings to focus on the present moment and, without judgment, perceive all their thoughts and bodily sensations[9]. In the context of food, Mindful Eating (ME) is an approach defined as attention without criticism or judgment to the physical and emotional sensations arising during the act of eating or in circumstances related to food[10].

Studies show that the use of interventions based on Mindful Eating in patients with obesity is effective in reducing maladaptive eating behaviors[11]. In this context, implementing these interventions is a promising and sustainable alternative with the potential to reduce the demand for health care. Therefore, this work is justified by the relevance of the approach to restoring health indicators and psychological well-being.

Thus, this research aimed to systematically review the literature in search of studies that addressed the effects of the Mindful Eating approach on the eating behavior of overweight individuals.

METHODS

This study is a systematic review that followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 (PRISMA 2020) guideline, using a checklist that includes seven sections with 27 items[12].

The review's eligibility criteria were structured according to the acronym PICO, used to describe Population, Intervention, Comparison/Control, and Outcomes[13]. The "Comparison/Control" element was not applied as a criterion because it was not relevant to the research objective, giving rise to the following guiding question: "Is the Mindful Eating approach capable of promoting an improvement in the eating behavior of overweight individuals?".

Population

Men and/or women aged 18 or over who are overweight and/or obese (BMI ≥ 25 kg/m²). Interventions with studies evaluating the effects of interventions based on the Mindful Eating approach. For comparison, studies that include controls with or without nutritional interventions, as well as studies without a control group, and in terms of outcomes, studies that cover the eating behaviors associated with overweight individuals.

Types of studies

Randomized or non-randomized clinical studies, systematic reviews with or without meta-analysis, and observational studies, published in full in Portuguese and English, were included in order to increase the authors' ease of understanding. In addition, they were peer-reviewed in order to guarantee the validity of the reports and without a year restriction, in order to reach the maximum number of viable studies.

Databases and search strategies

The literature search was carried out in the electronic databases Google Scholar and PubMed, accessed directly in the databases themselves, and Web of Science, Lilacs, Scopus, and EMBASE, until August 17, 2024. No restrictions were applied to the year of publication to reach the maximum number of studies available.

The keywords used in the search strategy were defined, in English and Portuguese, based on previous readings of scientific articles on the subject. The search terms were divided into three levels: Exposure, Outcome, and Population, respectively. Thus, the levels created were: 1) Mindful eating. Mindfulness; 2) Eating Behavior. Food consumption. Eating habits. Behavioral Nutrition. Nutritional Sciences. Non-prescriptive nutrition. Food and Nutrition Education. Protocols; 3) Obesity. Overweight.

The terms were combined using the Boolean OR operator to join the synonyms and then the AND operator to intersect the lines. Finally, after searching for the terms, the combinations were adjusted according to each database used, as described in Table 1.

Selection of studies

The bibliographic selection process in the databases was carried out manually, in three stages, based on pre-defined eligibility criteria.

A priori, the titles of the articles were read, and those that were outside the scope of this study were excluded, such as those that did not address the topic, were available in another language, duplicated, or were beyond page 10 in the Google Scholar database.

After the initial stage, the abstracts were read and analyzed, and, from this reading, papers that did not address the scope of the PICO strategy or that were not fully available were removed.

The remaining articles were read in full, and those that met the criteria of participants, interventions, results, and study design were included in the review.

The entire search process was recorded in a Microsoft Excel spreadsheet for evaluation of the data gathered and subsequent data

Table 1: Distribution of database search strategies.

