



Effect of emotional intelligence in glycemic control in patients with type II diabetes

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Abstract

Diabetes, in addition to adverse physical effects, is associated with many psychological problems. The correlation between physical health and emotional intelligence are acceptable. The aim of this study was to determine the effect of emotional intelligence training in glycemic control in patients with type II diabetes. The present study was a quasi-experimental research, which was conducted in Mashhad city, Iran. The participants included 20 patients referring to the diabetic centers. They were selected through convenience sampling and randomly divided into two groups of experiment (n=10) and control (n=10). To measure blood glucose, the level of HbA1c in patients was measured before and after training. The experimental group attended in a period of emotional intelligence training. The training sessions were held as group discussion during 8 weeks, one session of 120-min per week. The findings suggest that emotional intelligence training significantly reduced the level of blood glucose (HbA1c) in the test group compared to the control group. Based on the results, emotional intelligence training, as a psychological intervention, by affecting understanding, interpretation, regulation and efficient use of excitement, is effective along with medication therapy in controlling blood glucose in type II diabetic patients.

Keywords: Diabetes, Emotional Intelligence, Glycemic, Type II

Introduction

59% of all worldwide deaths and 46% of burden of all diseases are due to chronic and non-communicable diseases. Diabetes is a chronic disease with debilitating side effects that has chronic and imperceptible course at its initial stages. This disease is one of the main targets in health policy [1]. Diabetes is

the most common chronic metabolic disorder in which the body is not able to produce insulin or use it properly [2]. According to pathogenic processes that increase the blood sugar, diabetes is classified into major groups of type I and type II. About 85 to 90 percent cases of diabetes are attributed to

type II [3]. In type II diabetes, or adult-onset diabetes, insulin deficiency is not necessarily the problem, but the problem is mainly seen in target tissues, especially muscles. The resistance to insulin in these tissues is high. Since sugar cannot enter into target tissues, the glucose level in the blood increases. The high blood glucose stimulates pancreas to produce more insulin by β cells and release it in the blood, which brings about hyperglycemia and hyperinsulinemia [4]. Symptoms including frequent urination, thirst, hunger, and weight loss have drawn the attention of physicians to the diabetes since thousands of years ago [5]. Diabetes complications are divided into two forms of early and late complications. The early complications such as impaired consciousness usually are caused by acute deformation of blood glucose for a variety of reasons. The long-term complications such as cardiovascular disease and nephropathy, neuropathy, diabetic foot, and retinopathy usually are caused by high chronic and long-term blood sugar [6].

The glycosylated hemoglobin is one of the most important treatment goals for blood sugar control in patients with type II diabetes and the most important indicator for blood glucose control in these patients. This indicator, unlike other indicators, is not influenced by daily fluctuations in blood sugar [7]. The A1c hemoglobin is a form of hemoglobin in which the beta chain of hemoglobin A1 is connected to glucose with non-enzymatic reaction, suggesting the average of blood glucose over the last 8 to 12 weeks [8]. The results of this test show the percentage of hemoglobin which is in combination with sugar. The higher percentages reflect the higher average blood glucose level. The American Diabetes Association [9] recommends that the amount of glycosylated hemoglobin in adults should be preserved less than 7 percent (5.6 percent in Iran) while the results of this test may have half of a percentage fluctuation from one laboratory to another. In type II diabetes, there is a genetic background; in other words, studies have shown that 20% of the population

is prone to diabetes type II genetically, but less than half of them will fall afoul of this disease. The main environmental factors that increase the risk of type II diabetes, possibly in the field of genetics, include: lifestyle (lack of exercise and poor eating habits) and psychological factors [1]. It can be said that genetic factors are predisposing determinants and environmental factors are developing and exacerbating determinants for diabetes disease. Some environmental factors such as sedentary make body prone to type II diabetes. However, some other factors such as psychological factors, besides making body prone to the disease, can interfere with its control measures [10].

