

# The Effectiveness of Mindfulness-Based Stress Reduction Training on Adherence to Medication and Proper Food Consumption in Patients with Diabetes Type 2

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## Abstract

**Objective:** Diabetes is one of the most important metabolic diseases worldwide and has a worrying prevalence. The aim of the present study was to evaluate the effectiveness of mindfulness-based stress reduction (MBSR) on adherence to medication and appropriate food consumption in patients with diabetes type 2.

**Method:** The research design was quasi-experimental with pre-test-post-test and control groups. The statistical population of this study consisted of all patients with diabetes admitted to the Diabetes and Metabolic Diseases Clinic in Tehran. The sample size was 30 who were divided into two Experimental (n=15) and control groups (n=15). Kelly Hayes (1994) and the food frequency questionnaire (FFQ) were provided to both groups as research instruments. The control group stayed on the waiting list and the mindfulness intervention training was performed for the experimental group in eight 90-minutes sessions. The research data were analyzed using descriptive statistics and repeated measures analysis of variance.

**Results:** The results showed that mindfulness-based stress reduction training has significantly increased adherence to treatment and proper food consumption in patients with diabetes type 2 ( $p < 0.05$ ), and this increase has remained constant over time.

**Conclusion:** In order to adhere to the treatment and proper nutrition of patients with type 2 diabetes, stress-based mindfulness training can be used.

**Keywords:** Mindfulness-Based Stress Reduction, Adherence to medication, Proper food consumption, Diabetes.

## Introduction

Diabetes Mellitus is one of the most important metabolic diseases worldwide. Diabetes has a worrying prevalence that has increased by 50% over the last ten years. With 4 million deaths per year, this disease accounts for 9% of all deaths in the world, and in many countries, it is the most important cause of blindness and the leading cause of amputation and

kidney failure (Gholam Aliei, Shahnajrini, Roshanaee & Rezapour, 2015). According to the International Diabetes Federation (IDF) in 2017, 8.8% of the adult population (about 425 million people) had diabetes, and by 2045, their number will reach more than 629 million. Meanwhile, 212 million people are still undiagnosed (Atlas of the international Diabetes federation, 2017). It is predicted that this disease will be one of the most important causes of death and disability in the world in the next 25 years. Statistics show that in 2010 more than 285 million people worldwide had diabetes, which was 67% more than in 2004, and it is estimated that by 2030 this number reaches 439 million people. Diabetes type 2 leads to decreased life expectancy (up to 8 years)

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and increased incidence of cardiovascular, cerebral, and peripheral vascular disease, vision problems, neurological problems, and depression. Inadequate insulin secretion to overcome insulin resistance is a hallmark of the transition from glucose intolerance to diabetes type 2 (Wu Shin et al., 2016). Due to the nature of the disease and long-term complications, diabetes is classified as a chronic disorder that has no definite treatment but is controllable (Hashemi & Boya, 2017).

Research shows that anxiety is associated with diabetes (Miller & Dimateo, 2011). In general, the psychological effects of diabetes type 2 include anxiety and stress. Sometimes it is difficult to cope with diabetes and the management of this disease puts a lot of pressure on the patient. This has consequences for the individual such as anxiety, worry, and distress; as a result, it affects the quality of life of a diabetic person (Davazadeh Emami et al., 2018). Mind-body medicine is a method that has been used to reduce the effects of chronic diseases in many countries and is a field that emphasizes the interaction between the brain, mind, body, and behavior, and comprises powerful methods that directly affect physical and mental health. Meditation is one of the common techniques in this view and mindfulness refers to a meditation that emphasizes the presence and awareness of the present time (Whiteboard & Critzer, 2014).

Mindfulness-based therapies are highly effective in treating some clinical disorders and physical ailments because they address both physical and mental dimensions. Currently, the most common method in mind-body medicine is mindfulness-based stress reduction (MBSR) (Bauer, 2016). Anxious diabetic patients are less likely to adhere to medications and diet, which in turn leads to poorer glycemic control. Evidence suggests that treatment of psychological conditions can lead to positive treatment outcomes. Poor control of diabetes and the non-use of insulin, in turn, can increase the risk of depression and anxiety (Karan & Molsiotis, 2011). Gavanmard and Goli

(2015) conducted a study to evaluate the effectiveness of mindfulness-based stress reduction training on negative emotions and reducing gastrointestinal symptoms in gastrointestinal patients. Analysis of covariance showed that negative emotions and the severity of gastrointestinal symptoms decreased in the experimental group compared to the control group in the post-test. The results of examining the mean of experimental and control groups showed that negative emotion scores (depression, anxiety, and stress), and severity of gastrointestinal symptoms were reduced in the experimental group. Diabetes-related stress is problematic, so many psychological interventions are used simultaneously with medical treatments to control this disease and its related complications (Cooley, 2012).