Database	Search strategy
Google Scholar	Mindful eating OR Mindfulness AND Eating Behavior OR Food consumption OR Eating habits OR Behavioral Nutrition OR Nutritional Sciences OR Non-prescriptive nutrition OR Food and Nutrition Education OR Protocols AND Obesity OR Overweight
PubMed	((((((Mindful eating[MeSH Terms]) OR (Mindfulness[MeSH Terms])) OR (Atenção plena[MeSH Terms]))) AND ((((((((((((((((Eating Behavior[MeSH Terms]) OR (Food consumption[MeSH Terms])) OR (Eating habits[MeSH Terms])) OR (Behavioral Nutrition[MeSH Terms])) OR (Nutritional Sciences[MeSH Terms])) OR (Non-prescriptive nutrition[MeSH Terms])) OR (Food and Nutrition Education[MeSH Terms])) OR (Protocols[MeSH Terms])) OR (Comportamento alimentar[MeSH Terms])) OR (Consumo alimentar[MeSH Terms])) OR (Hábito alimentar[MeSH Terms])) OR (Nutrição comportamental[MeSH Terms])) OR (Ciências da nutrição[MeSH Terms])) OR (Nutrição não prescritiva[MeSH Terms])) OR (Educação alimentar e nutricional[MeSH Terms])) OR (Protocolos[MeSH Terms]))))) AND ((((((Obesity[MeSH Terms]) OR (Overweight[MeSH Terms])) OR (Obesidade[MeSH Terms])) OR (Excesso de peso[MeSH Terms])) OR (Sobrepeso[MeSH Terms]))))
Web of Science	((ALL=({Mindful eating} OR {Mindfulness})) AND ALL=({Eating Behavior} OR {Food consumption} OR {Eating habits} OR {Behavioral Nutrition} OR {Nutritional Sciences} OR {Non-prescriptive nutrition} OR {Food and Nutrition Education} OR {Protocols})) AND ALL=({Obesity} OR {Overweight})
Lilacs	Mindful eating OR Mindfulness [Palavras] and Eating Behavior OR Food consumption OR Eating habits OR Behavioral Nutrition OR Nutritional Sciences OR Non-prescriptive nutrition OR Food and Nutrition Education OR Protocols [Palavras] and Obesity OR Overweight [Palavras]
Scopus	(TITLE-ABS-KEY ({Mindful eating} OR {Mindfulness}) AND TITLE-ABS-KEY ({Eating Behavior} OR {Food consumption} OR {Eating habits} OR {Behavioral Nutrition} OR {Nutritional Sciences} OR {Non-prescriptive nutrition} OR {Food and Nutrition Education} OR {Protocols}) AND TITLE-ABS-KEY ({Obesity} OR {Overweight}))
Embase	('mindful eating':ti, ab,kw OR mindfulness: ti, ab,kw) AND (('eating behavior':ti, ab,kw OR 'food consumption, ab,kw OR 'eating habits', ab,kw OR 'behavioral nutrition':ti, ab,kw OR 'nutritional sciences':ti, ab,kw OR 'non-prescriptive nutrition':ti, ab,kw OR food: ti, ab,kw) AND 'nutrition education':ti,ab,kw OR protocols:ti,ab,kw) AND (obesity:ti,ab,kw OR overweight:ti,ab,kw)

extraction. Also, based on the PRISMA 2020 flowchart, the specification of the selection process for the articles searched was structured and categorized into: identification, screening, and inclusion.

Data extraction

Data was extracted using a standardized electronic form using Microsoft Excel software, designed to systematically collect data from the literature. The following quantitative and qualitative data was extracted: author, year, study development period, country, city, collection site, study design, population description, sample size, sample calculation, age range, inclusion criteria, exclusion criteria, article objective, exposure, intervention, outcome and main results, verifying the accuracy of the information extracted from each study.

Evaluation of the Methodological Quality of Studies

Initially, the methodological quality of the included studies was assessed using a standardized electronic form with Microsoft Excel software. Discrepancies were resolved by consensus. The methodological quality of the studies was determined using the checklist tools A Measurement Tool to Assess Systematic Reviews 2 (AMSTAR 2) for systematic reviews with or without meta-analysis and the Joanna Briggs Institute (JBI) for randomized, non-randomized, and observational studies.

AMSTAR 2

The AMSTAR 2[14] tool, an updated version of the tool for critical appraisal of systematic reviews, is made up of 16 domains. AMSTAR 2, therefore, groups together seven questions considered critical and nine non-critical, in which some critical items relate to previously established review methods, a comprehensive literature search strategy, and a satisfactory technique for assessing and explaining the risk of bias.

The method for evaluating the included systematic reviews was carried out on the tool's online platform, in which the automatically generated quality classification is divided into high, moderate, low, and critically low.

JBI for randomized clinical trials

In the JBI evaluation, since there is no scoring and evaluation scale, the team of reviewers must agree and define, in advance, a cut-off point that will guide the decision on how to classify the studies judged[15-17]. The points were then calculated based on the number of "Yes" answers each article received, and an adjustment was made to the number of questions in each specific checklist for the study designs.

The evaluation procedure was carried out manually using the checklist available on the downloadable platform.

Thus, the JBI[15] checklist for randomized studies has 13 questions that deal with blinding, randomization, and concealment of allocation, differences between the participants included in the compared groups, blinding of the administrators and evaluators of the intervention, other exposures or treatments occurring simultaneously, and analysis of the results.

Thus, randomized studies were classified as high methodological quality (score from 13 to 10), moderate quality (score from 9 to 5), and low quality (score from 4 to 0).

JBI for non-randomized clinical trials

The JBI[15] checklist for non-randomized studies has 9 questions that discuss the temporal relationship of the variables, differences

between participants in the compared groups, the presence of a control group, complete follow-up of the groups, and analysis of the results.

Non-randomized studies were classified as high methodological quality (score from 9 to 7), moderate quality (score from 6 to 4), and low quality (score from 3 to 0).

JBI for observational clinical trials

Finally, the JBI[17] checklist for observational studies has 11 items that address similarities between the compared groups, validity and reliability of exposure measures, confounding factors, and strategies to deal with them, disprove the outcome, and appropriate and complete follow-up time and analysis of the results.

The observational studies were classified as high methodological quality (score 11 to 9), moderate quality (score 8 to 5), and low quality (score 4 to 0).

Summary of results

As a result of the methodological heterogeneity between the results, it was not possible to carry out a meta-analysis. Therefore, the data from the studies that were included were discussed in narrative form, and the characteristics were summarized in a descriptive table for the main results.

