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Effect of Cognitive-behavioral Training Combined with Motivational Interviewing on Treatment Adherence and Hemoglobin A1c in Patients with Diabetes and Depressive Symptoms

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Abstract

Background: Depression associated with diabetes increases the possibility of non-adherence to care and treatment programs. The use of psychological approaches can improve patients' self-management ability.
Objectives: This study aimed to examine the effect of cognitive-behavioral training combined with motivational interviewing on treatment adherence and hemoglobin A1c (HbA1c) in patients with diabetes and depressive symptoms.
Methods: This randomized clinical trial was performed on two groups of 45 patients (n = 90) with type 2 diabetes and depression in a diabetes clinic affiliated with a teaching hospital in Iran in 2021. The participants were selected using convenience sampling and randomly divided into two intervention groups. The patients in the cognitive-behavioral intervention group with motivational interviewing attended eight face-to-face training sessions three times a week, and the patients in the cognitive-behavioral group attended only four cognitive-behavioral training sessions two times a week. Twelve weeks after the intervention, the personal information and HbA1c levels reported by the laboratory were collected using an information form. Other data were collected using the Morisky Medication Adherence Scale. The collected data were analyzed with SPSS software (version 22) using paired samples *t*-test, independent samples *t*-test, chi-square test, and analysis of covariance (ANCOVA).
Results: The results of ANCOVA showed that the mean score of medication adherence of the patients in the cognitive-behavioral group with motivational interviewing after receiving the intervention (5.54 ± 1.05) was significantly higher than the medication adherence score of the patients in the cognitive-behavioral training group (4.87 ± 1.01) (P = 0.002). Moreover, the mean HbA1 level of patients in the group receiving cognitive-behavioral training combined with motivational interviewing (8.42 ± 0.69) was significantly lower than the corresponding value for patients in the cognitive-behavioral training group (9.47 ± 1.28) (P = 0.001).
Conclusions: Cognitive-behavioral training combined with motivational interviewing had a greater effect than cognitive-behavioral training alone on increasing medication adherence and reducing HbA1c levels in patients with diabetes and depression. Thus, motivational approaches can be incorporated into routine psychological training to better manage diabetes and depression symptoms.

Keywords: Motivational Interviewing, Cognitive-behavioral Therapy, Diabetes, Depression, Medication Adherence, HbA1c

1. Background

Chronic medical problems were considered life-threatening factors in the past. However, the advances made in treatment methods have currently been helping people have longer lives. Diabetes is a chronic disease that covers a group of metabolic diseases whose main symptom is high blood glucose levels due to insulin resistance or impaired insulin secretion (1). Type 2 diabetes accounts for approximately 85 to 90% of people with diabetes (2). Given its high prevalence and numerous complications, this disease is of great importance. Diabetes is one of the most important health, medical, and socio-economic problems in the world (3). Diabetes statistics and trends are increasing in the world, so that in 2017, its overall incidence and prevalence were reported as 22.9 and 476 million people, respectively, which are projected to increase to 26.6 and 570.9 million people by 2025 (4). The

prevalence of diabetes in different regions of Iran has been reported to vary at least from 1.3 to 18.6% (5).

In addition to medical treatments, there are many alternative actions for controlling type 2 diabetes. Seven important behaviors for controlling the disease include regular medication use, adopting a healthy diet, regular physical activity, blood sugar monitoring, self-care, reducing the risk of acute and chronic complications, and healthy and effective coping in diabetes management (6). Adherence to treatment plans and prescribed medications is an important challenge for patients with type 2 diabetes. If treatment plans are not followed, patients suffer from serious complications of the disease and even need immediate hospitalization and treatment (7). Wabe et al. showed that adherence to treatment regimen was associated with a decrease in HbA1c, so that with a 10% increase in adherence, HbA1c decreased by 0.14 to 0.16% (8).

