The effect of mindfulness-based stress reduction in depression and blood sugar reduction diabetic patients with BIS type of personality

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Abstract

The present study was carried out to investigate the effectiveness of mindfulness-based stress reduction in depression reduction and blood sugar control in diabetic patients with Behavioral Inhibition type of personality. It was a quasi-experimental study with pretest/posttest design employing one experimental and one control group. The participants were 225 patients in Tehran. First, 30 patients with diabetes Type 2 were selected on the basis of interview and then randomly assigned to two experimental and control groups (n=15 in each group). Then, Wilson's personality questionnaire and beck's depression inventory were used to collect data. After conducting the pretest and measuring blood sugar level, the experimental group received an intervention in eight sessions of 120 minutes while the control group received no intervention. Finally, the posttest was administered to both groups. The results indicated that there was a significant difference between the results of the pretest and posttest, indicating that mindfulness-based training had a positive effect on the reduction of stress as well as reduction of blood sugar among patients with type 2 diabetes. Therefore, the mindfulness-based educational method can be used in clinics and healthcare centers to reduce stress and blood sugar levels among patients suffering from diabetes Type 2.

Keywords: Depression, Diabetes, Mindfulness, Personality

Introduction

Diabetes is a complex metabolic disorder characterized by hyperglycemia (blood sugar level higher than normal). Hyperglycemia occurs as a result of impaired insulin secretion or insulin action or both. Diabetes is a chronic, debilitating problem [1]. Stress and anxiety will stimulate neural and hormonal pathways, especially hypothalamus, pituitary and adrenal axes. Catecholamine and glucocorticoid axes affect tissue function structure, which can release cystokinin. All these phenomena increase the production of glucagon and decrease the glucose uptake (or breakdown) in environmental muscles. Cystokinin, primarily through interleukin, causes oxidative stress and inflammation, which in turn can lead to insulin resistance and cardiovascular complications [2]. Gray believes BIS/BAS are behavioral inhibition and activation systems. Extensive research has been conducted in relation to brain/behavioral systems and mental disorders.

High level of Behavioral Inhibition System (BIS) activity is associated with symptoms of anxiety [3] and personality disorders of type C [4]. On the other hand, its low level activity is associated with hyperactivity and attention-deficit disorders [3] as well as psychopathy [5]. It also assumes that high level of Behavioral Activation System (BAS) activity is associated with conduct disorder and other antisocial personality disorders. While low level of activity is considered to be a sign of depression [3]. Studies show that diabetes type 1 and type 2 can have different effects on the brain structure [6], and it seems that psychological factors also play a role in metabolic control. Depression is one of the negative consequences of poor glycemic control and possibly responsible for sexual dysfunction in women with type 1 diabetes [7]. Diabetes doubles the risk of depression and anxiety. Depressed diabetic patients are less likely to adhere to medication and diet, which in turn leads to poorer glycemic control. Evidence suggests that treatment of psychological conditions can lead to positive therapeutic outcomes. Poor control of diabetes and lack of insulin, in turn, can increase the risk of depression [8]. One of the effective ways to improve the health of patients with diabetes is mindfulness [2]. Relaxation can regulate cortisol and other stress hormones. Structured meditation such as mindfulness will teach individuals to induce such a response by focusing on diaphragmatic breathing [2]. Mindfulness refers to a meditation that emphasizes the participation and awareness in the present time. During the last thirty years, interest in the therapeutic use of mindfulness has increased, so that the literature reviews suggest more than 70 scientific papers published by 2007 in this area [9]. A review conducted by Merkes showed that all 15 studies that had the inclusion criteria for the research by focusing on fibroma, chronic pain, multiple chemical sensitivity, and cardiovascular diseases emphasized the positive results of treatment in mindfulness and affirmed that mindfulness had no adverse side effects or negative consequences. The same result was reported in another review of 18 studies on cancer, hypertension, diabetes, AIDS, chronic pain, and skin diseases [10]. It can be concluded that mindfulness-based stress reduction will have positive long-term result in reducing stress, depression, and anxiety in a variety of chronic diseases [11]. Mindfulness-Based Cognitive Therapy (MBCT) and Cognitive-Behavioral Therapy (CBT) were studied in 2013, to treat the symptoms of depression in diabetic patients.

