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Original Article

Effectiveness of mindfulness based cognitive therapy on weight loss, improvement of hypertension and attentional bias to eating cues in overweight people

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ABSTRACT

Objectives: Prevalence rates of overweight and obesity are dramatically ever-increasing across the world. Therefore, this study was to evaluate the effect of mindfulness-based cognitive therapy (MBCT) on weight loss, hypertension, and attentional bias towards food cues in a group of women affected with this condition.

Methods: A total of 45 participants were selected out of women referring to the Nutrition and Diet Therapy Clinic affiliated to Shahid Beheshti University of Medical Sciences, Iran, and then randomized into three groups of 15. The first experimental group was subjected to an energy-restricted diet therapy together with MBCT during 8 sessions, the second group took the diet therapy alone, and the third group received no intervention. Body mass index (BMI), hypertension, and attentional bias towards food cues were correspondingly evaluated before, at the end, and four weeks after the completion of the interventions.

Results: The results of this study revealed that MBCT, along with diet therapy, had been significantly more effective in weight loss, decrease in BMI, lower systolic blood pressure (SBP), and attentional bias towards food cues compared with the diet therapy alone ($P \leq 0.01$). MBCT had no significant impact on the decline in diastolic blood pressure (DBP) in participants in the follow-up phase.

Conclusion: This study demonstrated that MBCT along with the conventional diet therapy was more effective in weight loss, decrease in BMI, hypertension control, as well as attentional bias towards food cues than the diet therapy alone.

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What is known?

- Most conventional treatments of overweight and obesity are of limited efficacy; thus, it is really difficult to reach weight loss, and most importantly, to maintain it.

- Raising mindfulness in individuals has led to a slowdown in energy intake, and environmental policies and approaches in this area have also resulted in a reduction in obesity in some countries; however, such approaches to weight loss have not been sufficient in cases affected with severe obesity.

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What is new?

- This research study was conducted on overweight women to evaluate the effect of psychological interventions on weight loss, hypertension, and attentional bias towards food cues.

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- The findings revealed that both interventions, i.e. mindfulness-based cognitive therapy and diet therapy, could drop off weight and lower body mass index (BMI) of overweight women, and it seemed that psychological techniques along with adherence to hypocaloric diet could be more effective.

1. Introduction

Overweight and obesity are known as the main risk factors for cardiovascular disease (CVD), diabetes, hypertension, various types of cancer, mental disorders, as well as increased mortality rates [1]. The incidence rates of overweight and obesity have also increased dramatically in recent decades. According to the World Health Organization (WHO), it is estimated that today more than one billion people across the world are affected with overweight and more than 300 million of them are considered as obese individuals [2].

It has been further proven that obesity management is a challenging issue. This multifactorial condition originates from disturbed biological, social, and neuropsychological interactions; thus, its control and treatment is not within a single scope [3]. Existing methods for management and treatment of adult overweight and obesity include nutrition counseling, increase in physical activity, behavioral changes, pharmacotherapy, and surgery [4]. Most conventional treatments of obesity are also of limited efficacy, and it is really difficult to reach weight loss, and most importantly, to maintain it [5]. In particular, treatments based on restricted diets are not effective in the long term and may bring more psychological distress to individuals. Commonly, body weight is likely to return after a weight-loss period, which is regarded as a common problem in weight loss programs based on reduced energy intake [5]. Medications administered for this condition with their adverse side effects as well fail to result in significant weight loss [6]. Moreover, physical activity and exercise have been suggested to enhance weight loss in overweight and obese individuals although their long-term efficiency in weight loss is unknown [7]. Therefore, raising mindfulness has led to a slowdown in energy intake, and environmental policies and approaches have correspondingly brought about a reduction in obesity in some countries even if such approaches to weight loss in cases with severe obesity have not been sufficient [4]. With regard to high prevalence rates of overweight and obesity as well as their heavy clinical burdens; there is a need to adopt innovative therapeutic strategies in this regard. Accordingly, factors such as motivation and personality traits seem to be effective in the success of such programs. However, the results of interventional studies on the impact of mindfulness on facilitating weight loss are not consistent and less methodological power along with variability in the related literature has confined the strength of existing evidence [8].