Diabetes is often associated with mental disorders which unfortunately may reduce the patient's ability to control the diseases. The reduction in patient's ability to control diabetes can intensify the mental problems which run patients afoul of a vicious cycle. These problems may even be intensified by patients mental reaction and negatively affect the experience of diabetes symptoms [10]. Psychological factors and negative emotions can cause illness or aggravation of existing illness in two ways. The first is when one experiences negative emotion a disruption in the process of engagement in healthy behaviors (such as balanced feed, exercise, sleep, etc.) and control of the disease may be occurred. The second is when one experiences negative emotion the psychological pressure on the immune system makes endocrine glands to lose their favorable working conditions and diseases such as diabetes to occur [11]. White [10] also believes that psychological factors such as anger and stress, in addition to direct effects on glycemic control, may cause diabetic patient's behaviors to be distorted from self-care behaviors. Zardozi and colleagues [12] have shown that chronic psychological stress caused by negative emotion can reduce the effects of medication in patients with diabetes and make the metabolic control disrupted. For many years,

the basic philosophy was that diabetic patients should adjust their own lives in accordance with the needs and requirements of the disease. In recent years, however, it has been replaced by the belief of helping patients coordinate diabetes with their lives. The goal of the most treatment strategies is to strengthen the effective disease control approaches, reduce mental health problems related to diabetes, and minimize elegant, sophisticated interactions between these factors. Therapists work with patients on important issues including: stress and daily hassles caused by diabetes, psychopathology in patients with diabetes, psychological consequences of diabetes, and familial problems caused by diabetes [10]. Negative emotion in these patients can disrupt the control of blood sugar. It is well known that poor glycemic control has a positive significant relationship with recall of negative emotion in life among these patients [13]. Rajabpour and Tavakolizadeh [14] believe that one of the main factors in adaptation to traumatic experiences of chronic diseases is cognitive and emotional processing. Cognitive and emotional processes can be facilitated by social-environmental factors associated with emotional intelligence.

Emotional intelligence is a fundamental element of human behavior which acts independently of IQ (intelligence). Mortiboys [15] defines emotional intelligence as the ability to recognize and control our own and others emotions. Many studies that have been conducted in the concept of emotional intelligence are generally based on two distinct approaches. In the first approach, that is named the ability model developed by Salovey and Mayer [16], the emotional intelligence is defined as a set of mental abilities mainly active in the realm of emotional information processing. According to this approach, cognition and emotion are in the interaction with each other and emotional intelligence is a kind of abstract reasoning about emotion and feelings. In the second approach, which is named the combination model, in general, emotional intelligence is defined as a set of

personality traits and non-cognitive abilities that psychologists like Goleman and Bar-On [17] are well-known theorists of it. Many researchers believe that there is a relationship between emotional intelligence and effective performance in compliance with the demands of everyday life [18]. The direct relationship between emotional intelligence and good, healthy life shows that how much is important paying attention to emotions, being aware and stay aware of them, and using them to guide behavior [19]. Extremera and Fernandez-Berrocal [20] in a research on the relationship between emotional intelligence and perceived social, mental, and physical health concluded that the different components of emotional intelligence have relations to problems such as depression and anxiety, on one hand, and positive perception of health, on the other hand. In recent years, researches have shown that there is a high correlation between emotional intelligence and proneness to a variety of diseases. Negative emotions can weaken the immune system and make the body vulnerable to all diseases [21]. Emotional intelligence skills can enhance the brain's ability to cope with anxiety and excitement. This causes the immune system to stay strong and have more resistance against diseases [19]. People with chronic diseases may experience more problems in their adaption because of low self-esteem [14]. Tsaousis and Nikolaou [22] in their review found out that there is a significant relationship between emotional intelligence and mental/physical health. Also, Bar-On [23] expressed there is a significant correlation between physical health and emotional intelligence. Other researchers suggest that ability to control emotions which is one of the four dimensions of emotional intelligence has a close relationship with physical health. It has been shown that people who are not able to control their emotion are more prone to chronic diseases [16]. The researchers also have found that after psychological intervention, the average level of A1c hemoglobin significantly decreased

in experimental groups. It has been proven that people with the ability to organize their own thoughts and emotion can better control their disease and show more adaptation [14]. Haffey also believes that there is a significant relationship between emotional intelligence and self-regulatory control activities (related to blood glucose control) in patients with adult-onset diabetes [24]. According to what was mentioned about the relation between emotional intelligence and health and based on numerous studies suggesting the need of people with diabetes for the skills of emotion regulation and negative thoughts control (through designation/implementation of interventions based on effective, useful psychological approaches focused on diabetes as a self-management disease), yet the current researches have investigated the impact of training programs along with other approaches such as cognitive behavioral and so on. Therefore, this study aimed to evaluate the effect of emotional intelligence training on controlling blood glucose in type II diabetic patients.