The effectiveness of mindfulness interventions in promoting the health and well-being of diabetic patients has attracted much interest from researchers. Mindfulness-based stress reduction is one of the most widely used techniques of the mind-body approach whose positive therapeutic effects on a variety of chronic diseases, both patients and their caregivers, have been confirmed. Mindfulness-based stress reduction teaches people to create such a response by focusing on diaphragmatic breathing (Davidson et al, 2009). Hashemi et al. (2015) in a study found that depression, anxiety, stress, and self-esteem were associated with hemoglobin A1c levels, and the effect of mindfulness-based stress reduction group training was effective in reducing some psychological symptoms of patients with diabetes type 2 and increasing self-confidence and controlling blood sugar in these patients.

Also, Alipour et al. (2017) have done a study to determine the pure and combined effect of two mindfulness-based relaxation techniques (MBR) and transcutaneous electrical stimulation (CES) in reducing executive dysfunction and prospective and retrospective memory errors in patients with diabetic type 2. One of the principles of diabetes control is patients' adherence to their physician's medical

advice, which leads to improved blood sugar control and reduced glycosylated hemoglobin (HbA1C), which in turn results in reduced complications and related costs (Pagot, 2010). Many studies have shown that diets rich in fiber such as vegetables, apples, barley, and grains have an effective role in healing diabetes, so a deficiency of these substances can be effective in the development of diabetes. The results of studies show that patients can experience a better quality of life with proper control and management of blood sugar. Improving the quality of life of diabetic patients is highly emphasized in the Clinical Guide to Diabetes Control (Gholam Alie, 2015). Proper diet is one of the pillars affecting the quality of life and plays an important role in the control and treatment of diabetes.

In recent years, to examine the relationship between diet and chronic disease, instead of traditional views based on nutrients or foods and food groups, nutritionists have examined diet in general and in terms of dietary patterns, because dietary patterns express the person's nutritional behaviors, and by analyzing the dominant dietary pattern, more accurate information can be obtained about the relationship between disease and food consumption. Therefore, maintaining and promoting the health of patients and preventing the complications of diabetes is one of the priorities of the health system. Successful control of diabetes requires long-term (and in most cases, lifelong) care of the patient, and the patient's role in controlling the disease is more important than the role of the care team and the need for continuous care and lifestyle changes. Therefore, patients' training and improving their ability to take care of themselves is extremely important (Brunner & Sodart, 2012). Accordingly, due to very limited research in this area and to identify the factors related to medication adherence in Iran, this study was conducted to investigate the effectiveness of mindfulness-based stress reduction training on adherence to proper medication and food intake in patients with diabetes type 2.

## Method

The present study is quasi-experimental with a pre-test-post-test and a control group. In this study, before performing the mindfulness-based stress reduction intervention, all selected subjects with diabetes type 2, were measured by a pre-test of adherence to treatment and consumption of appropriate foods. The role of the pre-test in this project was to control and compare adherence to treatment and food consumption of experimental and control groups in the pre-test, post-test, and follow-up.

The statistical population of this study consisted of all patients with diabetes type 2 admitted to the Diabetes and Metabolic Diseases clinic in Tehran, with a total number of 30. To conduct an experimental study (with treatment and control groups), a test power of 0.88 can be achieved by selecting at least 15 subjects for each group. The samples selected by the convenience sampling method were divided into two experimental (=15) and control (=15) groups. The tests were performed individually first by the researcher on the sample and then the experimental group was trained and the test was performed on them again. After one month, the researcher again distributed the research questionnaires to assess the stability of the effectiveness of the training (follow-up). The inclusion criteria included at least one-year suffering diabetes type 2, diagnosed by a physician, and age range between 40-80 years. Exclusion criteria were the patient has no other physical or mental illness, absence from more than 2 participations in the therapy sessions, and having great stress due to unforeseen events. In this study Repeated variance analysis was used to test the research hypotheses using SPSSv21 software.

### Ethical statement

Obtaining written consent from participants to attend the research and allowing them to continue their participation or quit the study at any time, respecting the privacy of clients, training the control group participants after confirming the effectiveness of the intervention model, and publishing the results

honestly, all were among the ethical considerations of the study.