Mindfulness-based cognitive therapy (MBCT) and weight-loss diets have not been so far used simultaneously for one experimental group, so the present study examined such treatments in an experimental group at the same time to evaluate their effects on weight loss, hypertension, and attentional bias. Furthermore, the role of mindfulness on sustainability of individuals in terms of their diets was considered. Since overweight and obesity are typically associated with hypertension, the importance of blood pressure control seems reasonable and evaluation of the impact of mindfulness on this condition can be also of use. If psychological techniques such as MBCT reduce attentional bias towards food cues, positive steps can be taken to weight loss. To the best of author's knowledge, no study had been thus far published on effectiveness of MBCT on attentional bias towards food cues which made this study an innovative one in this regard.

2. Methods

2.1. Participants

The present study was a quasi-experimental research with a control group accomplished by pretest/post-test, as well as a follow-up phase. All the study participants ($n = 45$) were overweight women referring to the Nutrition and Diet Therapy Clinic affiliated to Shahid Beheshti University of Medical Sciences, Iran, who were randomly stratified according to their BMI via a permuted block randomization using Random Allocation Software (RAS), and then assigned to three groups of 15. The sample size adequacy was also determined based on previous studies [9]. To select the study participants, convenience sampling method and random assignment were utilized. The objectives and the characteristics of the research were further described by a nutritionist. A questionnaire about patients' demographic characteristics information, history of diseases, use of medications, history of diabetes, as well as use of supplements was also completed at the onset of the study. The inclusion criteria in this study were willingness to join the study via signing the written consent form, body mass index (BMI) of 25.0–29.9 kg/m²; absence of menopause, lactation, and pregnancy, no cancer, hepatic, renal, thyroid, gastrointestinal, and specific psychiatric disorders, no weight-loss surgery, non-attendance in cognitive therapy sessions, age range of 30–50 years, female gender, no weight loss over the past 6 months, non-use of herbs and medications to suppress appetite and to lose weight, and no consumption of vitamin-mineral supplements. The participants meeting any of the following criteria were also excluded from the study i.e. non-collaboration (non-attendance in more than two sessions), divorce and death of one of the relatives during the study, and incidence of certain physical illnesses in need of taking medications or adhering to a special diet.

2.2. Ethics approval and consent to participate

The patients who meet the inclusion criteria were fully informed about the study's protocol. This trial was approved by the Medical Ethics Committee of Payame Noor University, Tehran, Iran, and in accordance with the Declaration of Helsinki (approval no. IR.PNU.REC.29360). Each subject signed an informed consent form.

2.3. Interventions

The first experimental group was subjected to a diet therapy together with MBCT, the second experimental group took the weight-loss diet therapy alone, while the third group received no intervention as the control group. The weight-loss diet therapy for the first and the second experimental groups was equally implemented by a trained nutritionist and the participants adhered to a diet plan involving eating 3349 kJ (800 kcal) below the total daily dietary intake which was assessed on three days using 24-h recall questionnaires (2 weekdays and 1 weekend). To create a variety in the diet while maintaining its general principles, all the participants were given a dietary exchange list, and finally, they were asked to visit the nutritionist every two weeks for further control and counseling. The MBCT was held only for the first experimental group (8 sessions, 2-h per week). The summary of the content of the MBCT sessions is given in Table 1.

2.4. Measurements

The data including body weight, systolic blood pressure (SBP) and diastolic blood pressure (DBP), and attentional bias were recorded at the onset and the end of the study (after 8 weeks) and 4

Table 1
Summary of 8 MBCT training sessions.

| No. | Contents of MBCT training |
|-----|--|
| 1 | To describe the aims and programs of the research, to introduce the participants to each other, to describe the concepts and usages of mindfulness based cognitive therapy, conscious breathing and scan body exercises and to explain about homework. |
| 2 | Homework review, to practice eating based on mindfulness and conscious breathing and explanation about homework. |
| 3 | To practice conscious “see” or “hear”, sitting meditation, talking about the benefits of meditation and its effects on each person and examination walking with awareness. |
| 4 | Practicing mindfulness-based eating, sitting meditation, awareness breathing, to discuss between people and share experiences, homework reviewing and determining. |
| 5 | Mindfulness- based attention to hard and painful thoughts, conscious breathing and mental imaging. |
| 6 | The practicing mindfulness-based walking and eating, sitting meditation and homework determining. |
| 7 | Sitting meditation, conscious breathing, body scanning, exchange of ideas and to express feelings by p participants and to prepare for the end of the course |
| 8 | Reviewing past sessions and summarizing, focusing on the future, reminding of aims, enquiring participant’s observations about the effects of intervening on their lifestyle, thanking and appreciating them, awarding gifts and acknowledgment. |

weeks after the completion of the study (after 12 weeks).