In the mentioned study, 94 diabetic patients were assessed with BDI test and then, 31 patients were treated with MBCT and 32 with CBT while 31 were without any interference. Three months later, the results showed that both MBCT and CBT had played important roles in reducing depression symptoms and distress related to diabetes [12,13]. In another research, the effectiveness of mindfulness-based stress reduction was studied in controlling diabetes. The data indicated a significant difference between pretest and posttest results of experimental groups. This significant difference was seen in the results of post-test between the experimental and control groups while there was no significant difference in the results of pretest between the control and experimental groups or between the results of pretest and post-test in the control group [10]. In 1983, 10 million people were suffering from diabetes in America [14]. Today, it is estimated that 3.1 million in England and 285 million people around the world have contracted this disease and due to complications such as prevalence of aging, change in lifestyle, lack of healthy diet, lack of exercise and the obesity associated with it, this number will reach beyond 435 million by 2030 [1]. As a result, diabetes, particularly type 2 diabetes, is highly prevalent worldwide and it is important to manage this disease since it can affect the lives of 200 million people. In managing diabetes, it must be considered that even when medication, diet, and exercise are observed, there is still no guarantee for controlling blood sugar, since stress is an important factor in increasing the blood sugar [15].

Therefore, many psychological and medical interventions are used simultaneously to control the disease and its related

complications [16]. One of these interventions is mindfulness. Despite the beneficial effects of mindfulness on hypothetical diseases such as diabetes, a review of research carried out in Iran indicated the absence of further studies. Therefore, the aim of this research was to investigate if mindfulness-based stress reduction can reduce depression and blood sugar in patients with type 2 diabetes.

Method

This quasi-experimental study was an applied research with pretest-posttest design that followed experimental and control groups in 2 months. The study population consisted of patients with diabetes type 2 visiting the diabetes center of Ekbatan complex in Tehran in summer 2015. The participants were those diabetic patients who suffered from depression. They applied to attend training sessions to treat their complication, reduce their blood sugar level, and receive specialized psychological intervention. In an initial interview, the participants were selected according to the inclusion criteria for the study that included participants aged 20-50, having at least secondary school degree, no history of mental or physical illness except the case of the study, and attending in all therapy sessions without receiving any other counseling or psychological services. Fifty-five

patients were eligible for the study. The two questionnaires including Gray-Wilson and BDI were administered on them and their blood sugar (HBA1C) level was controlled by a physician. Based on the extracted results from the questionnaires and blood sugar tests, in the first stage, 30 patients who scored higher in Gray-Wilson questionnaires and BDI were selected as participants. In the next stage, patients were allocated randomly to experimental and control groups (n=15 in each group). It was explained to the participants that the goal of the therapy sessions as a research work is to help them reduce depression and control their level of blood sugar. The issue of informed consent was raised and all the participants declared that they would enter the research with full consent.

Then, mindfulness therapy sessions were held in the group form only for the experimental group once a week, while the control group received no intervention. At the end of the intervention, a posttest was administered to both groups. To evaluate the long-term effect of the therapy, one month follow-up was performed on both groups. At the end of follow-up, in order to observe ethics in the research, a one-day workshop on mindfulness was held for the control group. The content of therapy sessions on mindfulness-based stress reduction is briefly mentioned in Table 1.