### Measures

**General adherence scale (GAS):** This scale was developed by Hayes in 1994 to measure the adherence level of chronic patients. The respondents answer this questionnaire within 2-3 minutes, and mark each question with one of the answers: 'always', 'most of the time', 'many times', 'sometimes', 'rarely', and 'never'. The general adherence scale measures the patient's willingness to adhere to the doctor's advice in general, which has 5 items and its internal validity is reported as 0.81. The scoring of this scale is based on a 6-point Likert scale. In the Hayes's study, the construct validity of the scale

was calculated through internal consistency which was reported acceptable ( $R=0.81$ ), and the reliability of this scale was obtained through test-retest with an interval of 2 years ( $N = 281$ ,  $GAS = 0.060$ ), which was reported acceptable. The reliability of the scale was obtained at 0.47 using Cronbach's alpha coefficient. In the study of Zahednejad et al., Cronbach's alpha coefficient of this questionnaire was reported as 0.68.

**Treatment Adherence Scale (IMB):** The Fisher and Fisher's (IMB) adherence to treatment questionnaire (1992) is one of the recent and most comprehensive models that has provided a generalizable and cost-effective model which considers the elements of previous theories. The general adherence scale is designed to measure the rate of chronic patients'

**Table1.** Structure and content of mindfulness sessions

Treatment sessions	The outlines of the treatment model applied to the experimental group
Session1	Introducing participants, welcoming, discussing how the majority of people live in an unconscious mind and often not paying attention to what they are doing, explaining the idea that our thoughts make our emotions, exercising meditation with a focus on breathing, and body examination exercises.
Session 2	Body examination exercise, inviting participants to talk about their experiences of mindfulness exercises, examining barriers, discussing some of the characteristics of mindfulness such as non-judgmental or abandonment, practicing thoughts and feelings, practicing sitting meditation with a focus on breathing.
Session3	Short seeing or listening exercise, sitting meditation with a focus on breathing and physical senses, three-minute breathing space, conscious body movement exercises.
Session 4	Sitting meditation with a focus on breathing, body, sounds and thoughts (so-called sitting meditation with four main components), discussion about stress and common reactions of people to substitute situations and attitudes, conscious walking.
Session 5	Marine sitting meditation with a focus on breathing, body, sounds, and thoughts, discussion about acknowledging and accepting the reality of the current situation as it is, practicing the second series of conscious body movements.
Session 6	Three minutes of breathing space, discussion about the thoughts that are not often real contents.
Session 7	Sitting meditation practice and open awareness (awareness of everything that comes to mind from time to time), discussing about the best way of self-care, practice reviewing pleasant daily activities against unpleasant ones and learning to plan for pleasant activities, practice love and kindness meditation.
Session 8	Body examination exercise, discussing the usage of what they have learned so far, evaluating training, providing more resources.

willingness to follow the doctor's advice in general. But the specific adherence scale measures patients' adherence to essential disease-specific recommendations. For example, the Diabetes Adherence Scale measures the adherence of diabetic patients to recommendations for medication and lifestyle changes based on a 6-point Likert scale with 7 items. The reliability of both general and specific adherence scales was obtained in the study of Hayes et al. with a sample size of 281 based on test-retest correlation. The reliability of the Iranian version of general and specific adherence scales, translated into Persian by Zarani et al., was obtained and confirmed on 152 heart patients (for GAS = 0.47, and SAS, 0.57).

*Food Consumption Evaluation measurement:* A person's usual food intake over the past year is measured by the FFQ (Food Frequency Questionnaire), including 164 food options, and the subjects are asked to determine the frequency of their consumption of each food during the past year. Depending on the type of food consumed, the frequency of consumption per day, week, or month is asked. Experienced nutritionists completed the questionnaires. Using the home scale guide, the values were converted to grams for each food option, then, to perform food pattern analyses, food items were divided into forty groups, and foods were grouped based on the similarity between their nutrients. In some cases, certain food items were individually considered as a food group due to the combination of unique nutrients in that food.

## Results

Table 2 demonstrates demographic information

of the samples in percentage, frequency, and cumulative percentage.

**Table 2.** Demographic information of the samples by gender

Gender	Frequency	Percentage
Male	12	42.37
Female	17	57.63
Total	29	100

According to Table 1, 42.37% of participants of this study were men and 57.63% were women.

Table 3 shows the frequency and percentage of sample by age.