The dot-probe task was used to measure attentional bias to food stimuli. Details of how the dot-probe task and scoring methods are presented in the various studies [10,11]. To standardize the level of hunger, all participants were asked to refrain from eating for 2 hours before the test. E-Prime directed the visual prob task and response collection; it was run on a 15-inch (1 inch = 2.54 cm) laptop with a detection power of 600 × 800 pixels. In a food-related visual probe task, subjects are subjected to a food-related word or picture matched to a neutral word or picture simultaneously showed parallel on a computer screen. The subject was placed 50 cm away from the computer screen, and each participant was tested individually. The schedule was presented to the subjects as follows: They were told that their reaction time would be computed and was trained to glance at the fixation cross when it revealed on the computer screen. This stage was pursued by a pair of the word, and after this, a dot-probe appeared to the left or right of the computer screen, in the position of one of the words. They were instructed to press as quickly as possible one of two response keys to display on which location the dot-probe had revealed. They were given 80 trials. A central fixation cross was shown for 500 ms, immediately followed by a word pair for 500 ms. The interval between the subjects’ response and the fixation cross at the start of the next trial was 1 s. Attentional bias is calculated from the duration of time it takes to successfully recognize the position of a probe that replaces food or neutral stimuli.

2.5. Statistical analysis

MBCT and energy-restricted diet therapy were considered as independent variables in this study. BMI, systolic blood pressure (SBP) and diastolic blood pressure (DBP), as well as attentional bias towards food cues were considered as dependent variables. To test the research hypothesis, analysis of covariance (ANCOVA) and repeated measures analysis were used. The data were also analyzed using the SPSS Statistics software (version 23). *P*-values less than 0.05 were further considered to be statistically significant.

3. Results

To evaluate the study groups matched in terms of age, height, weight, and BMI; analysis of variance (ANOVA) was used (Table 2). Based on the results of Shapiro-Wilk test and Levene’s test, the homogeneity of variances and the normality of all variables were further confirmed ($P > 0.05$). However, based on the results of Mauchly’s test of sphericity, no homogeneity of variance was observed for weight and BMI ($P < 0.05$) although SBP and DBP as well as attentional bias profited such a homogeneity ($P > 0.05$). Due to failure to observe sphericity of weight and BMI, the results of

Table 2

The results of ANOVA to the comparison of age, height, weight and body mass index mean between the studied groups.

| Variable | Sum of squares | df | Sum of squares Average | F | P |
|----------|----------------|----|------------------------|------|-------|
| Age | 51.04 | 2 | 25.52 | 0.82 | 0.450 |
| Height | 75.81 | 2 | 37.91 | 1.49 | 0.240 |
| Weight | 1.46 | 2 | 0.73 | 0.02 | 0.980 |
| BMI | 5.61 | 2 | 2.85 | 1.53 | 0.230 |

Note: BMI, Body mass index; *P*-value less than 0.05 was considered to be statistically significant.

Greenhouse-Geisser correction test were further presented in the output of repeated measures analysis (Table 3).

Besides, the results of the present study revealed a significant difference in the mean scores of body weight and BMI between the first experimental group (i.e. MBCT + diet therapy) and the second one (that is, diet therapy alone) as well as the first experimental group and the control group ($P \leq 0.01$). Also, evaluation of the second experimental group and the control group showed the significant effect of the diet therapy on weight loss and BMI ($P \leq 0.01$) (Table 4). Based on Table 5, body weight and BMI in the first experimental group decreased over time in the follow-up phase, indicating that the impact of diet therapy on MBCT had been sustained. A significant change was correspondingly observed in the mean scores of SBP and DBP between the first experimental group and the second one. As well, comparison of BMI in the first experimental group and the control group demonstrated a significant difference in pretest/posttest and pretest/follow-up phases ($P \leq 0.01$). No significant difference was also observed in the mean scores of SBP and DBP between the second experimental group and the control group. Moreover, there was a significant difference between the mean scores of SBP in pretest/posttest and pretest/follow-up phases ($P \leq 0.01$). A significant difference was correspondingly found between mean scores of DBP in pretest/post-test phases ($P \leq 0.01$). Therefore, it was concluded that only a significant reduction had been sustained in SBP in the first experimental group. Moreover, there was a significant difference between the mean scores of attentional bias towards food cues between the first experimental group and the second one and also between the first experimental group and the control group ($P \leq 0.01$), suggesting that the extent of attentional bias had significantly diminished in the first experimental group compared with the second one. No significant change was also found between the second group receiving diet therapy alone and the control group. Likewise, there was a significant difference between the mean scores of attentional bias in pretest/posttest and pretest/follow-up phases ($P \leq 0.01$) (Table 5). Therefore, it was concluded that the significant reduction in attentional bias in the first experimental group had remained constant. Moreover, there was no significant difference between

