Research Paper: The Effectiveness of Mindfulness in Attention Bias Toward Food in Overweight Individuals

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ABSTRACT

Background: The increased overweight and obesity prevalence has been a major concern worldwide. The present study aimed at investigating the effect of a mindfulness intervention on the attentional bias toward food in overweight individuals.

Methods: The statistical population in this quasi-experimental study using a pretest-posttest design with the control group consisted of overweight individuals with a body mass index of higher than 25, referring to centers related to weight management in Mashhad. Using convenience sampling, 36 samples were selected based on inclusion-exclusion criteria and were placed in two experimental and control groups randomly. The repeated measures were undertaken by SPSS Software, v. 22 for attentional bias toward food. The test was done in three 7-week pre-intervention and post-intervention phases of mindfulness therapy and at follow-up for three months after the end of the intervention.

Results: The results of the data analysis showed a significant difference between the two groups in terms of the reaction time of participants to the food emotional Stroop test.

Conclusion: The results showed the significant effect of a mindfulness intervention on the attentional bias toward food in overweight individuals.

1. Introduction

Over the three decades, the overweight and obesity levels have been increased significantly. Nowadays, one out of three persons in the world suffers from overweight and obesity. Hence, more than about 3 million people die as a result of obesity [1]. In addition to increasing the statistics of mortality, overweight and obesity increase the number of chronic diseases, such as type II diabetes, hypertension, cardiovascular obstructions, stroke, cancer, metabolic syndrome, and osteoarthritis [2]. Hence, not only quality of life, but also economic issues are also affected by this issue [3]. It is vital to make a reliable evaluation of the intention and concern of individuals on the food symptoms to find a careful measurement of criteria relevant to overweight. Hence, the scholars use neuropsy-

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chological tests, which can involve the attention system of individuals bindingly [4]. Recent studies have used the measurement of attentional bias toward food as a valid and reliable predictor, and measurement of individuals in terms of their concerns toward food materials [5]. Attention is the most fundamental principle in successful interactions with the environment. Attention enables the individuals to screen the data received from the environment [6]. Attentional bias is a phenomenon, by which individuals conduct their direct attention to the valuable stimuli for the person. Despite the effort of individuals to ignore that, the phenomenon happens [7].

The evidence and studies in the field of mental pathology show that the binding and uncontrollable nature of the majority of behavioral disorders can be explained by attentional bias [8]. Many studies have used mindfulness interventions to overcome overweight and obesity over the years and decades [9]. Along with these studies, useful interventions and reports are provided in the field of relapse of addictive behaviors [10]. Attention and relevant practices can be one of the most series concepts, and attention has a special meaning in mindfulness: attention in the present time, and with patience, without automatic reaction and confrontation [11].

Mindfulness can help free people from automatic thoughts, habits, and unhealthy patterns of behavior. Hence, mindfulness plays a vital role in behavioral regulation. The studies have revealed that mindfulness meditation can improve mood, and short-term practice can decrease fatigue and anxiety [1]. Studies have shown that mindfulness practices can enhance the capacity of automatic processes in the metacognitive awareness of individuals. This ability is correlated with the components of addictive behaviors, such as craving and seeking drugs [12]. Strengthening attention in these practices can remove the defected cognitive cycles in addictive behaviors, and can make learned positive coping strategies grow instead of addictive behaviors through the psychophysiological mechanisms [10, 13]. Mindfulness practices can also facilitate no involvement of attention deficit in symptoms related to the addictive subject in addictive behaviors. Such specification can finally decrease and meet attentional bias toward the symptoms of addictive behaviors [10].

Some studies have pointed to the role of attentional bias in obesity and addiction [14] and some systematic review studies have specifically examined the role of attentional bias in weight gain [15, 16]. A meta-analysis in recent years has also considered the role of cognitive interventions on the modification of attentional bias and its effect on dietary symptoms [17]. Accordingly, due to the importance of interventions that modify the cognitive system by working on the attentional bias, the mindfulness intervention method has received much attention and recently many studies have been conducted on the effect of mindfulness on the modification of attentional bias on food and its effect on overweight and obesity [18, 19]. Hence, because of the availability of mindfulness intervention compared to the previous solutions for weight control and reduction, there is a need for research in this field and the importance of studying this field is felt more than before.