Table 1 *Content of sessions on mindfulness-based stress reduction*

Sessions order	Content
Session 1	Orientation and outline of the program and its objectives in each session, relationship between diabetes and emotional problems and its management, Mental eating based on mindfulness and body scan practice along with breathing **Home assignment:** Mindfulness in other issues
Session 2	Body scan meditation, practicing to be non-judgmental and abandoning disturbing thoughts, sitting meditation **Home assignment:** Mindfulness of pleasant events, sitting meditation and body scanning and mindfulness of a new daily activity
Session 3	Non-judgmental auditory and visual practice for 2 minutes, sitting meditation and breathing with attention to senses **Home assignment:** triple stage meditation, 3-minute breathing practice, body scanning
Session 4	Four-dimensional sitting meditation: mindfulness-based walking with the aim of mental tracking **Home assignment:** sitting meditation, body scanning, 3-minute physical activity and breathing (during an unpleasant event)
Session 5	Sitting meditation with the focus on breathing, objects, and sounds with the aim of using meditation techniques in stressful situations
Session 6	Sitting meditation focusing on breathing of physical senses, disillusionment, home assignments
Session 7	Four-dimensional meditation, self-care practices, specifying pleasant and unpleasant events
Session 8	Body scan meditation, 3-minute breathing practice, dealing with obstacles, discussion about previous sessions

In this study, the following tools were used for data collection.

Wilson-Gray questionnaire (GWPQ): it is a self-assessment personality questionnaire for evaluating the activity of brain and behavior and its components. This tool was designed by Wilson, Bart and Gray in 1989 and consists of 120 items. For each item, there are three choices: yes, no, don't know.

For each item with the sign of minus (-), "Yes" zero score, "Don't know" 1 score, and "No" 2 scores and for each item with the sign of plus (+), "Yes" 2 scores, "Don't know" 1 score, and "No" zero score are awarded [17]. For the reliability of the questionnaire, Cronbach's alpha coefficients for the components of approach, active avoidance, passive avoidance, extinction, and fight/flight, respectively were as follows: For men 0.71, 0.61 , 0.58 , 0.61 , 0.65,0/65 and for women 0.68 , 0.35 , .059 , 0.63 , 0.71 , 0.71. The values indicate appropriate internal consistency of the test. Also, the convergent validity of the test was proven by using the correlation between GWPQ and Eysenck personality questionnaire [17].

Beck Depression Inventory (BDI): It was developed in 1961 by Beck et al. The questionnaire includes 21 items measuring physical, behavioral, and cognitive symptoms of depression. Each item has four choices scored from 0 to 3 that measure different degrees of depression from mild to severe. The maximum score in this scale is 63 and the minimum is zero. The comparison between BDI and Hamilton questionnaire (1960) indicates the advantage of BDI is that it doesn't depend on experimenter's skill or bias, and deals more with the measurement of psychological disorders and their correlation with each other was 0.75 [18]. The meta-analysis results of BDI indicate that the coefficient of internal consistency is between 0.73 and 0.93, with the mean of 0.86. Test-retest reliability coefficients are between the range of 0.48 and 0.86. Concurrent validity with clinical ratings for psychiatric patients indicates moderate to high correlation coefficients, Mdn 0.55-0.96 and r=72 [19].

For descriptive statistics, frequency, mean and standard deviation indices and for inferential statistics, multivariate analysis of covariance (MANCOVA) was used.

Results

The mean age was 46.3 in the experimental group and 47.2 in the control group. The participants in both groups had high school diploma, and they were all married. 68 percent of The participants had been diagnosed with diabetes during the last 3 years.

Table 2 *Mean and Standard Deviation of the depression scores in pretest, posttest, and follow-up*

Statistical index	Factors	Pretest	Posttest	Follow-up
Experimental group BIS	No.	15	15	15
	Mean	18.20	9.33	9.30
	SD	8.29	7.17	8.10
Control group BIS	No.	15	15	15
	Mean	19.98	21.13	21.26
	SD	8.20	7.87	7.98

The data in Table 2 shows that there is not a significant difference in the pretest scores between the experimental and control groups before the intervention even though the mean score of experimental group in the pretest is more than that of control group. We can also see that the mean score of experimental group in the posttest is less than the mean score in the pretest. Levene's test was used to check the compliance with ANCOVA. Regarding the observed F value, the depression level was not significant at the level of 0.05 (p>0.05). Thus, the variance of depression variable among the participants (in Experimental and control groups) is not different and variances are equal.