Table 3
Variables in the studied groups (Mean \pm SD).

| Variable | Group | Pretest | After 8 weeks | After 12 weeks |
|---------------------------------------|-------------|--------------------|--------------------|--------------------|
| Weight (kg) | Diet + MBCT | 70.95 \pm 7.74 | 67.66 \pm 7.29 | 66.90 \pm 7.39 |
| | Diet | 71.33 \pm 5.38 | 7.19 \pm 4.91 | 70.63 \pm 4.93 |
| | Control | 71.37 \pm 6.10 | 71.69 \pm 5.90 | 72.99 \pm 6.52 |
| BMI (kg/m ²) | Diet + MBCT | 27.80 \pm 1.62 | 26.52 \pm 1.58 | 26.22 \pm 1.65 |
| | Diet | 26.96 \pm 1.37 | 26.53 \pm 1.16 | 26.71 \pm 1.23 |
| | Control | 27.07 \pm 1.07 | 27.19 \pm 1.03 | 27.67 \pm 1.15 |
| SBP (mmHg) | Diet + MBCT | 117.23 \pm 13.03 | 105.69 \pm 10.29 | 101.08 \pm 9.61 |
| | Diet | 114.07 \pm 15.22 | 115.20 \pm 10.89 | 114.27 \pm 11.18 |
| | Control | 120.13 \pm 11.06 | 121.47 \pm 10.15 | 121.33 \pm 10.13 |
| DBP (mmHg) | Diet + MBCT | 78.92 \pm 8.43 | 70.62 \pm 5.67 | 71.67 \pm 6.14 |
| | Diet | 75.47 \pm 7.94 | 73.73 \pm 6.45 | 76.80 \pm 7.16 |
| | Control | 78.13 \pm 8.43 | 77.47 \pm 5.73 | 77.87 \pm 7.15 |
| Attentional bias(ms) | Diet + MBCT | 3.76 \pm 0.76 | 2.08 \pm 0.67 | 1.98 \pm 0.90 |
| | Diet | 3.72 \pm 0.87 | 3.97 \pm 0.74 | 3.74 \pm 0.73 |
| | Control | 3.94 \pm 0.65 | 3.83 \pm 0.47 | 4.06 \pm 0.56 |
| Response time to neutral stimuli (ms) | Diet + MBCT | 6.33 \pm 0.15 | 6.22 \pm 0.12 | 6.19 \pm 0.10 |
| | Diet | 6.31 \pm 0.15 | 6.36 \pm 0.12 | 6.27 \pm 0.17 |
| | Control | 6.37 \pm 0.16 | 6.31 \pm 0.14 | 6.34 \pm 0.15 |
| Response time to food stimuli(ms) | Diet + MBCT | 6.23 \pm 0.09 | 6.19 \pm 0.12 | 6.17 \pm 0.10 |
| | Diet | 6.19 \pm 0.16 | 6.24 \pm 0.11 | 6.17 \pm 0.14 |
| | Control | 6.26 \pm 0.16 | 6.21 \pm 0.16 | 6.21 \pm 0.15 |

Note: BMI, Body mass index; DBP, Diastolic blood pressure; SBP, Systolic blood pressure; 1 mmHg = 0.133 kPa.