RESULTS

Selection of studies

Figure 1 shows the PRISMA 2020 flowchart of the selection process for the included studies. In summary, 751,011 articles were identified, of which 745,274 were excluded for the following reasons: duplicates, records outside the delimited language, and after page 10 of the Google Scholar platform. 5,692 records that did not meet the objectives of the review were eliminated during the title and abstract analysis. Thus, after removing 8 articles that did not allow full access to the content and a further 8 because they did not meet any of the eligibility criteria, 29 studies were read in full.

In the full-text selection stage, 16 articles were removed, of which: one study was discarded because it did not investigate the outcome of interest; one study was excluded because it was a research protocol; seven studies did not carry out the Mindfulness and Mindful Eating intervention; five studies were discarded because they did not cover eating behaviors related to overweight; two studies were excluded because they were integrative reviews. Therefore, 13 articles were deemed eligible and included in this systematic review.

Characteristics of the studies

The main characteristics of the included studies are described in Table 2. The studies were carried out in five countries: the USA, the UK, France, Greece, Brazil, Spain, UK and Italy. The articles included in the review are four systematic reviews, three with meta-analysis, three randomized clinical trials, five non-randomized clinical trials, and one observational cohort study, published between 2010 and 2024 and with samples ranging from 10 to 194 individuals.

Thus, although the age range of studies is not presented in a single format, the minimum age of the participants in the studies is 18 years, with the average age ranging from 45.8 years to 48.15 years. Their main outcomes investigated the effects of Mindful Eating interventions on overweight adults (BMI ≥25 kg/m^2) with a view to outcomes related to eating behavior, health, body weight, and well-being.

Methodological quality of the studies

Table 3 shows the methodological quality of the studies, assessed using the AMSTAR 2 and JBI tools. The studies obtained an average score ranging from 12 to 9, with only one article receiving 2 points.

Thus, seven articles were classified as high quality[18-24], while two studies were considered to be of moderate quality[25,26]. One study was of low quality[27], while three were of critically low quality[28-30]. Thus, the thirteen studies were included in the review, as the author's aim was exclusively to identify the methodological quality of the studies used in the review and then classify them.

The study by Ruffault et al.[27] indicated low quality due to the lack of pre-established protocols and the absence of comprehensive literature search strategies, which are critical domains of the assessment tool. Three articles showed critically low quality[28-30] because they did not score in all the critical domains of AMSTAR 2, including factors such as lack of adequate detail on each study included in the review, comprehensiveness of the literature search, and failure to use satisfactory techniques to assess the risk of bias.

On the other hand, Miller et al.[25] showed moderate quality due to insufficient data on the concealment of the allocation of comparison groups and the blinding of participants and researchers. Likewise, Hanson et al.[26] showed moderate methodological quality as a result of the lack of strategies to deal with incomplete follow-up of research participants and inconsistencies regarding the identification and treatment of confounding factors.

Finally, the trials with high methodological quality obtained this result because they scored well in several categories and presented relevant methodological information.

Study results

Table 4 describes the main interventions and results evaluated. From a complete reading of the articles selected for review, interventions based on Mindfulness training with a focus on Mindful Eating were identified in all the studies. The interventions were organized into group meditations (n=9) and via a smartphone app