Method

The present study was a quasi-experimental applied research that designed as pretest-posttest with control group. The statistical population included all 40 to 60-year old patients with type II diabetes refereeing to five health centers in Mashhad in 2014. A multistage convenience sampling method was used in which the health center of number one was selected as the available sample. After receiving approval to conduct the research in two active diabetes centers (that were also selected due to the availability), 63 cases were selected according to inclusion and exclusion criteria. The sample size was determined according to Cohen table and taking into consideration the significance level of 0.05, the volume of average effect of 0.5 and the test power of more than 55%. Hence, the number of 20 participants was selected and randomly divided into the experimental group (n=10) and control group (n=10). The

inclusion criteria to the study were: having a minimum age of 40 and maximum of 60 regardless of gender, having minimum education of middle school, the ability to primary communication, having enough free time and motivation to participate in training sessions, and being involved in diabetes at least for 2 years. Lack of acute or chronic diseases which may cause problems for patient during long meetings, lack of severe medical complications of diabetes, not taking psychiatric medications, not using illicit medications and no drug abuse as well as not receiving any psychological training were the other inclusion criteria. Also, the registration of people diagnosed with major psychiatric disorders was refused. The exclusion criteria included: absence in the meeting for three times or more and involving in any medical and psychiatric complication during the training period.

The consent form was read and signed by the patients for ethical considerations.

HbA1c levels were measured in both groups before training. In fact, the effect of treatment method on better control of blood sugar levels can be inferred from the reduced hemoglobin A1c. The index is reported as percentage and it is justified according to the normal range established by each laboratory [13]. In the present study, Nyco Card device and kits were used for measurement of HbA1c before and after training on emotional intelligence. The educational content was prepared by overviewing books and articles related to emotional intelligence based on Bradberry and Greaves' theory. Then, the content was confirmed by experts and delivered to the type II diabetic patients in the experimental group as booklet.

The group sessions as question and answer were also held for better educating patients through engaging them in the learning process. A 120-min session per week (for 8 weeks) was held which hosted by the researcher only for the experimental group. Summary of emotional intelligence training sessions is presented in the following:

First session	Acquaintance with members, statement of regulations, cognition of emotional intelligence, primary emotions and relationship between emotion and physical health (diabetes).
Second and third sessions	Acquiring self-awareness, achieving the ability to identify strengths, weaknesses, emotions, and naming of emotions, being aware of relationship between emotions and thoughts, acquiring self-esteem, better understanding of own abilities and finding the most inspiration of own existence
Fourth session	Emotion regulation 1, introducing causes and consequences of emotions, discussing about how situation understanding helps the person, establishing the understanding of own emotions, keeping the focus under pressing conditions, control of impulse and negative emotions
Fifth and sixth sessions	Recognition and understanding of others' emotions, paying attention to the needs and wishes of others, making and maintaining satisfactory relationships, empathy, listening skills, conflict resolution, identifying and removing barriers to relations
Seventh session	Emotion regulation 2, achieving the ability to adapt with feelings, thoughts, and behaviors of others in different situations, learning and applying effective skills of adaptation and flexibility, familiarity with the skills such as styles of problem-solving and anger management and understanding of significance of these skills in life for raising the level of health
Eighth session	Reviewing and summing up, emphasizing on practice for institutionalization of the skills

In order to respect the rights of participants in the control group, a summary of training sessions at one meeting was presented to them. The A1C test two weeks before and one week after the final session was conducted meetings. In this study, data were analyzed in two descriptive and inferential statistics. For this purpose, SPSS 22 was utilized. Univariate analysis of covariance was used to evaluate the assumptions of research.

Results

In terms of gender, 9 patients (90%) in the experimental group were female and one (10%) was male while in the control group, 7 patients (70%) were female and 3 (30%) were male. The education level of 5 participants (50%) in the experimental group was under diploma, 4 participants (40%) were diploma, and 1 participant (10%) was above high school diploma.

In the control group, the education level of 7 patients (70%) was under high school diploma

while 3 patients (30%) had high school diploma. In terms of age, 1 patient (10%) in the experimental group was 45-50, 4 patients (40%) were 50-55, and 5 patients (50%) were 55-60. In the control group, 3 patients (30%) aged between 45 and 50, 2 patients (20%) between 50 and 55, and 5 patients (50%) between 55 and 60. 8 patients (80%) in the experimental group experienced diabetes less than 4 years, 1 person (10%) between 4 and 8 years, and 1 (10%) between 8 and 12 years. In the control group, 8 patients (80%) were diagnosed with diabetes less than four years, and 2 patients (10%) more than 12 years.