Depression is one of the most common health problems found in people with diabetes. Depression is three times higher in patients suffering from diabetes, with a prevalence of 8 to 27%, than in normal people (9). Furthermore, 18 to 25% of patients with diabetes are diagnosed with major depressive disorder (10). Patients with depressive diabetes are more likely to have poor self-control in areas such as nutrition, exercise, and glycemic control. Depression, along with diabetes, worsens the prognosis of the disease, increases non-adherence to care and treatment programs, reduces the quality of life, and increases mortality (11). Negative lifestyle changes due to depression have many negative consequences, including an increase in HbA1c for patients with diabetes due to lack of enjoyment and lack of energy in depression (10). Increasing a score in depression in patients with diabetes causes a 10% increase in non-adherence to treatment recommendations. Depression raises blood sugar through poor adherence to self-care and self-management programs, which contributes to the spread of depressive symptoms (12).

A variety of interventions, from patient education to behavioral modification strategies have been used for diabetes management (13). Training is one of the most important ways to reinforce self-management ability, but regular and traditional training programs are successful only by 5 to 10%. Therefore, new effective approaches are required to help these patients to improve their self-management ability (14). Compared to other chronic diseases, diabetes requires more lifestyle changes, so psychological interventions can improve various aspects of the disease and acceptance and adherence to treatment (15). Cognitive-behavioral therapy involves a psychological approach that is based on the assumption that thoughts are the cause of emotions and, ultimately behavior. Its cognitive component highlights the importance of the meaning that a person places on objects, situations, or events, and the behavioral component focuses on the relationship between problems, behavior, and thinking. Cognitive-behavioral therapy can help reduce depressive symptoms by developing the ability to identify and re-evaluate negative thoughts that affect emotions and behavior (16, 17).

Another way to empower patient self-care management strategies is to use motivational interviewing (18), which is an effective strategy for patient empowerment that increases the sense of self-efficacy in self-care behaviors (19). Motivational counseling is a client-centered method and guideline to reinforce and increase the intrinsic motivation for change through the discovery, identification, and resolution of ambivalence (20). Motivational interviewing and cognitive-behavioral therapy are common interventions that can be combined to address complex issues such as adherence to treatment guidelines. Research has shown that a combination of two confirmed methods of motivational interviewing and cognitive-behavioral therapy was an effective solution to improve the cancer patients' medication adherence (17). Various studies have shown that this integrated therapy improves clinical indicators and outcomes in challenging medical situations (21). According to Darwish et al. combined treatment of depression and diabetes will be effective when the intervention is presented in the form of a cohesive and integrated approach that can address and treat both problems together. In addition to drugs, non-pharmacological interventions such as cognitive-behavioral therapy and motivational client-centered techniques can be helpful (10).

2. Objectives

Given the importance of medications and blood sugar control in diabetic patients and the sensitivity of associated depressive symptoms to psychological interventions, this study aimed to examine the effect of cognitive-behavioral training combined with motivational interviewing on treatment adherence and HbA1c in patients with diabetes and depressive symptoms.

3. Methods

This study was a randomized clinical trial approved with the code IRCT20160924029954N14 and was conducted on 90 patients with type 2 diabetes and depression in the diabetes clinic of Khatam Al-Anbia hospital and Bu Ali hospital affiliated to Zahedan university of medical sciences in Iran in 2021. The patients who met the inclusion

criteria were identified and were placed into two groups (cognitive-behavioral training intervention and cognitive-behavioral education intervention with motivational interviewing), each with 45 members using the random allocation rule. The inclusion criteria were type 2 diabetes diagnosed based on the patients' medical records, HbA1c of 8 or higher, the age range of 20 - 60 years, a score of at least 21 on the Beck Depression Inventory, confirmation of depression by a clinical psychologist based on the mental status examination, having no other psychiatric disorders, suffering from the disease for six months to one year, having no communication problems, and having no addiction and substance abuse. Furthermore, the critical condition of the disease, hospitalization, not attending more than one treatment session, and not doing assignments were some of the most important exclusion criteria.