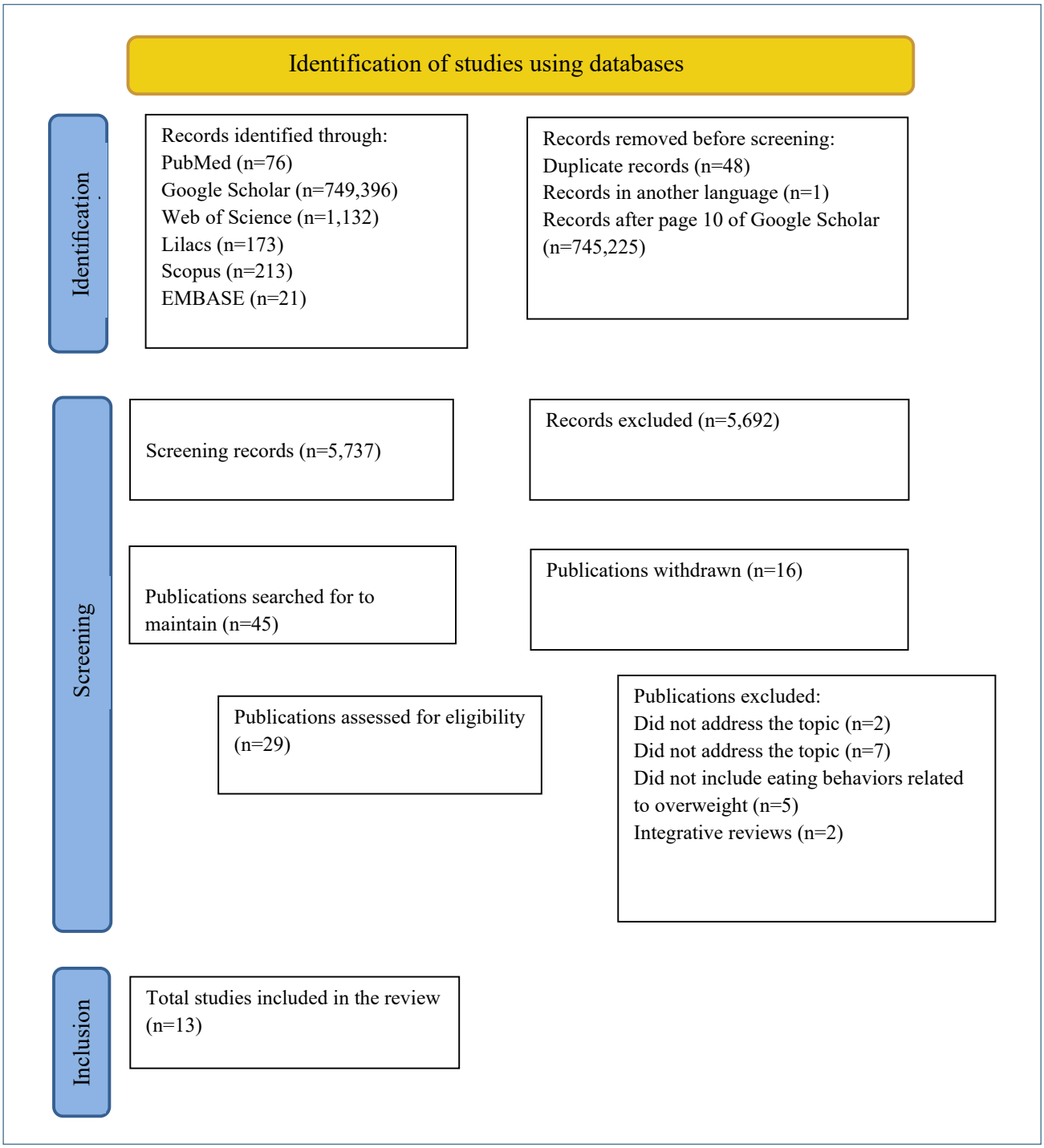

Figure 1: Flowchart of study selection according to PRISMA 2020.

(n=1). In addition, the control groups received differentiating interventions (n=3), no intervention (n=2), or were not included as comparison groups (n=4). The duration of the intervention ranged from 28 days to 5.5 months, with studies including post-intervention follow-up (n=7). Finally, a small number of studies presented results obtained through syntheses of other articles (n=4).

The results show that all the studies analyzed showed a significant improvement in eating behavior[18-30]. In addition, five studies reported a reduction in the intake of sweets, trans fats, total sugars, eating out, and fast food consumption[18,24-26,28]. Likewise, seven articles showed significant reductions in impulsive eating, binge eating, disinhibition (loss of control over eating), as well as increases in cognitive restraint (cognitive control over food intake) and oral control[19,20,22,27-29].

A reduction in bulimia and other eating disorders was found in two of the articles analyzed[19,22,23]. Meanwhile, five studies showed

Table 2: Description of the general characteristics of the studies analyzed in the systematic review.

Authors/year	Country	Study design	Population	Outcomes
O'Reilly et al. 2014[28]	United States of America	Systematic review	21 articles describing the effects of the intervention on adults with obesity	Change in eating behaviors related to obesity.
Mason et al. 2016[18]	United States of America	Randomized clinical trial	Sample =194; Age =47.0 years (SD=12.7) Criteria = BMI ≥30 kg/m²	Reduced consumption of sweets and evidence of lower fasting glucose levels.
Hanson et al. 2018[26]	England	Observational cohort study	Sample =53; Age =25 - 66 years Criteria = BMI >35 kg/m²	Redução do consumo de doces e evidência de níveis mais baixos de glucose em jejum.
Dalen et al. 2010[20]	United States of America	Non-randomized clinical study	Sample =10; Age =31-62 years Criteria = BMI ≥30 kg/m²	Decrease in weight, BMI, improvement in eating behavior, mental health, physiological markers (glucose, LDL, adiponectin), and inflammation.
Mason et al. 2018[21]	United States of America	Non-randomized clinical study	Sample =10; Idade =31-62 anos Criteria = IMC ≥30 kg/m²	Reduction in craving-related eating episodes and the effects of the intervention on body weight, body fat, and body fat distribution.
Miller et al. 2012[25]	United States of America	Randomized clinical trial	Sample =52; Age =35-65 years Criteria = BMI ≥ 27 kg/m²	Mindful eating facilitates greater weight loss compared to the Diabetes Self-Management Education approach, changing dietary intake and lowering blood glucose.
Ruffault et al. 2017[27]	France	Systematic review and meta-analysis	12 articles describing the effects of the intervention on overweight and obese adults	Change in BMI, impulsive eating, including uninhibited and uncontrolled eating, binge eating, and changes in physical status, activity level, from baseline to post-intervention.
Zervos et al. 2022[22]	Greece	Non-randomized clinical study	Sample =57 Age =45.8 years (SD=12.0) Criteria = BMI >25 kg/m²	Improving individuals' conscious attention and eating behavior, reducing stress levels, increasing self-compassion, and, finally, acquiring better control of body weight.
Salvo et al. 2021[23]	Brazil	Non-randomized clinical study	Sample =57 Age =45,8 anos (DP=12,0) Criteria = IMC >25 kg/m²	Acceptance of the Mindfulness-Based Eating Awareness Training protocol among overweight women in Brazil, with a positive impact on weight change, risky eating behavior, anxiety, depression, and self-compassion.
Salvo et al. 2022[32]	Spain	Randomized clinical trial	Sample =41; Age = 45-75 years Criteria = BMI ≥ 25 kg/m²	A reduction in emotional eating, external eating, and the frequency of binge eating. There was also a reduction in the Bite severity scale in overweight and obese individuals.
Smith et al. 2023[30]	United Kingdom	Systematic review and meta-analysis	34 articles describing the effects of the intervention on overweight and obese adults	Reducing emotional eating and promoting weight loss in overweight and obese adults.
Minari et al. 2024[24]	Brazil	Non-randomized clinical study	Sample = 82 Age =37-56 years Criteria = BMI ≥ 30 kg/m²	Improvement in anthropometric data, binge eating episodes, body image dissatisfaction, eating habits, and quality of life in participants with obesity and binge eating disorder in the short term.
Idelson et al. 2024[29]	Italy	Systematic review and meta-analysis	14 studies describing the effects of the intervention on cardiometabolic risk factors.	Decrease in anthropometric and cardiometabolic parameters, as well as improvement in psychological and behavioral aspects, such as reduction in stress, anxiety, emotional eating, and reduction in binge eating rates.