**Table 3.** Frequency and percentage of the sample by age

Age	Frequency	Percentage
40-50	4	1.20
50-60	6	9.1
60-70	11	77.9
70-80	8	11.27
Total	29	100

According to Table 3, the most frequent suffering from Diabetes type 2 is dedicated to people aging 60-70 years. Table 4 displays the results of repeated ANOVA to examine the effectiveness of mindfulness-based stress reduction training on the adherence to the medication of patients with diabetes type 2.

According to the statistics in Table 4, the Z statistic of the Kolmogorov-Smirnov test is not significant for following the treatment and consumption of appropriate food in all groups. Therefore,

**Table 4:** Descriptive indicators of research variables for experimental and control groups in pre-test and post-test

Statistical indicators		pre-exam		Post-test		Kalmogorov Smirnov	
Variable	group	Average	Average	Average	Average	K-S-Z	P
Adherence to treatment	experiment	124/41	4/62	131/11	6/22	0/23	0/18
	Control	126/32	6/51	125/33	4/45	0/16	0/21
Food consumption	experiment	142/12	2/64	150/37	3/96	0/29	0/08
	Control	143/01	2/91	142/16	2/77	0/18	0/20

the distribution of all variables is normal. Also, the findings of the above table show that in the research variables, the average of the experimental groups from pre-test to post-test has increased, but the mean of the control group has not changed significantly in these stages.

As can be seen in Table 5, the results of variance analysis show that the effect of mindfulness-based stress reduction on the adherence to the medication of patients with diabetes type 2 is significant

groups in the test stages.

The pairwise comparison of subjects at three different stages shows that there is a significant difference in adherence to medication in the pre-test, post-test, and follow-up ( $P > 0.05$ ) stages, but there is no significant difference between post-test and follow-up ( $P > 0.05$ ). As a result, it can be said that adherence to medication has increased significantly and this increase has remained constant over time

As can be seen in Table 7, the results of variance analysis

**Table 5.** Summary of Repeated variance analysis of the effect of mindfulness based stress reduction training on the adherence to the medication

Variable	Source of changes	Total squares	Df	Mean of squares	F value	Significance level	Effect size
Adherence to medication	Group effect	121/18	1	105/21	9.15	0/004	0.25
	Error effect	357/40	28	11/49			

(Partial $\eta$ =0.25,  $p < 0.05$ ,  $F = 9.15$ ), and as a result, there is a significant difference between the scores

indicate that the effect of stress mindfulness-based

**Table 6.** Pairwise comparison analysis of adherence to medication of research groups

Steps	pre-test and post test		Follow-up pre-test		Follow-up Post- test	
	Means differences	sig	Means differences	Sig	Means differences	Sig
Adherence to Medication	-0.97	0.005	-1.90	0.04	-0.93	0.19

of pre-test, post-test, and follow-up in the degree of improvement of patients with diabetes type 2 in adherence to medication ( $p \leq 0.05$ ).

Table 5 displays the results of a pairwise comparison analysis of adherence to the medication of research

stress reduction training is significant on proper food consumption in patients with diabetes type 2 (partial=0.30,  $P < 0.05$ ). As a result, there is a significant difference between scores of adherence to the medication of patients with diabetes type 2 in the pre-test, post-test, and follow-up stages ( $p \leq 0.05$ ).

**Table 7.** Repeated variance analysis to evaluate the effect of mindfulness-based stress reduction on appropriate food intake

Variable	Source of changes	Total squares	df	Mean squares	F	Significant level	Effect size
Proper food consumption	Group effect	3089.53	1	2178.09	12.04	0.000	0.30
	Error effect	48.6924	28	180.80			

The pairwise comparison of subjects at three different stages shows that there is a significant difference between pre-test, post-test, and follow-up

findings are in line with the findings of Javanmard, Zare, and Mohammadi (2019), Zare Shahabadi et al. (2010), Sugli Teppen, Behnam, et al. (2012), Shojaei

**Table 8.** Pairwise comparison analysis of food consumption of research groups

Steps	Pre-test, post-test		Pre-test follow-up		Post-test follow-up	
	Mean differences	Sig	Mean differences	Sig	Mean differences	Sig
Proper food Consumption	11.28	0.001	-15.28	0.001	-3.99	0.27

food consumption scores ( $P > 0.05$ ), but there is no difference between post-test and follow-up scores. As a result, it can be said that the consumption of appropriate foods has increased significantly, and this increase has remained constant over time.