Following a study by Vala et al. and taking a 95% confidence interval and 95% test power, the sample size was estimated as 25 persons in each group using the following formula (22).

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 \left(S_1^2 + S_1^2\right)}{\left(\bar{X}_1 - \bar{X}_2\right)^2} = 24.56$$

$Z_{1-\frac{\alpha}{2}} = 1.96$, $S_1 = 4.04$, $\bar{X}_1 = 15.83$, $Z_{1-\beta} = 1.64$, $S_2 = 5.00$ and $\bar{X}_2 = 20.50$.

To ensure the adequacy of the sample size, 45 patients were selected in each group (90 patients in total).

The instrument used to collect the data were a demographic information form, the Medication Adherence Scale (MMAS-8-Item), and the Beck Depression Inventory (BDI). The demographic information form was used to record the patients' HbA1c, age, sex, education, marital status, occupation, duration of illness, and family history of the disease.

The Medication Adherence Scale (MMAS-8-Item) was developed by Morisky et al. to assess medication adherence in patients with hypertension. After being revised by specialists and developers, this tool is widely used to measure medication adherence in various diseases. This tool contains eight items, of which seven items are socred yes = 0 or no = 1, and one item is scored based on a five-point Likert scale ranging from 0 to 4 (never / rarely / sometimes / often / always). The total score on this scale ranges from 0 to 11. A higher score indicates higher medication adherence. A score greater than 6 shows desirable medication adherence (23). In a study conducted in Iran, Ghanei Gheshlagh et al. administered the scale to patients with type 2 diabetes and confirmed its validity using the criterion validity method and its reliability using Cronbach's alpha (0.72) (24).

The Beck Depression Inventory (BDI) was also used to screen for depressive symptoms in patients with diabetes in this study. The inventory was developed by Aaron Beck et al. in the early 1960s to assess the severity of depression with an emphasis on the cognitive and behavioral dimensions of depression. The inventory contains 10 self-report items, each with four options (scored 0 to 3), to examine the growing severity of depression. The minimum and maximum scores in the inventory are 0 and 63, respectively. The cutoff point on this tool is 21, and it measures the physical, behavioral, and cognitive symptoms of depression. Each respondent's score is obtained directly by adding the scores of individual items. The validity and reliability of this tool have been assessed and confirmed in several studies in Iran (25, 26). The reliability of the instrument in the present study was evaluated and confirmed with Cronbach's alpha of 0.88. Both of the above questionnaires were completed by the participants as self-report tools.

After obtaining permission under code IR.ZAUMS.REC.1399.190 from the ethics committee and an introduction letter from the Vice-Chancellory for Research and Technology, the researcher referred to the Diabetes Clinic of Zahedan University of Medical Sciences. After making arrangements with the physician in charge of the clinic, the sampling procedure began. The participants were selected using convenience sampling from patients with a diagnosis of type 2 diabetes who met the inclusion criteria. If meeting other inclusion criteria including HbA1c above 8 (based on clinical laboratory test results using the Diazyme laboratory kit, Germany), the patients with a cutoff point above 21 were identified using the Beck Depression Inventory, and then those with depression symptoms confirmed using the mental status examination (MSE) applied by a clinical psychologist were included in the research sample. The type 2 diabetes patients with depression were then randomly assigned to two groups: Cognitive-behavioral training only and cognitive-behavioral training plus motivational interviewing. To this end, 90 colored balls (45 white balls for cognitive-behavioral training and 45 red balls for cognitive-behavioral training with motivational interview) were randomly taken out of a container, and the group membership number was recorded on a list based on the color of the selected ball. Afterward, the researcher attended the clinic and assigned the selected patients to either the control or intervention group based on their membership numbers. Referring to the research envi-

ronment and selecting eligible patients, gradually and in order of the prepared list, the membership of each patient was determined in the order of inclusion in the study, and the relevant intervention was performed for him/her.