Table 4
The mutually compare of weight, BMI, blood pressure and attentional bias and of groups using LSD post hoc test.

| Variable | Diet + MBCT vs. Diet group | | Diet + MBCT vs. Control group | | Diet vs. Control group | |
|-------------------------|----------------------------|-------------------|-------------------------------|-------------------|------------------------|-------------------|
| | Means difference | Significant level | Means difference | Significant level | Means difference | Significant level |
| Weight(kg) | -2.02 | <0.001 | -3.49 | <0.001 | -1.48 | <0.001 |
| BMI(kg/m ²) | -0.79 | <0.001 | -1.36 | <0.001 | 0.56 | <0.001 |
| SBP(mmHg) | -11.99 | <0.001 | -14.09 | <0.001 | -2.09 | 0.240 |
| DBP(mmHg) | -4.44 | 0.002 | -7.02 | <0.001 | -2.08 | 0.160 |
| Attentional bias(ms) | -1.89 | <0.001 | -1.73 | <0.001 | 0.17 | 0.480 |

Note: BMI, Body mass index; DBP, Diastolic blood pressure; SBP, Systolic blood pressure; 1 mmHg = 0.133 kPa.

Table 5
The mutually compare of weight, BMI, blood pressure and attentional bias and in study stages using LSD post hoc test.

| Variable | Pretest vs. After 8 weeks | | Pretest vs. After 12 weeks | | After 8 weeks vs. After 12 weeks | |
|-------------------------|---------------------------|-------------------|----------------------------|-------------------|----------------------------------|-------------------|
| | Means difference | Significant level | Means difference | Significant level | Means difference | Significant level |
| Weight(kg) | 1.37 | <0.001 | 1.05 | <0.001 | -0.33 | 0.020 |
| BMI(kg/m ²) | 0.53 | <0.001 | 0.41 | <0.001 | -0.12 | 0.020 |
| SBP(mmHg) | 3.02 | 0.002 | 4.92 | <0.001 | 1.89 | 0.090 |
| DBP(mmHg) | 3.57 | <0.001 | 2.03 | 0.006 | -1.54 | 0.100 |
| Attentional bias(ms) | 0.52 | <0.001 | 0.55 | <0.001 | 0.03 | 0.800 |

Note: BMI, Body mass index; DBP, Diastolic blood pressure; SBP, Systolic blood pressure; 1 mmHg = 0.133 kPa.

posttest/follow-up phases, which confirmed the sustained effect of the intervention on this variable (Table 5).

4. Discussion

This study was conducted on overweight women to evaluate the effect of psychological interventions on weight loss, hypertension, and attentional bias towards food cues. Accordingly, the findings revealed that MBCT and weight-loss diet therapy had controlled weight and correspondingly decreased BMI in both experimental groups upon the completion of these interventions, but this reduction was higher in the first experimental group compared with the second one, and thus, it seemed that psychological intervention along with adherence to hypocaloric diet could be more effective. According to the data from the 12th week (i.e. follow-up phase), it was observed that weight loss and reduction in BMI had continued in the first experimental group in the follow-up

phase. The results of this study were also consistent with the findings reported by Mousavian et al. in which they had shed light on this type of psychological intervention alone in one group and weight-loss diet therapy in the other group [12]; while, in the present study, these two interventions had been evaluated in a single group. Dalen et al. had similarly applied a six-week training course based on a Mindful Eating and Living (MEAL) intervention in a pilot study on obese individuals and had provided preliminary evidence of eating intervention based on mindfulness that had caused significant improvements in weight, eating behaviors, and psychological distress in obese people [13]. Moreover; Daubenmier et al. had determined the effect of adding MBCT to a diet-exercise program on 194 adults affected with obesity for 5.5 months, and had concluded that MBCT along with a diet-exercise program had not revealed any significant weight loss but had increased long-term improvement in some features of metabolic health in obesity [14]. Asadollahi et al. had further investigated the

effectiveness of MBCT and a dietary approach to control weight loss in obese people and had observed that MBCT and diet therapy had resulted in weight loss in obese patients. Moreover, the results of the two-month follow-up had revealed fixed results [15]. Recently, in a randomized clinical trial by Lyzwinski, it had been observed that mindfulness-based intervention could have beneficial impacts but small effect sizes on stress, eating behaviors, and mindful eating practices [16]. The findings of another study had also demonstrated that a mindfulness-based approach could improve cognitive accessibility of health and weight loss associated with a series of objectives [17]. In contrast, Rosenzweig et al. had investigated the effect of mindfulness-based stress reduction (MBSR) technique on psychological and metabolic parameters of 14 patients with diabetes. One month after the fulfillment of the study protocol, they had concluded that MBSR was not effective in weight loss [18]. It should be noted that their participants were diabetic patients who differed from the individuals recruited in the present study.