positive changes in emotional eating, food consumption related to desire, reward, and for social reasons[19,21,28-30]. On the other hand, one study reported an increase in bulimia and preoccupation with food after a 14-month post-intervention follow-up[22]. Improvements and maintenance of eating behavior observed at post-intervention follow-up were reported in five articles[18-21,25].

DISCUSSION

The data found in this study show satisfactory effects of Mindful Eating behavioral therapy on the eating behavior of overweight individuals. The main and most consistent effects observed were reductions in compulsive eating behaviors, eating disorders, and emotional eating, while there was an improvement in eating quality and oral and cognitive control over food intake. In this way, the findings of this research corroborate that the ME approach has the potential to be an alternative to promote benefits in the eating behaviors of the overweight community.

Evidence has been found on the effectiveness of interventions in ME on different aspects of the eating behavior of overweight people. In the present review, the findings of Dalen et al.[20,24,29] reveal major reductions in binge eating through an increase in patients' ability to observe, accept, and be more aware of their internal hunger and satiety signals. In addition to the direct relationship with a reduction in symptoms of depression and anxiety, factors that play an important role in binge eating. Similarly, the study by Ruffault et al.[27] brought together a set of articles that support this evidence, since Mindfulness applied to participants had an overall positive effect, reducing impulsive eating and binge eating.

The findings are similar to those identified in the randomized controlled pilot study by Cancian et al.[31], which focused on dialectical behavioral therapy interventions with Mindfulness modules,

Table 3: Quantitative assessment of the methodological quality of the studies according to the AMSTAR 2 and JBI critical appraisal checklists.

Critical Analysis																			
		Questions																Total	
Evaluation instrument	Author/year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Yes	Classification
AMSTAR 2	Ruffault et al. 2017[27]	Y	PY	Y	N	Y	Y	Y		Y	N	Y	Y	Y	Y	Y	Y	12	Low
	O'Reilly et al. 2014[28]	Y	N	N	N	N	N	N	N	N	N	NA	NA	N	N	NA	Y	2	Critically Low
	Idelson et al. 2024[29]	N	N	N	PY	Y	N	Y	PY	PY	Y	Y	Y	Y	Y	Y	Y	9	Critically Low
	Smith et al. 2023[30]	Y	Y	Y	PY	Y	Y	Y	Y	N	Y	Y	N	N	Y	N	Y	11	Critically Low
JBI RCT	Mason et al. 2016[18]	Y	Y	Y	Y	PC	Y	Y	Y	Y	Y	Y	Y	Y				12	High
	Morillo-Sarto et al. 2023[19]	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y				11	High
	Miller et al. 2012[25]	Y	UC	Y	UC	UC	UC	Y	Y	Y	Y	Y	Y	Y				9	Moderate
JBI NRCT	Dalen et al. 2010[20]	Y	Y	Y	N	Y	Y	Y	Y	Y								8	High
	Mason et al. 2018[21]	Y	Y	Y	N	Y	Y	Y	Y	Y								8	High
	Zervos et al. 2022[22]	Y	Y	Y	Y	Y	Y	UC	Y	Y								8	High
	Salvo et al. 2021[23]	Y	Y	Y	N	Y	Y	Y	Y	Y								8	High
	Minari et al. 2024[24]	Y	Y	Y	N	N	Y	Y	Y	Y								7	High
JBI OCO	Hanson et al. 2018[26]	Y	Y	Y	NA	NA	Y	Y	Y	Y	N	Y						8	Moderate

RCT: Randomized Clinical Trial; NRCT: Non-Randomized Clinical Trial; OCO: Observational Cohort Trial; Y: Yes; PY: Partially Yes; N: No; UC: Unclear; NA: Not Applicable.

showing improvements in binge eating and depression, as well as reporting a reduction in stress and anxiety. In the study by Salvo et al.[32], similar findings were observed where the effects of mindfulness training are more pronounced for binge eating than for other eating behaviors.

