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Effectiveness of cognitive-behavioral therapy in diabetes self-management and HbA1C level in patients with type 2 diabetes

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Abstract

Background: Self-care activities exert a dramatic impact on the physical and mental performance of diabetic patients.

Objective: The present study aimed to determine the effectiveness of cognitive-behavioral therapy in diabetes self-management and HbA1C level in type 2 diabetes patients.

Methods: A multi-group pretest-posttest control group design was used in this quasi-experimental investigation. The statistical population of the study consisted of 25-55 years old diabetic patients referred to one of the health centers in Ghaemshahr in 2020, among whom 30 subjects were selected by purposeful sampling method and assigned to two groups of cognitive-behavioral therapy (n=15) and control group (n=15). Data were obtained using Tobert and Glasgow Diabetes Self-Management Questionnaire (2002), and glycosylated hemoglobin test (HbA1c). Data were analyzed in SPSS software (version 22) using repeated measure analysis of variance.

Results: The results demonstrated that the cognitive-behavioral group had a significant effect on diabetes self-management and hypoglycemia (P<0.001). Moreover, the effectiveness of cognitive-behavioral therapy in diabetes self-management and HbA1C levels in patients with type 2 diabetes remained stable three months after the intervention.

Conclusion: As evidenced by the obtained results, the effective of cognitive-behavioral therapy in diabetes self-management and HbA1C levels in patients with type 2 diabetes has been confirmed.

Keywords: Cognitive-behavioral therapy, Diabetes, Diabetes self-management, HbA1C

Introduction

Today, developing countries are all experiencing an epidemic of diabetes, especially type 2 diabetes. The prevalence of this disease in most countries is still rising non-stop. In addition, due to high blood sugar in the years before diagnosis, the patient may develop diabetes complications which are more common in old age. The sum of these factors affects the patient's condition (1). Among the important therapeutic goals in diabetic patients is metabolic control, as well as the evaluation of care and treatment in them. The goal of treatment is to lower blood sugar levels to optimal levels and improve the quality of life in elderly patients with diabetes (2). At present, the management of blood sugar in diabetes is of utmost importance since it prevents acute and long-term complications (3). So far, apart from drug treatment, many solutions have been offered for the control of blood sugar. Many studies have demonstrated the positive effect of various interventions on the control of diabetes (4).

These issues confirm the need to provide appropriate treatment facilities in the field of optimal control of diabetes. Today, most experts consider the basic principles of diabetes treatment to be the use of diet, physical activities, and medication. Regular physical activity significantly reduces glycosylated hemoglobin, hyperlipidemia, and the risk factors for heart disease; moreover, it brings considerable psychological benefits to the patient. Until a few years ago, infectious diseases were the major health problem in Third World countries, while today, chronic diseases, such as diabetes, pose a serious threat to developing countries. It is a hypothetical condition that requires daily blood sugar monitoring, frequent injections, regular visits to medical staff, detailed exercise, and a diet plan to achieve satisfactory control. There is no definitive cure for this disease and prevention is the most effective treatment. Acute and chronic complications can be prevented or delayed by timely identification and proper care based on patient education (5).

Type 2 diabetes is a chronic and complex disease that requires ongoing medical care. This disease is very much related to lifestyle, and its complications have a negative effect on the quality of life of patients (6). The progression of complications and high treatment costs of this disease is mainly due to inadequate control of glycosylated hemoglobin (7). Therefore, the first goal in the treatment of diabetes

is to control blood glucose levels, which is considered the most reliable metabolic indicator of diabetes. Accordingly, the improvement of glycosylated hemoglobin to prevent disease complications, such as micro complications is important.

The achievement of the right level of glycosylated hemoglobin, on the other hand, requires daily care and self-care activities. Among these, diabetes self-care activities are the essential first step in empowering the patient, requiring attention to diet, physical activity, blood sugar monitoring, and compliance to the prescribed medications (8). Today, multiple studies have indicated that controlling blood sugar and managing diabetes is not possible without self-care activities (9). Although self-care education is very important in diabetes, it must be practiced to be beneficial. Failure to do so can lead to a fourfold increase in subsequent complications which affect the patient's psychological adjustment. The main goal of all diabetes treatment measures is the reduction of its dangerous side effects and control of blood sugar (10).