### Discussion and Conclusion

The result of the study indicates the effectiveness of mindfulness-based stress reduction training on adherence to the treatment of patients with diabetes type 2. The pairwise comparison of subjects at three different stages showed that there was a significant difference between adherence scores in the pre-test, post-test, and follow-up stages, but there was no significant difference between post-test and follow-up scores. As a result, it can be said that the consumption of appropriate foods has increased significantly and this increase has remained constant over time.

No research has been found to investigate this issue. The result also shows the effect of mindfulness-based stress reduction training on the proper nutrition of patients with diabetes type 2. The pairwise comparison of the subjects at three stages showed that there was a significant difference between scores of proper food intake in the pre-test, post-test, and follow-up stages, but there was no significant difference between post-test and follow-up scores. As a result, it can be said that the amount of proper food consumption has increased significantly and this increase has remained constant over them. These

Zadeh et al. (2013), Zare et al. (2014), Alto et al. (2017), Grayson, Brynard, and Rosenbrog (2011), and spear et al. (2013).

In explaining the research findings, it can be said that mindfulness helps people cope better with stress, pain, and illness. This approach increases the state of mindfulness in people, and this state of mindfulness improves their performance by reducing mental rumination and emotional avoidance, as well as increasing self-regulatory behaviors. On the other hand, mindfulness-based stress reduction group training, in addition to learning meditation skills, provides a supportive environment for individuals within the group, and participants have the opportunity to express their emotions about the disease and share their experiences. This social support and expression of emotions are effective in the attempts to cope with the disease and improve the situation.

As mindfulness is considered an exercise, this approach improves awareness of thoughts, feelings, physical sensations, non-judgmental processes, and purposefulness elimination (Lin & Ha, 2013). Many treatments help clients feel better. These therapies are intended to make the client feel better emotionally at the end of the therapy. This treatment is based on pervasive consciousness or mindfulness. In this therapy method, comprehensive consciousness means consciously bringing awareness to the experience of the here and now, along with openness, interest, acceptance, and non-disturbing thoughts

(Emmanuel et al., 2017).

In this treatment, people learn to accept their feelings instead of avoiding them. Also, their thoughts and thinking processes are addressed through more mindfulness and link them to goal-oriented activities, and people are asked to work for their goals and values and experience their thoughts and feelings. Most mindfulness-based stress reduction programs consist of an individual or small group assessment and mentoring session in which the group leader explains the logic and methodology of the training and asks participants to give reasons for attending the session. This challenge is discussed by the need for intensive homework exercises for mindfulness exercises and participants are encouraged to attend all sessions and verbally commit to doing homework (at least 45 minutes each day for 6 days a week). Many mindfulness-based stress reduction programs include a unique post-session interview that discusses session experience and future goals are discussed (Kols et al, 2012).

Given that the times of sessions are dedicated to the exercises of mindfulness and discussion on the individual experiences, these eight sessions are mostly empirical in which a bulk of mindfulness exercises are trained. Stress training information includes topics such as stress psychology, stress response, and the effect of assessment on stress perception, which are mingled in most sessions. Stress-related training topics include stress psychology and stress response, and the effect of assessment on stress perception in most sessions are combined (Grossman et al, 2008).

Also, self-care in patients with diabetes includes blood glucose monitoring, proper diet, physical activity, blood sugar test, foot care, smoking reduction, and other similar activities which can be related to more body awareness. A person can show good self-care behaviors regularly if he better communicates with his body. In mindfulness training, a person, by performing a regular exercise such as body examinations or sitting meditation,

learns to be aware of his body and any pleasant and unpleasant sensations that may occur in the body to promote this awareness. As the body is more known by the person, he is more likely to justify himself and develop self-care behaviors (Niko Gofar et al, 2016).

In mindfulness training, individuals are taught two formal and informal exercises. Formal exercises, such as body examinations, sitting meditation, raising eating exercises, training thought, and feelings, etc., can be practiced at certain times of the day and done regularly and continuously. In addition to formal exercises, there are also informal exercises whose goals are for people to learn to generalize the teaching of mindfulness to life as a whole and to live consciously. Mindfulness living turns out to be a lifestyle. For example, when doing daily life activities such as cooking, cleaning, washing, eating, walking, and other activities, one can consciously do each and benefit from the advantages and positive results of mindfulness in all life experiences (Gentlemen et al, 2018).

One of the limitations of the research is that it was performed on people with diabetes type 2 in Tehran, so generalizing the result to other cities and individuals should be done cautiously. It is recommended to hold reminding sessions after the end of the treatment period to prevent the drop effect during the intervention. It is also recommended that counselors and therapists use this therapeutic approach in counseling groups for people with diabetes type 2 and related training courses.

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