The patients who were assigned to the cognitive-behavioral training group with motivational interviewing completed the questionnaires and then attended the eight-session cognitive-behavioral training and face-to-face motivational interviewing for three weeks with the help of audio-visual equipment in one of the clinic's rooms after determining the time and place upon the patients' agreement. Each training session lasted 90 to 100 minutes, with the content detailed in Tables 1 and 2. After taking the motivational interviews, the patients attended the cognitive-behavioral training sessions. The questionnaires were again completed by the participants 12 weeks after the intervention in the clinic or at their homes. The patients in the cognitive-behavioral education group also took the pretest and then attended four face-to-face cognitive-behavioral intervention sessions (two sessions per week) using audio-visual equipment with the content displayed in Table 1. Similar to the previous group, 12 weeks after the intervention, the participants again completed the questionnaire in the clinic or at home. The questionnaires were completed by the patients in both groups before and after the intervention with the help of a researcher who did not know the type of intervention performed for the patients. It should be noted that the HbA1c level was measured for the patients in both groups both before and after the intervention in a laboratory using a German-made Diazyme diagnostic kit.

The effectiveness of cognitive-behavioral training intervention for Iranian diabetic patients has been addressed in previous studies (16). Besides, the initial content of the motivational interviewing sessions was developed following Fields' model (2006) and revised in line with previous studies in the literature. This group motivational interviewing format has been assessed and used many times in Iran by various authors (27-29). Both cognitive-behavioral and motivational interviewing interventions were provided to the patients by the main researcher, who held a master's degree in psychiatric nursing under the supervision of the co-author who held a Ph.D. degree in counseling.

The collected data were coded and then analyzed by SPSS-22 software. The normality of the data was assessed according to the sample size in each group using the Shapiro-Wilk test. The paired-samples *t*-test was used to compare the mean scores in each group before and after the intervention. The independent samples *t*-test was run to examine intergroup differences, and the chi-square test was used to compare the frequencies of the qualitative variables between the two groups. Moreover, analysis of covariance was used to examine the effectiveness of the interventions and also to control the impact of the pretest and some intervening factors. All statistical analyses were performed at a significance level of 0.05 (P = 0.05).

4. Results

The age range of the patients in the intervention group was 23 to 58 years, and that of the control group was 24 to 59 years. The results of the independent samples *t*-test did not show any difference between the two groups in terms of the patients' age (P = 0.57). The duration of the disease ranged from seven to 98 months, but the independent samples *t*-test did not show any significant differences between the intervention and control groups in terms of the disease duration (P = 0.18). Moreover, the body mass index for the patients in the intervention group ranged from 20.10 to 35.96, and that of the patients in the control group ranged from 23.90 to 35.30, and the results of the independent samples *t*-test did not show any significant intergroup difference (P = 0.96). An analysis of the patients' demographic variables using the chi-square test (Table 3) indicated that there was no significant difference between the two groups in terms of occupation, gender, education, marital status, and type of medication (0.05 < P).

The results of the study concerning the effect of the training interventions (Table 4) showed that the HbA1c levels were not significantly different (P = 0.49) before the intervention between the group receiving cognitive-behavioral training plus motivational interviewing (10.03 $\pm$ 1.13) and the group receiving cognitive-behavioral training (10.21 $\pm$ 1.36). However, HbA1c was significantly lower (P = 0.001) in the participants in the group receiving cognitive-behavioral training plus motivational interviewing (8.42 $\pm$ 0.69) than in patients in the group receiving cognitive-behavioral training (9.47 $\pm$ 1.28). There was also a significant difference in the mean difference of HbA1c between the two groups (P = 0.001). As shown in Table 5, the results of analysis of covariance (ANCOVA), by establishing the assumptions of this test to control the significant effect of pretest scores, showed that the HbA1c levels in patients in the two groups were significantly different after the intervention (P = 0.002).