One of the factors which prevent and delay the acute complications of diabetes is its timely identification and teaching proper self-care to control the disease and prevent its progression (11). Diabetes, as a chronic disease, requires a self-management approach (12); therefore, one of the important components concerning diabetic patients is self-management which is an active and operational process led by the patient him/herself. Diabetes self-management is defined as a set of behaviors performed by diabetic patients to achieve diabetes control in their daily lives (13). The management of blood sugar in diabetes is of paramount importance since it prevents acute and long-term complications.

Averaging the amount of glycosylated hemoglobin measured and used is now thought to be a good predictor of diabetes complications (14). Self-management which is an active and practical process led by the patient consists of specific activities to achieve disease management goals. Its purpose is to control blood sugar, prevent acute and chronic complications, and improve diabetic patients' quality of life. In general, self-management is an important way to maintain and improve a patient's behaviors and health status by encouraging the patient to actively participate in self-care. Furthermore, it increases responsibility for controlling symptoms and complications, assists people in achieving high levels of independence, and improves work efficiency (15).

Various therapeutic methods, including cognitive-behavioral therapy, have been used in psychology to improve self-management strategies in type 2 diabetic patients (16). Cognitive-behavioral therapy (CBT) is a type of psychotherapy that assists patients in understanding the thoughts and feelings that influence their behavior (16). Beck believes that therapists can assist people in rebuilding their minds in order to cope better with stress. In fact, the patient is encouraged in this therapeutic approach to consider the relationship between negative thoughts and feelings of depression as hypotheses to be tested and to use behaviors that result in negative thoughts as a criterion for assessing the validity or correctness of those thoughts (17). The term cognitive-behavioral education emphasizes the importance of thought processes, as well as environmental influences. Cognitive-behavioral therapy combines cognitive and behavioral techniques (18).

This type of treatment assists the patient in identifying distorted thinking patterns and dysfunctional behaviors, and it employs regular discussions and structured behavioral tasks to assist people in changing these distorted and dysfunctional thoughts (18). Hallajian (18) and Ismaili et al. (19) confirmed the effectiveness of cognitive-behavioral education in type 2 diabetic patients' blood sugar and depression control, as well as lifestyle enhancement.

The dearth of practical studies and therapeutic interventions in the field of psychological treatment of diabetes in Iran highlights the necessity of the present study in the field of health psychology in Iranian society with diabetes. In this regard, psychosocial factors affecting proper control of blood sugar play a major role in the psychological treatment of patients, increasing self-care behaviors, preventing disease complications, and improving the patient's quality of life. Moreover, the identification of the factors affecting the success and failure of the diabetes control and treatment process enables the treatment team to develop more effective interventions to help patients and their families.

Objective

The current study sought to ascertain the efficacy of cognitive-behavioral therapy in diabetes self-management and HbA1C levels in type 2 diabetes patients.

Methods

A multi-group pretest-posttest control group design was used in this quasi-experimental investigation. The current study's statistical population included 320 diabetic patients aged 25 to 55 years who were referred to one of Ghaemshahr's health centers in 2020. Based on similar studies, the sample size was calculated at 30 cases with an effect size of 0.40, a confidence level of 0.95, a test power of 0.80, and a loss rate of 10% using G-power software. Therefore, 30 patients were selected via the convenience sampling method to participate in the study and assigned to two groups of experimental and control (n=15 in each group). The inclusion criteria were as follows: at least one year of type 2 diabetes based on the physician’s approval,

hemoglobin A1c level above 6%, the age range of 25-55 years, a minimum education of diploma, average socioeconomic status, no other psychological treatment, absence of any skeletal diseases, as well as heart and respiratory failure that cause problems in and use of dialysis, etc.) leading to hospitalization. On the other hand, absence from more than two sessions in treatment sessions and the occurrence of major stressors due to unforeseen events were considered exclusion criteria. At the end of the sessions and in the final session, all participants completed the research questionnaires again and the research questionnaires were administered three months after the end of the training course.