Considering the evidence, the ME approach can treat dysfunctional eating attitudes related to bulimia in overweight people. According to Shaw et al.[7], individuals who practice mindful eating behavior are less likely to develop eating disorders and can maintain a more balanced diet.

The evidence from this review points to a general improvement in emotional, craving-related, reward-related, and socially motivated eating, which suggests motivational and psychological changes associated with the act of eating[19,21,28-30]. This is consistent with research by Hooker et al.[33] which showed that emotional regulation and reduction of emotional and external eating were better promoted through Mindfulness. Thus, providing positive results with potential implications for health and psychological well-being.

The study by Miller et al.[25] showed that the Mindful Eating approach is equally capable of modifying the dietary intake of adults with diabetes mellitus when compared to a diabetes self-management program adopted in several countries. On the other hand, this differs from the findings of Miller et al.[34], in which there was no significant difference in food intake between the Mindful Eating and diabetes self-management groups. However, there was a significant increase in the consumption of fruit and vegetable portions in the diabetes management group, explained by the fact that this intervention focused on discussing the benefits of fruit and vegetable consumption, while ME did not emphasize the consumption of specific foods[34].

In summary, the data found indicates that Conscious Eating, by establishing a deeper contact between the individual and their emotional and physiological signals, can increase the ability to recognize the body's interoceptive sensations of hunger and satiety. Additionally, it has the potential to lead to more rational decision-making regarding food choices, contributing to the re-evaluation of unconscious eating behaviors through meditation.

It is worth noting that one study identified an increase in the concentration of gray matter in the hippocampus, in which post-intervention structural changes in this region may reflect an improvement in the regulation of emotional response, enabling eating to be done in a non-impulsive way in response to emotions[35]. Likewise, there are changes in the concentration of gray matter in other brain regions involved in memory processes, learning, social cognition, and self-referential processing, contributing to self-knowledge in making decisions about how, when, and how much to eat[35].

Table 4: Description of the interventions and main results found in the studies analyzed in the systematic review.