Table 3 *Mean and standard deviation of blood sugar in pretest, posttest, and and follow-up*

Statistical index	Factors	Pretest	Posttest	Follow-up
Experimental group BIS	No.	15	15	15
	Mean	169.46	141.73	141.11
	SD	31.04	30.04	30.01
Control Group BIS	No.	15	15	15
	Mean	156.46	156.66	156.89
	SD	35.41	35.53	35.49

The data in Table 3 shows that there is not a significant difference in the pretest scores between the experimental and control groups before the intervention even though the mean score of experimental group in the pretest is higher than that of control group. We can also see that the mean score of experimental group in the posttest is lower than the mean score in the pretest. Level's test was used to check the compliance with ANCOVA. Regarding the observed F value, the blood sugar level (HbA1C) was not significant at the level of 0.05 (p>0.05). Thus, the variance of blood sugar variable among participants (in the Experimental and control groups) is not different (the variances are equal).

To study the homogeneity of variance, the Box Test was used. The results showed that the Box value was not significant (p>0.05). As a result, the assumption of different covariance for depression and blood sugar was established in the groups. To test the effectiveness of mindfulness, univariate analysis of covariance was used. The results are shown in Table 4, 5 and 6.

Table 4 *Univariate analysis of covariance to assess the level of depression*

statistical Index of variables	Sum of squares	df	F	Significance	Effect size	Test power
Pretest	416.59	1	6.89	0.01	0.21	0.71
Group	1067.27	1	17.66	0.001	0.39	0.98
Error	1631.67	27				
Total	3238.96	29				

Results in Table 4 show that by eliminating the effect of pretest variables and considering the estimated factor F, there is a significant difference in the posttest between the adjusted mean scores of depression in participants according to experimental and control group membership. This means that the treatment of mindfulness-based stress reduction is effective in reducing depression. The results of univariate analysis of covariance showed the effect size of 39%. It can be said that 39% of the variance of the dependent variable is explained by the independent variable and it concludes that mindfulness training in experimental group in comparison with control group has greater impact on depression in patients with BIS personality.

Table 5 *univariate analysis of covariance to assess the level of blood sugar (HbA1C)*

statistical Index of variables	SS	DF	F	Sig	Effect size	Test power
Pre-test	390904.03	1	170.52	0.001	0.86	0.99
Group	4637.34	1	20.22	0.001	0.42	0.99
Error	6190.23	27				
total	46740.30	29				

Table 5 shows that by eliminating the effect of pre-test variable and considering the estimated factor F, there is a significant difference in the post-test between the adjusted mean scores of blood sugar in participants based on their membership in the experimental control groups. This means that the mindfulness treatment was effective in reducing

blood sugar in diabetic patients (F=20.22 , SIG=0.001).

The results of univariate analysis of covariance showed the effect size of 42%. It can be said that 42% of variance of the dependent variable is explained by the independent variable. In conclusion, mindfulness training for participants in the experimental group had a great impact on reducing blood sugar in diabetic patients with BIS personality.

Table 6 *Comparison of mean values in the posttest and follow-up of experimental group*

Statistical index scale	DF	Mean difference MD	T score	Sig
Depression	14	0.2	0.89	0.34
Blood sugar	14	0.28	1.42	0.16

After two months, follow-up test was administered to the experimental group. according to Table 6, since the significance level for all subscales is larger than 0.05, with 95% certainty it can be said that the effect of mindfulness training has been stable.