Furthermore, the mean score of medication adherence significantly increased from 4.78 $\pm$ 1.12 to 5.54 $\pm$ 1.05 (P = 0.001) in patients in the group receiving cognitive-behavioral training with motivational interviewing and from 4.18 $\pm$ 1.32 to 4.87 $\pm$ 1.01 in the group receiving cognitive-behavioral training after the intervention (P =

Table 1. The Content of Cognitive-behavioral Training

Session	Description
1	Raising the patients' awareness of the impact of emotions on diabetes; Discovering the relationship between emotions, thoughts, and behavior; Identifying and challenging negative thoughts; Inducing effective thoughts to change emotions
2	Discussing the impact of stress on diabetes; Introducing stress management techniques; Introducing muscular relaxation exercises
3	Introducing complications of diabetes; Diagnosing stress and anxiety; Challenging anxious thoughts associated with the future
4	Discussing the impact of social relations on diabetes; Discussing the role of irrational thoughts on social relations; Introducing the role of social support in promoting self-care behaviors

Table 2. The Content of the Motivational Interviewing Intervention

Session	Description
1	Focusing on stages of behavior change; Practicing behavior change to change oneself
2	Discussing the quantity and quality of self-care behaviors; Increasing the patients' awareness of complications of the failure to engage in self-care behaviors
3	Identifying values and the conflict between values and poor self-care; Identifying positive and negative aspects of self-care behaviors
4	Discussing factors underlying obsessive-compulsive disorder; Identifying obsessive situations; Coping with obsessive situations; Determining goals, prospects, and plans

0.01). Given the significant difference in the medication adherence scores between the two groups before the intervention and also the lack of significant mean differences in the medication adherence scores between the two groups (P = 0.75), the result of analysis of covariance, by establishing the assumptions of this test to control the significant effect of pretest scores, showed that the mean scores of medication adherence by the patients in the two groups were significantly different after the intervention (P = 0.002).

5. Discussion

The results of the present study showed that cognitive-behavioral training combined with motivational interviewing was more effective than cognitive-behavioral training alone in improving medication adherence and also reducing HbA1c levels in patients with diabetes and depressive symptoms. However, it was shown that cognitive-behavioral training could, in turn, have a positive and significant effect on increasing medication adherence and reducing HbA1c levels in patients with diabetes and depressive symptoms.

Some studies have also confirmed the effectiveness of cognitive-behavioral training in medication adherence and reduction of HbA1c levels. Empirical evidence shows that improving the psychological condition of patients with diabetes can lead to positive treatment outcomes. Accordingly, Vala et al. showed that a mindfulness-based stress reduction program significantly reduced the level of HbA1c in patients (22). In contrast, Barzegar Damadi et al. showed that group cognitive-behavioral therapy, despite improving the psychological status of patients with diabetes with depressive symptoms, did not have a positive and significant effect on reducing HbA1c (30). The time-consuming nature of behavioral changes and subsequent decrease in HbA1c levels following the relief of depressive symptoms and the effect of HbA1c on more important variables such as medication adherence and physical activity may be the reasons for the ineffectiveness of cognitive-behavioral therapy in this study. Furthermore, Spoelstra et al. showed that cognitive-behavioral therapy alone did not make a significant difference in increasing medication adherence in patients with chronic diseases (31). The possible reason for the ineffectiveness of cognitive-behavioral training could be attributed to the research population that included patients with a life-threatening disease, ie, cancer, who underwent chemotherapy.