Fisher's test results showed that differences between the control and experimental groups in terms of gender (1.26), age (1.61), and education (1.45) was not significant at the level of 0.05; in other words, these features were controlled in both groups.

The following table gives a description (mean and standard deviation) of blood sugar levels «A1C» before and after training on the basis

Table 1 Descriptive indices of blood sugar variable

Group	Stage	Mean	Standard deviation
Experiment	Pretest	8.37	1.73
	Posttest	7.46	1.38
Control	Pretest	7.19	1.08
	Posttest	7.76	0.93

of control and experimental groups.

In assessing the effect of emotional intelligence training in blood sugar of type II diabetic patients, the auxiliary random variable is pretest and the dependent variable is posttest. Before applying the covariance analysis on the data, it is necessary first to check the pre assumptions of the analysis, including normal distribution of data using Kolmogorov-Smirnov test. The statistics obtained in pretest for the experimental (0.12) and control (0.23) groups showed that the significance level is higher than the error level of 0.05 (0.2 and 0.13, respectively). Therefore, at the confidence level of 95 percent, the values of blood sugar were normally distributed.

Moreover, to check the assumption of homogeneity of variances, Levine's test was used. The results showed that Levin's statistic ($F=0.023$, $p=0.88$) is not significant at the level of 0.05, indicating the homogeneity of variances. In order to evaluate the results of the homogeneity of regression coefficients, F statistic in the interacting effect of control variable (pretest) and intervention (training) ($F=0.19$, $p=0.66$) was insignificant which indicated the homogeneity of regression coefficients in two groups. After proofing the assumptions, univariate analysis of covariance was employed to assess the effect of emotional intelligence training in blood sugar of type II diabetic patients. The results of covariance

Table 2 Results of covariance analysis on the effect of emotional intelligence on blood glucose in type II diabetic patients

Source	Sum of squares	df	Mean of square	F	P value
Modified model	17.29	2	8.64	18.26	0
Pretest	16.84	1	16.84	35.57	0
Group	5.01	1	5.01	10.58	0.005
Error	8.04	17	0.47		

analysis are presented in Table 2.

As can be seen in Table 2, due to the significant effect of blood sugar levels in pretest (covariate), its effect was controlled and as can be seen, after removing the effects of covariate, the educational intervention still showed a significant effect on reducing blood sugar.

The significance level of hypothesis testing was equal to 0.005 which is below the level of error of 0.05; so, at the 95% confidence level, emotional intelligence training is effective in blood sugar of type II diabetic patients. Regarding the adjusted mean scores (7.06 in the experimental group and 8.15 in the control group), blood sugar levels in type II diabetic patients reduced after training (1.09). The test power of 0.89 and Eta coefficient of

0.68 were obtained that show 68% of blood sugar variance is explained by emotional intelligence training.

Discussion

This study aimed to examine the effect of emotional intelligence training in glycemic control in type II diabetic patients in Mashhad. In this study, blood glucose was determined through the measurement of glycosylated hemoglobin.

The results showed that the mean blood sugar levels in patients with type II diabetes dropped after the intervention, indicating that strengthening and training on emotional intelligence alongside medication therapy is effective in reducing blood sugar levels in

type II diabetic patients.

To explain the mechanism of blood sugar reduction in patients participating in this study, it is necessary to notice the point that any patient is influenced by the emotional and environmental factors; then, we can say that every disease has psychosomatic aspects because "Emotional factors through the nervous and hormonal ways can influence all physiological processes." [25]. In type II diabetic patients, the hormone that regulates blood sugar levels are the same as hormones that are secreted in stressful situations and hence, can cause negative emotions in people. During the experience of negative emotions, the released hormones make an impact on blood sugar levels and also increase the secretion of cortisol [9,17]. Since cortisol influences the liver and results in the increase in glucose level and decrease in its use in body tissues [26], it seems that such training can suppress or reduce the secretion of cortisol and hence, can help better control blood sugar of diabetic patients. Similarly, negative emotions can affect blood sugar levels indirectly by exacerbation of behavioral changes and making patients less adhered to self-care treatments [10]. At the meantime, training such as emotional intelligence can cause to improve self-care behaviors and better adaptation of patients by helping them identify and control their emotions. Examination of available studies showed that there is no study published dealing with emotional intelligence training effect in diabetes control. However, the study of Bay and Bay [27] showed that combined psycho-physiological therapy significantly reduced blood sugar in type II diabetic patients. Also, Rakhshandehroo et al. [28] showed that educational intervention can significantly promote awareness, attitude, and performance of diabetic patients and also improves metabolic control among them. Thus, providing such education along with other medical interventions as a part of comprehensive treatment procedure is recommended. Since an important objective of emotional intelligence is to identify and control emotions in a proper way, researches which have been conducted in