Diabetes Self-Management Questionnaire

The Diabetes Self-Management Questionnaire was developed by Tobert and Glasgow in 2002 to assess the self-management of diabetic patients. This 15-item self-report questionnaire examines patients' self-care criteria over the previous seven days, including general and diabetes-specific diet (5 questions), exercise (2 questions), blood sugar test (2 questions), insulin injection or anti-diabetic pill (1 question), foot care (4 questions), and smoking (1 question) (Tobert et al., 2000). Except for the smoking behavior, which has a score of zero to one on this scale, each behavior is assigned a score of 0-7, and an overall compliance score is obtained by adding the scores of each question. The total score blood sampling and attending meetings, absence of severe mental illnesses, such as psychotic disorders and sensory disturbances, non-use of psychotropic drugs or current substance abuse, lack of severe complications of diabetes (such as renal failure ranges from 0-99. In the study by Hamadzadeh et al. (20), the content validity of the questionnaire was obtained at 84.9 by eight professors and its reliability was calculated at 0.78 by Cronbach's alpha method. Hamadzadeh et al. (20) administered a diabetes self-care questionnaire (summary of diabetes self-care activities) to 275 patients with diabetes in Taleghani Hospital in Tehran. Daily blood glucose measurements were performed by the instructor at the end of treatment sessions with a blood glucose tester and by a person in the control group.

Glycosylated Hemoglobin Test (E.NCC) (HbA1c) This is the standard method for assessing and controlling long-term blood sugar. As plasma glucose levels rose, the non-enzymatic binding of glucose to this hemoglobin increased. Because erythrocytes have a 120-day lifespan, this change represents how the blood glucose level has changed over the last 2-3 months (21). As a result, a drop in HbA1c was linked to the success of blood sugar treatment and control. The descriptions of each session of cognitive-behavioral therapy are presented in Table 1.

Table 1 – The Protocol of Cognitive-behavioral therapy

Session	Content
First	The value and aim of cognitive-behavioral therapy, as well as the difficulties of clients, were formulated in the form of a cognitive-behavioral approach in this session after getting acquainted and building a good relationship.
Second	In everyday life, behavioral mastery was taught and exercises were given.
Third	Working to address the root reasons of the incident, including allowing kids to consider why they are being harassed. What ties things together? Demonstrate your worth by completing tasks and prioritizing them.
Fourth	Emotional signals were taught, including how to think, feel, and record thoughts.
Fifth	Fighting negative ideas, thinking skills, and focusing on cognitive errors, incorporating evidence and looking at things from a different perspective (if so, what could go wrong?)
Sixth	Finding negative self-talk and training to replace it with positive self-talk were examples of negative self-talk.
Seventh	Allow yourself to let go of negative thoughts by taking notes, continuing to document your thoughts, and developing problem-solving abilities.
Eighth	Finding your own views, prior teachings, questioning beliefs, and making them plain were all part of changing and correcting misconceptions.
Ninth	Willingness to finish the training and replace negative feelings with positive ones.
Tenth	The progress of the subjects and the usage of alternative tactics were addressed, and then the prior sessions' contents were quickly revisited and the learned strategies were practiced.

The mean and standard deviation were used in the descriptive statistics section. The repeated measure analysis of variance was used to perform inferential statistics in SPSS software (version 22).

Results

Participants in this study ranged in age from 29 to 44 years. In terms of gender, 43.56% of cases were male, while 56.44% were female. The mean ages of participants in the CBT and control groups were

41.79±7.73 and 40.86±8.71, respectively (P>0.05). The mean and standard deviation of research variables in the experimental and control groups are displayed in Table 1.

Table 2. The mean and standard deviation of research variables in experimental and control

Variable	Group	Pre-test		Post-test		Follow-up	
		M	SD	M	SD	M	SD
Diabetes self-Management	CBT	44.82	6.72	49.55	7.93	49.83	7.74
	Control	44.33	6.24	45.16	6.21	45.16	6.31
Blood sugar (HbA1c)	CBT	7.22	1.09	6.68	1.01	6.64	1.02
	Control	7.16	0.84	7.11	0.85	7.11	0.84

The Shapiro-Wilkes test results showed that the distribution of data related to research hypotheses was normal and the assumption of normal data was met. The Mauchly sphericity test results showed that it was also significant for the self-management variable of diabetes, indicating that the assumption of the equality of variances within subjects (sphericity hypothesis) was not observed (Mauchly's W=0.19; df = 2; P<0.001). As a result, the Greenhouse Geiser test was applied to assess the univariate test results for intragroup effects and interactions. All tests have a significance level of 0.0001, indicating that the mean of the tests in terms of the effectiveness of cognitive-behavioral therapy in improving diabetes self-management was significantly different. The Lambda Wilkes test, with a value of 0.48 and F=15.42, revealed a significant difference between the experimental and control groups in the effectiveness of cognitive-behavioral therapy in the improvement of diabetes self-management at a significant level of 0.0001.