Discussion

The study aimed to investigate the effect of mindfulness-based stress reduction technique to reduce depression and blood sugar in diabetic patients with behavioral inhibition system (BIS) personality trait. The result of analysis of covariance in Table 3 and 4 showed that there is a significant difference in the obtained scores between the experimental and control groups after removing the effect of pre-test. Thus, the study hypothesis was confirmed. This means that the method of mindfulness-based stress reduction training can reduce the level of depression and blood sugar in patients with BIS personality in the experimental group compared to the control group. The findings are consistent with the results of studies by Annika Tovote and Joke Fleer [12], Van Son [13], Bakhtiari and Abedi [20], Shahande [21], Pashaie [22], and Zareh [23]. The results of a study by Annika Tovote and Joke Fleer [12] indicate the impact of cognitive-based mindfulness and cognitive-behavioral therapy in reducing the symptoms of depression and emotional distress induced by diabetes. In line with these findings, Ghashghaie, Naziri and Farnam [24] examined the effect of mindfulness on the quality of life in patients with diabetes type 2. The results showed that in all aspects, the quality of life in experimental group increased in comparison with control group. Zareh and Zareh [23] studied the effectiveness of mindfulness-based stress reduction in controlling diabetes and the findings showed that mindfulness is effective in glycemic control that are in agreement with the results of the present study. The results of studies by Greene [25], young [26], Rosenzweig [27], and Schuster [28] show that mindfulness can reduce stress, increase quality of life, and decrease blood sugar and depression. To explain these findings, it can be said that in diabetes type 2, the glucose regulation system is not functioning properly, and non-compliance with treatment, inadequate monitoring of blood sugar and inappropriate treatment is effective in increasing blood sugar and depression [29]. The increased blood sugar will commonly lead to disability, early death, and numerous complications in social relationships. However, due to the global prevalence of diabetes and its associated economic impacts, researchers are looking for effective behavioral interventions. Emphasizing the role of chronic stress in insulin resistance, metabolic syndrome and diabetes type 2 in some studies has emerged the significance of the combination of psychological and pharmacological interventions. Therefore, fundamental cognitive-behavioral components of diabetes like self-management, disease admission, and stimulus to follow treatment involve in intervention programs [30].

Mindfulness-based stress reduction has an effective role in reducing the symptoms of many diseases such as diabetes. The results of previous studies indicate a significant

improvement in mood and a remarkable decrease in perceived intensity due to mindfulness.

Mindfulness can be applied on patients with a wide range of symptoms, mental health professionals to reduce stress in their relationships with patients, and even to reduce stress among caregivers of patients with chronic diseases. Psychological stress is a common phenomenon among diabetic patients [26] and is associated with adverse metabolic control [27]. Mindfulness-based stress reduction is a biological approach, which is a branch of cognitive-behavioral interventions aiming at promoting the skill of stress management in diabetic patients. Mindfulness can also be provided in the reducing stress in people with diabetes [26]. The result of studies on diabetes by Bowling and Green [25], Rosenzweig [27] and Schuster [28] indicate that mindfulness can play a major role in reducing stress, increasing quality of life, and reducing blood pressure as well as depression. The review of literature on mindfulness shows that this type of treatment has been successfully used in different situations on numerous patients. Such beneficial results may be because the mindfulness-based therapist emphasizes that patients avoid judgment, be conscious, and live in the present time, and concentrate on their capabilities and positive subjects.

Any research has some restrictions. Using convenience sampling methods and self-reporting tools were some limitations of the present study. Since this study was conducted on diabetic patients in Tehran, caution should be taken in generalizing the results to other groups. According to the present study, it is recommended that for achieving clearer and more accurate results about the effects of mindfulness training, this approach can be employed in further studies with larger sample sizes. Therefore, with respect to the effectiveness of this therapy in reducing the level of depression and blood sugar in diabetic patients with BIS personality, it is suggested that this treatment approach be used by psychologists and health experts.

Similar researches are suggested on the other psychological indicators such as anxiety, stress, anger, quality of life, hypertension, weight, adherence to treatment, and self-management behaviors. According to the results of this study, mindfulness-based stress reduction should be added to training programs for diabetic patients.

Conclusion

Mindfulness-based stress reduction has an effective role in reducing the symptoms of many diseases like diabetes. Since mindfulness focuses mainly on reducing emotional reactivity to stress and concentrates on present time and achieving self-awareness and considering the fact that diabetic patients mostly have symptoms of depression and anxiety, by using these methods they will achieve a higher consciousness; and by recognizing their abilities, they are less likely to experience tension and more likely to be able to manage their thoughts, feelings and conversations. Therefore, mindfulness can be an effective method in reducing the level of stress and blood sugar in patients with diabetes.

Contribution

Study design ideas: FMSH, FG, AK, SA
Collection and data analysis; FMSH, AK, SA
Preparation of article: FMSH

Conflict of Interest

"The authors declare that they have no competing interests."

for the research, authorship and/or publication of this article.

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