Authors/year	Intervention	Main results
O'Reilly et al. 2014[28]	Mindfulness exercises, mindful eating, mindful meditation, mindful body scanning, or acceptance-based practices.	Overall, 86% of the studies reported positive changes in eating behavior outcomes. Thus, 92% of the studies reported improvements in the frequency and/or severity of binge eating, 63% of the interventions resulted in positive changes in the occurrence of emotional eating and/or the desire to overeat emotionally, and 67% of the studies reported improvements in the frequency of external eating. Furthermore, 67% of the studies targeting food intake reported improvements in unhealthy food intake following MBIs.
Mason et al. 2016[18]	Intervention lasting 5.5 months, so that the Mindfulness Intervention Group received a nutritional plan and mindfulness training in various domains, and the Active Control Group received additional information on nutrition and physical activity. Follow-up of 12 months.	Greater increases in mindful eating from baseline to 6 months were observed among mindfulness intervention participants (from M=2.7±0.3 to M=2.9±0.3), compared to control participants (from M=2.6±0.3 to M=2.8±0.4). In addition, from 6 to 12 months, the control participants showed a substantial increase in their intake of sweets (from 9.3% to 11.3%), compared to the participants in the mindfulness intervention who maintained this reduction in their intake of sweets (from 8.4% to 8.2%).
Hanson et al. 2018[26]	An 8-week intervention in which the Intervention Group was taught mindfulness-based eating behavior strategies, and a retrospective Control Group was included to compare weight loss.	There was a statistically significant 4% improvement in overall self-reported eating style between the assessments carried out at the beginning and after the completion of the intervention (from 15.6 to 29.88), driven mainly by improvements in "fast-foodism", which is the consumption of fast foods with limited fresh food (from 5.45 to 8.06). In addition, participants improved their relationship with food, feeling able to plan meals.
Dalen et al. 2010[20]	Intervention lasting 6 weeks, taught with specific exercises including mindfulness meditation, eating exercises, and group discussion. No control group. Follow-up for 3 months.	Increases in cognitive restriction, compared to baseline, were observed at 6 weeks (from M=8.8±6.1 to M=14.1±5.4). In addition, at 6 weeks, compared to baseline, large decreases were observed in disinhibition (from M=9.5±4.6 to M=6.4±2.8), binge eating (from M=16.2±5.4 to M=9.2±5.1), and a large decrease in hunger (from M=7.6±3.9 to M=4.6±3.5). Then, compared to baseline, large reductions in disinhibition (from M=9.5±4.6 to M=4.5±2.5) and binge eating (from M=16.2±5.4 to M=7.2±2.3) were observed over 3 months.
Mason et al. 2018[21]	28-day intervention based on a smartphone app that teaches mindful eating skills, with direct guidance on how to practice mindfulness principles and review materials. No control group. 7-month follow-up.	Statistically significant reductions in craving-related eating were seen in all completers (from M=53.19±19.00 to M=31.80±19.22) and timely completers (from M=52.90±19.06 to M=33.70±19.33), groups cited in the study results. In addition, reductions in reward-related feeding were also evident among completers (from M=24.30±4.69 to M=17.25±6.02) and timely completers (from M=23.90±4.74 to M=17.39±6.07). Next, reductions in eating for social reasons were noted among completers (from M=1.51±0.88 to M=1.12±0.83) and timely completers (from M=1.50±0.89 to M=1.12±0.80).
Miller et al. 2012[25]	Intervention lasting 3 months, so that the Mindfulness-Based Eating Awareness Training Group received training in mindfulness meditation, eating and physical activity practice, and body awareness, and the Diabetes Self-Management Education Group addressed topics such as glycemic control.3-month follow-up.	There was a significant difference in trans fat intake between the MB-EAT (from M=1.48 g±0.10 to M=0.05 g±0.10) and DSME (from M=1.60 g±0.10 to M=-0.23 g±0.10) groups at the end of the study. Furthermore, total fiber showed a significant difference between MB-EAT (from M=10.48 g±0.82 to M=0.86 g±0.70) and DSME (from M=10.18 g±0.84 to M=3.46 g±0.72) at the end of the study. Soon after, there was a significant difference in the change in dietary intake of total sugars between MB-EAT (from M=42.52 g±2.78 to M= -1.50 g±2.95) and DSME (from M=45.53 g±2.83 to M=7.03 g±3.01) at the end of the study. Finally, MB-EAT participants reported a significant decrease in energy intake immediately after the intervention (from M=1,851 kcal±129 to M= -298 kcal±109) and at 3-month follow-up (from M=1,851 kcal±129 to M= -490 kcal±109).
Ruffault et al. 2017[27]	Mindfulness training on the health behaviors of overweight and obese adults and quantitative estimates of the effect size of mindfulness techniques.	The studies reported that post-intervention impulsive eating was statistically lower in the mindfulness intervention groups than in the control groups ($p<0.01$). Furthermore, mindfulness training significantly reduced impulsive eating from baseline to post-intervention in the intervention groups ($p<0.01$). Furthermore, mindfulness training statistically decreased binge eating from baseline to post-intervention in the intervention groups ($p<0.01$), and post-intervention binge eating was significantly lower in the intervention groups than in the control groups ($p<0.001$).
Zervos et al. 2022[22]	Intervention lasting 8 weeks, with the Intervention Group receiving mindfulness meditation, mindful eating practices, and cognitive therapy exercises, and the Control Group receiving no intervention. Follow-up of 14 months.	After completing the program, participants in the intervention group recorded a significant increase in oral control (from M=1.69±2.18 to M=3.39±2.45) and a significant decrease in bulimia (from M=3.83±4.13 to M=1.81±2.60). However, the participants in the control group had no significant changes in oral control (from M=1.27±1.61 to M=1.05±1.43) and bulimia (from M=3.00±3.52 to M=2.76±2.74). On the other hand, fourteen months after completing the intervention, diet and oral control had not changed significantly ($p=0.252$) compared to post-intervention levels, while bulimia/preoccupation with food had increased significantly ($p=0.030$).
Salvo et al. 2021[23]	A 13-week intervention based on the Mindfulness-Based Eating Awareness Exercise with guided meditation and mindfulness practices, didactic information, homework assignments, questioning about leadership, and group sharing of experiences and related issues. No control group.	There was a significant decrease from pre- to post-intervention in problematic eating behavior (from M=23.0±11.5 to M=16.2±9.4). Furthermore, of the participants who completed the intervention, 35% scored above the cut-off point for eating disorders, and all the participants who scored at the risk level for eating disorders decreased their score below the risk level. In addition, during the process, it was also possible to observe the development of internal perception of the body's signals, as well as behavioral self-knowledge and improvement in the relationship with food.

Continue...

Table 4: Continuation.