On the other hand, studies addressing the effectiveness of motivational interviewing without using other psychological therapies showed different results for the improvement of the mental condition and treatment indicators of patients with type 2 diabetes. A study showed that 30-min motivational interview sessions were able to significantly reduce the patients' HbA1c levels after the intervention while reducing the severity of depression and anxiety symptoms and increasing treatment satisfaction (32). Concerning the effectiveness of motivational interviewing, even some studies showed that the HbA1c level in the group receiving the motivational interviewing intervention was lower than that in the group receiving cognitive-behavioral training (16). However, in the present study, the patients with diabetes also suffered from depressive symptoms. Chen et al. found that the motivational interviewing

Table 3. Demographic Characteristics of Patients in the Cognitive-behavioral Group and Cognitive-behavioral with Motivational Interviewing Group

Variable	Cognitive-behavioral with MI, No. (%)	Cognitive-behavioral, No. (%)	P-Value
Gender			0.1[a]
Female	23 (51.1)	23 (51.1)	
Male	22 (48.9)	22 (48.9)	
Total	45 (100)	45 (100)	
Occupation			0.56
Employed	39 (86.7)	37 (82.2)	
Unemployed	6 (13.3)	8 (18.8)	
Total	45 (100)	45 (100)	
Marital Status			0.51
Single	15 (33.3)	18 (40)	
Married	30 (66.7)	27 (60)	
Total	45 (100)	45 (100)	
Drug			0.83
Oral	25 (55.6)	24 (53.3)	
Injection	20 (44.4)	21 (46.7)	
Total	45 (100)	45 (100)	
Education			0.53
Lower than diploma	12 (26.7)	11 (24.4)	
Diploma	15 (33.3)	11 (24.4)	
Higher than Diploma	18 (40)	23 (51.2)	
Total	45 (100)	45 (100)	
Age (y) [b]	44.56 ± 10.98	43.20 ± 12.02	0.57 [c]
Duration (mo) [b]	46.73 ± 30.48	40.47 ± 27.08	0.18
BMI [b]	31.04 ± 3.78	31.07 ± 2.94	0.96

[a] Chi-square test.
[b] Values are expressed as mean ± SD.
[c] Independent *t*-test.

Table 4. Hemoglobin A1C and Drug Adherence Scores of Patients in Cognitive-behavioral Group and Cognitive-behavioral with Motivational Interviewing Group Before and After the Intervention [a]

Variable	Before	After	Change	Paired *t*-test (Before-After)
Hemoglobin A1C level				
Cognitive-behavioral with MI	10.03 ± 1.13	8.42 ± 0.69	-1.60 ± 0.85	0.001
Cognitive-behavioral	10.21 ± 1.36	9.47 ± 1.28	-0.74 ± 0.99	0.001
Independent t-test	0.49	0.001	0.001	
Drug adherence score				
Cognitive-behavioral with MI	4.78 ± 1.12	5.54 ± 1.05	0.75 ± 0.93	0.001
Cognitive-behavioral	4.18 ± 1.32	4.87 ± 1.01	0.67 ± 1.06	0.01
Independent t-test	0.003	0.01	0.75	

[a] **Values are expressed as mean ± SD**

Table 5. The Results of Analysis of Covariance for the Effect of the Intervention on Patients' HbA1c and Medication Adherence

Source	Sum of Squares	df	Mean Square	F	Sig.	Effect Size	Power
Pretest (HbA1c)	44.37	1	44.37	78.14	0.001	0.47	1
Group	20.07	1	20.07	35.35	0.001	0.28	1
Error	49.40	87	0.56				
Total	7329.54	90					
Pretest (adherence)	36.68	1	36.68	68.69	0.001	0.43	1
Group	5.32	1	5.32	9.88	0.002	0.1	0.87
Error	46.86	87	0.53				
Total	1418	90					

group had a significant improvement in self-management, self-efficacy, HbA1c, and quality of life, but motivational interviewing did not have a significant positive effect on psychological status and reduction of anxiety, stress, and depression in these patients (13). Accordingly, it can be argued that it is not yet possible to demonstrate the effectiveness of cognitive-behavioral therapy in the treatment indicators of chronic diseases without the use of other motivational methods.