The arrangement of attention to creating repetitive cycles of factors causing overweight as a basic issue can prove the analysis of the effect of a mindfulness intervention on the attentional bias of individuals suffering from obesity. In this study, a quasi-experimental method was used to investigate the effect of a mindfulness intervention on the attentional bias of overweight individuals.

2. Methods

In this quasi-experimental study, two experimental and control groups were considered. The participants were tested in terms of reaction time in the pretest (before mindfulness intervention), posttest (after mindfulness intervention), and follow-up (three months after the intervention) using the emotional Stroop test for food materials. The independent variable in this study was the 8-week intervention of mindfulness, and the dependent variable was the time difference of reaction of participants to food-related variables. Also, the neutral variables were analyzed using the Stroop test for food. Obtained data were analyzed in the pretest, posttest, and follow-up steps using Repeated Measures ANOVA. This research was approved by the Ethics Committee of Islamic Azad University, Bojnourd Branch (Code: IR.IAU.BOJNOURD.REC.1399.031).

Participants

The participants in this study were selected using convenience sampling. They were participated and accepted in the relevant places and centers of obesity and overweight voluntarily. The sample size in this study was equal to 36 individuals based on the experimental studies in the field of overweight and psychological interventions. The Body Mass Index (BMI) of the participants was above 25, and overweight individuals were assigned to two experimental and control groups randomly with 18 individuals in each group [20]. Other inclusions and exclusion criteria of participants in this study included no

background of special physical or mental disease, no use of psychological medicine, lack of taking other psychiatric therapies, not being pregnant, and no intention of pregnancy until the end of the study for women. Also, the absence of more than one session in an 8-session course of mindfulness intervention was an exclusion criterion.

Measurement instruments

The instrument used to measure BMI was a standard and reliable instrument to measure the height and weight of participants, including a standard meter and a suitable and standard scale. The BMI could be obtained by dividing the weight in kg into the second square of height. The instrument for attentional bias toward food stimuli and symptoms was the food emotional Stroop test. To use the measurement in this instrument, the test used by Fadardi and Bazzaz [4] on the Iranian population was used. In this test, colored words are presented as stimuli, and the participants should name the color regardless of the meaning in the fastest and most careful way possible. Two groups of words are used in this test, including target words formed of foods, and neutral words with no stimulation for the individual with an attentional bias toward foods. The words are presented based on the reaction time per millisecond (msec) and randomly. The test was performed for every person in the pretest-posttest frame. The instrument was programmed under the Superlab Pro program and was taken using a computer set with a special keyboard defined to answer the test items. The Stroop test has high internal consistency (Cronbach's alpha), and there is sufficient evidence of its validity [4].

Procedure

First, 36 individuals with BMI above 25 were invited to participate in the study using convenience sampling and publishing a notification message. After getting their demographic information and gaining consent letters, they were divided into two experimental and control groups randomly. The participants were suffering from no special physical or mental disease, and women were not pregnant and with no intention of pregnancy until the end of the study. The pretest was performed for both groups and included measurement of BMI and conducting food emotional Stroop test regarding food symptoms used by Fadardi and Bazzaz [4].

The procedure in this study was as follows: to control the deprivation effect, the author asked about feeling severe hunger, and no one showed such feeling. The mean distance time from the last food meal was 3 hours. The purpose of this study was the evaluation of their reaction speed to a series of stimulants. All participants sat in front of a computer set with a 15-inch screen. The approximate distance from the screen was 40 cm. the answer keys were specified on the keyboard by colorful labels (R=red; M=yellow; C=green; and Z=blue). To make them ready, a practice was given. In this practice, colorful stains (70 times) were used to appear on the screen. Every time the stain was red, yellow, green, or blue (equally), the participants were asked to press the relevant key immediately after seeing the color. The size of colorful stains and the time of presentation were based on the word Stroop test. In this test, feedback was presented to the trial. If the trial presses the right key, the sign (+) appears, and the color appears. If the trial presses a wrong key, the word "wrong", and if the key is pressed lately the word "late" is appeared. After learning the place of colors, the food Stroop test was performed. The test was begun by test instructions.