Authors/year	Intervention	Main results
Salvo et al. 2022[32]	A 7-week intervention held once a week, with Mindfulness-Based Eating Awareness training. The sessions combined mindfulness theory and practice. With a control group. Follow-up for 12 months.	There was a significant reduction in emotional eating after the intervention (p=0.006) and after the follow-up period (p<0.001). The external eating subscale also showed a decrease compared to the initial score (p=0.035). After the follow-up period, reductions were seen in the Bite severity scale (p=0.004) and in the frequency of binge eating (p=0.001). Bulimic behaviors were partially improved by the intervention, and their severity was reduced at the 1-year follow-up.
Smith et al. 2023[30]	Mindfulness interventions with general techniques drawn from stress reduction, along with specific mindful eating training derived from Mindfulness-Based Eating Awareness Training and identifying and responding adaptively to food cravings, and providing emotional regulation skills.	Following the sub-analysis of effect size by intervention category, the studies with mindfulness-based interventions reported a change in percentage weight change of -1% (95% CI: -3 to 0). In addition, the sub-analysis of effect size by intervention category showed a considerable variation in the combined effect size for the emotional eating score, with mindfulness-based interventions scoring -24% (95% CI: -36 to -12). Thus, there was a greater percentage change in the reduction of emotional eating than in weight.
Minari et al.2024[24]	Intervention lasting 8 weeks with weekly individual meetings, guided by a Mindful Eating session, nutritional educational dynamics, cooking workshop, food sensory analysis, and questionnaire applications (Body Image Scale - BSQ; Binge Eating Scale - BES; Quality of Life Scale - WHOQOL BREF). No control group. Follow-up after 2 months.	There was a significant reduction in weight (p<0.0001) from 98 kg in the first week to 95 kg (from M=97.5±6.5 kg to M=94.1±6 kg). BMI also decreased significantly (p<0.0001) from 38.9 kg/m² at the first week to 36.3 kg/m² at the eighth week (from M=37.3±3.9 kg/m² to M=35.1±3.9 kg/m²). BES scores decreased significantly (p<0.0001) from 34 points in the first week to 30 in the eighth week (from M=33.2±3.3 points to M=31±3.3 points). Analyses of the number of binge eating episodes showed a significant reduction (p<0.0001) from 7 episodes in the first week to 3 episodes in the eighth week (from M=8±2.3 episodes to M=3 ± 1.4 episodes). It was observed that, after the start of the intervention, the patients began to consume around 350 kcal less than before. In addition, there was a significant increase in water intake (p<0.0001) and a reduction in the consumption of ultra-processed foods with a high calorie density. On the other hand, the patients began to consume more fruit, vegetables, legumes, rice, beans, lean proteins, whole grains, nuts, oilseeds, teas, spices, and herbs.
Idelson et al. 2024[29]	Interventions lasting between 4 and 24 weeks focused on mindful eating.	Of the studies analyzed, 86% assessed body weight, of which weight loss was described as significant in 50% of the studies. Through the meta-analysis, it was possible to identify that the effects on reducing body weight were significant after one year of intervention. As for waist circumference, 36% of the studies showed a significant reduction. Serum glucose was also assessed in 36% of the studies, of which 80% showed a reduction. There was also a reduction in binge eating symptoms in 23% of the studies (p between 0.003 and 0.001). Furthermore, it was also possible to identify a reduction in factors such as emotional eating at 10 weeks (p<0.027) and at six-month follow-up (p=0.003) in 7% of the studies. Significant improvements were reported in eating behaviors and dietary control, quality of life, physical activity, and perceived health. Stress and anxiety showed reductions in 14% of the studies at post-intervention.

p: p-value; M: Mean; CI: Confidence Interval

The effects of practicing interventions based on Mindfulness help people to connect with their inner thinking and consciousness, as well as increasing self-acceptance, self-regulation, and tolerance of suffering, establishing control of emotions and desires to eat[36]. In addition, there are positive effects of ME with an adaptive eating style, contributing to healthy eating patterns, and there is a positive correlation between ME and mental well-being, supporting further indications of an impact on health promotion in general[37].

There were limitations to this study: the small number of studies analyzed, with the outcome of interest of evaluating the effectiveness of the ME approach in modifying the eating behaviors of overweight individuals, is a relevant limitation. Furthermore, the imposition of the language eligibility criterion restricted the number of eligible studies and may have missed out on relevant literature in other languages. The absence of a meta-analysis due to methodological heterogeneity and the exclusion of studies including children and adolescents are also limitations.

Future research examining a larger number of studies and more health outcomes is needed, applying more rigorous and precise study analysis methods. Furthermore, more research is required to improve and clarify how and in what dimensions the effects of this cognitive-behavioral therapy affect the population of interest.

Despite the limitations, this review can provide insights into the therapeutic efficacy of ME for psychological and physiological outcomes in overweight or obese individuals. The results of this research are promising, as they can contribute to a better quality of life and be an alternative for the treatment of obesity, as understanding the types of eating behaviors is essential for their management.

Conclusion

The objective established in this review was achieved, since it was possible to identify that interventions based on Mindful Eating have been shown to be capable of positively modifying the eating behavior of overweight individuals. Furthermore, promising changes were highlighted in compulsive and emotional eating behaviors, as well as improvements in psychological well-being and eating quality.

Therefore, Mindful Eating seems to be a relevant and promising approach for research into obesity management, as well as for healthcare professionals, as it helps to develop effective and sustainable interventions aimed not only at weight loss, but also at improving patients' eating behavior and general well-being.

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