In contrast, a study on lifestyle-centered client counseling using the principles of motivational interviewing integrated into the structured diabetes program showed that the use of motivational interviewing principles in the care plan of patients with diabetes did not affect the treatment and care indicators of these patients, including HbA1c (33). Welch et al. showed that the use of motivational interviewing along with routine self-management training was less effective than diabetes training alone in lowering blood sugar in uncontrolled diabetic patients. They concluded that there was no strong empirical evidence to use motivational interviewing to better control the blood sugar of diabetic patients (34).

In line with the findings of the present study that confirmed the significant effectiveness of motivational interviewing and cognitive-behavioral training, several studies have demonstrated the effectiveness of integrated cognitive-behavioral intervention with motivational interviewing in different areas of health-related behaviors. As various studies show, this integrated therapy method is able to improve clinical indicators and outcomes in challenging situations such as reducing methamphetamine use and increasing medication adherence in HIV patients (35), postoperative weight loss (36), physical activity, and anthropometric indices in people without physical mobility (37) and reduction of anxiety following traumatic brain injury (38). A meta-analysis study conducted by Spoelstra et al. showed that integrated motivational interviewing and cognitive-behavioral therapy is an effective way to induce change and improve medication adherence in challenging clinical situations (17). In one study, the HbA1c level in patients with type 1 diabetes receiving motivational interviewing and cognitive-behavioral therapy was significantly lower than that in patients receiving routine care, and the patients were more successful in controlling their blood sugar while adhering more to self-management (21). Spoelstra argued that the main obstacle to increasing medication adherence is the lack of motivation, so it is necessary to add a motivational approach such as motivational interviewing to promote mediation adherence behavior. Interventions focusing on therapeutic factors such as motivation, self-efficacy, emotions, and beliefs using an integrated approach such as motivational interviewing and cognitive-behavioral therapy may increase patients' medication adherence (31). The positive effect of motivational interviewing and cognitive-behavioral training on increasing medication adherence and decreasing HbA1c in patients with diabetes and depression observed in the present study could be attributed to the fact that increasing medication adherence in patients as a primary outcome of therapeutic intervention secondarily reduced HbA1c in patients.

Overall, studies on patients with diabetes have shown that each of the cognitive-behavioral therapy and motivational interviewing alone compared to routine diabetes education is somewhat effective in improving medication adherence and reducing HbA1c levels. The patients in the present study had depression symptoms in addition to diabetes. This made the task of changing behavior a little more difficult. The results of the present study indicated that the combination of motivational interviewing and cognitive-behavioral therapy led to further behavioral changes that helped reduce patients' blood sugar levels. Accordingly, Rollnick et al. argued that using motivational interviewing as an introductory treatment to

increase readiness for change can increase the effectiveness of other subsequent therapies, including cognitive-behavioral therapy (39).

Although the present study showed that both intervention techniques led to a significant decrease in HbA1c levels in patients after training, HbA1c (8.42 and 9.47) was not still within the normal range. Experts believe that achieving normal blood sugar in diabetics, especially if it is associated with depressive symptoms, is not a realistic goal, but it is very valuable to try to control blood sugar within a normal range, as improving HbA1c in patients can delay the onset and progression of vascular complications (16).

The absence of a control group and the impossibility of monitoring the retention of the positive effects of the interventions were some limitations of the present study.

5.1. Conclusions

The present study showed that motivational interviewing combined with cognitive-behavioral training was more effective than cognitive-behavioral training alone in improving the blood glucose index of diabetic patients with depressive symptoms. Thus, this integrated approach can further improve medication adherence and reduce HbA1c levels. Given that depression is associated with poor self-care behaviors in diabetic patients, patients should be screened for depressive symptoms. Moreover, in addition to integrating psychological components, motivational interviewing principles can be used to promote medication adherence behavior and ultimately reduce blood sugar levels.

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Footnotes

Authors' Contribution: All authors discussed the results and contributed to the final manuscript.

Conflict of Interests: The authors did not declare any conflict of interest.

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