other context of psychological interventions (such as behavior cognitive) have shown a significant relationship between psychological intervention and blood sugar control. For example, Oraki et al. [29] conducted a study to investigate the effect of anger management training with cognitive-behavioral approach on treatment compliance and glycemic control in patients with type II diabetes and according to analysis of covariance, showed that anger management training can be effective in glycemic control (HbA1c) in the patients. Davazdah Imami et al. [26] and Mehrabi et al. [13] who investigated the effect of stress management training based on the theory of cognitive behavioral therapy in glycemic control among type II diabetic patients showed that these skills can reduce blood sugar. The study of White [10] also has shown that cognitive behavioral therapist can help diabetic patients increase their self-confidence (which is also one of the objectives of emotional intelligence) to get the best level of self-care behavior and ultimately blood sugar control.

Asaadi et al. [30] conducted a study to compare the effect of muscle relaxation (with the implicit goal of emotions effect on body and blood sugar control) in anger reduction and glycemic control in patients with diabetes type I and II. The results showed that after relaxation training, the mean blood sugar of diabetic patients in both intervention groups significantly decreased. Other findings from the study of Marandi et al. [31] on the effect of yoga exercise (which can be a part of the curriculum of emotional intelligence) on blood pressure, plasma insulin, and blood sugar levels in patients with diabetes type II indicate a significant difference in the mean blood glucose, plasma insulin, and blood pressure between the control and experimental groups which shows a significant improvement in blood sugar in type II diabetic patients.

Despite the lack of studies about the effects of therapeutic interventions of emotional intelligence in chronic diseases such as diabetes, the findings of this study are in line

with those of other studies focused on chronic diseases. The results of recent researches have shown that there is a high correlation between emotional intelligence and proneness to a variety of diseases.

Emotional intelligence skills can enhance the brain's ability to cope with the excitement. This causes the immune system to stay strong and have more resistance against diseases [19]. People with chronic diseases may face more problems in their adaptation. Researchers have shown that the ability to regulate emotions is one of the four dimensions of emotional intelligence that has a strong, close relationship with physical health. Also, it has been shown that people, who are not able to control their own emotions, are more susceptible to many chronic diseases [16].

Moreover, the results of numerous studies [22,24] indicate that there is a significant relationship between emotional intelligence and mental/physical health, implying that there is a significant correlation between physical health and emotional intelligence. The results of Suhutte et al. [32] showed that higher emotional intelligence is associated with higher levels of health. Hollahan and Moos [33] findings also confirm the relationship between emotional intelligence and physical symptoms. Mikolajczak et al. [34] also reported the results indicating the relation of emotional intelligence to health-related variables, which is in line with the results of the present study.

Mokhtari and colleagues [21] and Rajabpour and colleagues [14] also presented several reasons for emotional intelligence as a proper therapeutic intervention for chronic diseases such as heart disease, cancer, etc. so that strategies to increase emotional intelligence in coping with chronic diseases are recommend using workshops in hospitals and medical centers.

Conclusion

Overall, it can be concluded that emotional intelligence can help patients with type II diabetes to control their blood sugar at optimal levels.

However, final judgment in this regard needs

vast and varied researches. However, the findings of this study can re-emphasize the significance of emotional intelligence training in all aspects of human life, especially in expanding, devastating chronic diseases. This is because people with high emotional intelligence are capable to combine three components of emotional, cognitive, and physiological successfully with each other. The limitations of this study included lack of follow-up to determine the long-term effect of emotional intelligence training and ignoring factors such as socioeconomic, familial status of diabetic patients which are suggested to be alleviated in future researches.

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Contribution

Study design: MM, FS

Data collection and analysis: MM, FS

Manuscript preparation: MM, FS

Conflict of Interest

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

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