The participants were asked to show a reaction to colors regardless of the meaning of words immediately after appearing on the screen. They were asked to do this as fast as possible and carefully. In the step, no feedback was presented (the words late or wrong). Participants continued until the time of completing the food Stroop test, and the reaction time was recorded by computer per msec for target and neutral stimulants. Obtained data, including the time difference of reaction to emotional stimuli of food and neutral stimuli, were measured in the pretest, posttest, and follow-up. Analyses were performed by SPSS software, v. 22 using repeated measures ANOVA and Shapiro-Wilk and Bonferroni tests.

3. Results

In this study, 36 people participated with 18 individuals in the control group and 18 individuals in the experimental group receiving mindfulness intervention. The mean value and Mean±SD age were 38.83±7.801 in the control group and equal to 42.06±9.588 in the experimental group. The results of one-way ANOVA showed no significant difference between the two groups in terms of age (P=0.275, $F_{(1,24)}$=1.233). Also, the gender distribution was the same in both groups (22 females (61%) and 14 males (39%) in both groups). Analysis of the results showed that the two groups were not different in terms of pretest scores (P>0.05). Therefore, the two groups are homogenous in terms of pretest scores.

The results in Table 1 showed that no significant difference was observed between the two groups in terms of the pretest mean value. The descriptive results showed decreased meantime of reaction to the target variable in

Table 1. Descriptive indices of attentional bias in the experimental and control groups in three test steps

Variable	Group	Mean±SD		
		Pretest	posttest	Follow-up
Stroop	Control	341.28±131.833	339.83±134.145	346.22±133.716
	Experimental	365.00±119.090	284.17±114.278	309.50±91.694

Table 2. Covariance analysis for homogeneity of variances (Leven's) and Mauchly's Sphericity

Variable	Groups	Leven's		Mauchly's Sphericity Test		
		f	P	Mauchly's W	Sig.	Greenhouse-Geisser
Stroop	posttest	2.066	0.160	0.001	0.001	0.288
	follow up	1.723	0.198			

Table 3. Results of intergroup RMANOVA

Source of variances		SS	df	MS	F	P	η^2	Power
Intergroup	Group membership	221399.004	1	221399.004	5.341	0.003	0.315	0.855
	Error	1409392.667	34	41452.725				
Intragroup*	Test	30995.389	1.607	19287.717	10.334	0.000	0.233	0.964
	Test*membership	30945.056	1.607	19256.395	10.317	0.000	0.233	0.984
	Error	101981.556	54.638	1866.493				

* Results are presented based on Howes Geiser's correction.

posttest and follow-up in the experimental group compared to the control group. This shows the significant effect of a mindfulness intervention on the experimental group. To test the hypotheses, repeated measures ANOVA was used. At first, the hypotheses of RMANOVA were analyzed. The results are reported in Table 2.

The results of the Shapiro-Wilk test showed that the dependent variable was normal (<0.05). The results in Table 3 show the effect of the test (P<0.05, F=10.334), group membership (p<0.05, F=5.341), and test interaction and group membership (P<0.05, F=10.317) was significant in attentional bias. The effect size of the source of variance in terms of creating intergroup, intragroup, and interactive differences was equal to 0.315,

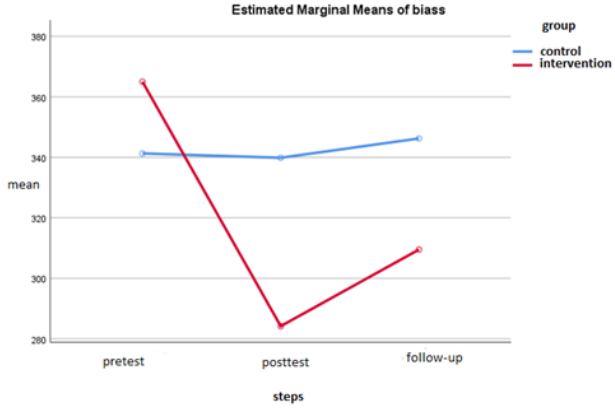

Figure 1. Comparison of the attentional bias based on test steps and groups

Table 4. Results of Bonferroni post hoc test to compare mean values of attentional bias according to test steps

Comparison Source	Mean Diff.	S.E	P	Confidence Level	
				Min	Max
Pretest-posttest	41.139	11.091	0.002	13.208	69.070
Pretest-follow up	25.278	8.545	0.017	3.759	46.796
posttest-follow up	-15.861	7.343	0.114	-34.353	2.631

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0.233, and 0.233, respectively. It means that intergroup, intragroup, and interactive effects explained 31.5, 23.3, and 23.30% of variances for the attentional bias, respectively. The power of the test was at a high level. It means that the sample size was sufficient to measure the differences. The results of the Bonferroni post hoc test to compare test steps are presented in Table 3.