Using psychological interventions in treatment of overweight and obesity, compared with some conventional techniques such as bariatric surgery, pharmacotherapy, and use of herbs such as ephedra seem cheaper, safer, and better. In particular, such interventions can have relatively positive effects on self-esteem, self-efficacy, stress management, and self-concept. MBCT is a relatively new method which allows for some kind of attention to body and peripheral positions at the moment, lessens auto-depression processes, helps people succeed in resolving overweight, and improves their ability to deal with stressful and undesirable situations in other various aspects of life [19,20].

The findings of this study revealed that reduction of SBP and DBP during the 8th week had been only seen in the first experimental group; thus, it was suggested that MBCT and weight-loss diet therapy were more effective than diet therapy alone in terms of reducing SBP and DBP. In the follow-up phase, SBP in the first experimental group was also significantly lower compared with that at the onset of the study, but there was no significant change in blood pressure in the second experimental group; accordingly, the effect of MBCT along with diet therapy was more unchanging. In this regard, Momeni et al. had also established that MBSR was effective in decreasing cardiac patients' SBP, perceived stress, and anger [21]. As well, Nyklicek et al. had applied the effect of MBSR on physiological activity of the body during acute stress. In this respect, a group treated with MBSR had shown higher decrease in SBP and DBP [22]. Tomfohr and a research team at Collier University in 2015 had also identified a significant relationship between mindfulness and blood pressure in a study recruiting 130 healthy young people with an average age of 21.7 years. Age, gender, BMI, race, depression, and stress levels had been also measured as secondary variables and the global score of mindfulness features had been associated with lower blood pressure [23]. Moreover, Bakhitari et al. had studied the efficacy of cognitive therapy on depression and hypertension in a group of women and had reported that depression scores as well as SBP and DBP had decreased, and this reduction had continued during the follow-up phase. Patients had further learned that using techniques such as positive thinking as well as thinking about positive words and issues could help them comprehend the effect of good or bad thoughts on their psychological states. They had been also asked to accept the present situation of their illness and do not show any behavioral responses to them which had moderated depression in these people [24]. In the present study, SBP and DBP in the participants in three groups at the onset of the study were within the normal range. It should be noted that the study participants recruited in this study were similar to those in the research by Tomfohr et al. who did not have hypertension [23]. However, SBP and DBP in the first experimental group receiving psychological intervention together with diet

therapy decreased significantly after intervention which was within the normal range.

In the first experimental group, difference in time at the end and in the follow-up phases of intervention was significantly lower than that at the beginning of the study, but no significant change was observed in the second experimental group and the control group. Thus, it was concluded that the effect of MBCT along with weight-loss diet therapy was more constant compared with the use of weight-loss diet therapy alone in terms of reducing attentional bias towards food cues. Results from some studies had also suggested a theoretical link between attentional bias towards food cue exposure and consumption. In a study in which women had been trained to use healthy or unhealthy food cues, increased attentional bias towards healthy food had been accompanied by healthy snack intake [25]. The findings of an open-label trial had further revealed the initial effectiveness of attentional bias modification programs for patients who binge eat [26]. Findings of behavioral and functional magnetic resonance imaging (fMRI) reported by Yokum et al. in overweight girls had also confirmed that BMI was positively correlated with attentional bias towards food cues. Moreover, participants who had experienced higher activation in the lateral orbitofrontal cortex were at higher risks for overeating and weight gain [27]. It should be noted that attentional bias is an automated and unconscious process that helps people decide to reduce their weight through diets when they fail to adhere to their weight-loss diet therapy. In the present study, reduced attentional bias was observed in the group receiving MBCT along with diet therapy in posttest/follow-up phases.

There were also limitations to this study; including non-control of participants' personality traits as well as one-step follow-up due to time constraints (4 weeks after the completion of the interventions).

5. Conclusion

In general, it seemed that a combination of cognitive interventions with hypocaloric diets was more effective than any of these interventions alone. Therefore, obese individuals can improve their mental health and strengthen their self-management once they receive nutritional and dietary recommendations and psychological support.

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Conflicts of interest

The authors declared no conflict of interests.

CRedit authorship contribution statement

Mercedeh Masoumi Alamout: Methodology, Investigation. **Mahdieh Rahmanian:** Conceptualization, Methodology, Writing - review & editing. **Vahideh Aghamohammadi:** Conceptualization, Methodology, Writing - original draft, Supervision. **Elahe Mohammadi:** Software, Data curation. **Khadijeh Nasiri:** Software, Data curation.

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Appendix A. Supplementary data

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