Table 4 shows that the differences were significant according to test steps from pretest to posttest and follow-up steps (P<0.05). However, the differences were insignificant from posttest to follow-up (P>0.05). The mean values decreased from pretest to posttest and follow-up steps; however, the values increased from posttest to follow-up. A comparison of the mean values based on group and test steps is illustrated in Figure 1.

According to the results, the research hypothesis was confirmed. It means that mindfulness interventions could affect the decreased attentional bias of overweight individuals. Hence, mean attentional bias in posttest and follow-up steps for the intervention groups was lower than the control group and the effect was not significantly different from posttest to follow-up.

4. Discussion

The results of this study showed that mindfulness intervention and taking the relevant practices in the experimental group decreased attentional bias toward food in overweight individuals compared to the control group with no intervention during study time. These results are consistent with the findings of Baquedano et al. [12] and show the effectiveness of mindfulness interventions on attentional bias. Also, the results showed that mindfulness interventions can generally affect the attention system. This result is consistent with the findings of Verhaeghen [8].

Attentional bias is very important, which has been less studied as an underlying factor decreasing the addictive behaviors of overeating and paving the way for overweight and obesity. Analysis of the vital issue of attentional bias has been done bindingly, and interpretation is minimized in such analysis. This is because the data extraction is done during a few milliseconds on the one hand. On the other hand, human interference is decreased because of the measurement of the data by the computer. Hence, the data can be more reliable for the analysis. Many studies have been conducted in the field of mindfulness, overweight, food, and overeating, which have analyzed the effects of a mindfulness intervention on the tendency for healthy eating, reduced addictive behaviors, and relapse of such behaviors. These studies have provided considerable results [21, 22].

Mindfulness can be interpreted as a special quality of attention, and the core element of intervention and change in attention [11]. Multiple studies have revealed that mindfulness interventions can promote attention-related skills. Such changes and improvement in attention are relevant to the types of attention; focused attention is directly correlated with meditation practices in mindfulness and is also correlated with selective and executive attention [8, 23].

Attentional bias is regarded as a phenomenon, in which the cognitive system is unable to show a uniform reaction to environmental elements in terms of semantic value. Such a difference in semantic value in the conceptual system of mind causes more space in the cognitive system occupied by special elements. This can result in recalling relevant information and processes of stimulant, and attentional bias ultimately. The process passes the gateway of selective attention, which is significantly correlated with mindfulness practices and interventions as mentioned [7, 24].

Moreover, the results of this study showed that the BMI of the experimental group receiving mindfulness intervention significantly decreased at the end of the course compared to the control group. This result is consistent with the findings of Alamout et al. [25], showing the effect of change in the attention system on weight loss. However, such weight loss can be just attributed to mindfulness intervention, and this can be because of oth-

er components affecting this method, such as decreased stress, increased tolerance, change in judgmental attitude, and increased moment perception. The effectiveness of these components in mindfulness interventions has been confirmed in multiple studies [26]. The results need further studies so that the effectiveness of attention system promotion in attentional bias toward food can be investigated using another methodology regardless of other components of mindfulness.

5. Conclusion

The results of the present study showed that mindfulness intervention and using the relevant techniques during eight weeks can make some changes in the amount of attentional bias of overweight individuals toward foods. However, the limitations of this study could be limited statistical population, which were concerned with weight loss. Because of the research nature, access to overweight individuals with no intention for such interventions can be the main limitation for studies in this field.

The main limitations of this study were the lack of careful measurement to differentiate the semantic factors of a mindfulness intervention, such as acceptance, and no judgment from the technical factors, such as attention system practices.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of Islamic Azad University, Bojnourd Branch (Code: IR.IAU.BOJNOURD.REC.1399.031).

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflicts of interests.

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