Table 3. Repeated measure analysis of variance to compare variables in experimental and control groups

Variables	Source of effect	SS	Df	MS	F	P-value	Eta square
Diabetes self-management	Time	119.13	1.10	172.27	58.44	0.001	0.63
	Time*group	95.01	1.10	85.64	29.05	0.001	0.46
	Group	277.12	1	277.12	11.98	0.001	0.22
Blood sugar (HbA1c)	Time	2.24	1.03	2.17	8.37	0.006	0.19
	Time*group	1.54	1.03	1.49	5.75	0.025	0.14
	Group	54.13	1	54.13	6.86	0.031	0.18

Table 3 shows that analysis of variance is significant for both within-subject (time) and between-subject factors. These findings indicate that, when the effect of the group is taken into account, the effect of time alone is significant. Furthermore, the interaction of group and time is significant, with a 0.46 effect. To compare pairs in groups, the Bonferroni post hoc test was also used.

Table 4. Results of Bonferroni post hoc test for comparison of diabetes self-management

Variable	Group		Post-test	Follow-up
Diabetes self-management	CBT	Pre-test	-4.67*	-4.95*
		Post-test	-	-0.28
	Control	Pre-test	-0.83	-0.70
		Post-test	-	0.17
Blood sugar (HbA1c)	CBT	Pre-test	0.54*	0.58*
		Post-test	-	0.04
	Control	Pre-test	0.01	0.01
		Post-test	-	0.03

The results illustrated in Table 4 indicate that the mean of diabetes self-management in the experimental group in the post-test stage was higher than that in the control group. These results also suggest that diabetes self-management in the follow-up phase in the cognitive-behavioral therapy group remained stable, as compared to that in the control group.

Discussion

As evidenced by the obtained results, cognitive-behavioral therapy was effective in diabetes self-

management in people with type 2 diabetes. The results of this study are in agreement with those reported by Guicciardi et.al (22), Arafat et al. (6), Pan et.al (23), and Yang et al. (24). It can be concluded that people with type 2 diabetes have a high risk of acute (such as hypoglycemia and diabetic ketoacidosis) and chronic complications (such as cardiovascular disease, kidney disease, blindness, and amputation independent of physical injury to the extremities); moreover, drug therapy does not improve the disease. Therefore, more than 95% of the recovery process is performed by the patient through individual care and requires special self-management behaviors for the rest of his/her life (23).

Specific beliefs about the disease lead to maladaptive coping strategies that exacerbate psychosomatic symptoms, as well as the resulting suffering and disability. Cognitive-behavioral group therapy first provides patients with the opportunity to freely and fearlessly express their dysfunctional thoughts, beliefs, and cognitive distortions; thereafter, it examines and corrects thoughts, underlying beliefs, and cognitive distortions (24).

Cognitive reconstruction uses rational reasoning to test the content of their anxious thoughts in the face of the reality of their life experiences and the flow of their anxious thoughts. That is, they test the probability of the occurrence of something they are worried about (25). Therefore, cognitive evaluation of events will be a response to the events of the past and a prelude to changing cognitive activity. Cognitive-behavioral education has an effective role in creating or changing cognition and attitude in people.

Therefore, cognitive-behavioral education to patients which is effective in improving patients' self-management depends on their ability to convey their thoughts, feelings, needs, and wants clearly, correctly, and effectively. According to the cognitive-behavioral model, negative cognitions and attitudes about disease control reduce self-management in individuals. Negative thoughts, such as diabetes is out of my control, evoke negative feelings, such as annoyance and anger, that lead to uncompromising health-related behaviors in the person (26).

The effectiveness of cognitive-behavioral therapy in HbA1C levels in diabetes patients has been confirmed. This finding is consistent with those obtained by Wang, Xia, Zhao, and Chen (27). This finding can be justified on the ground that cognitive-behavioral therapy helps patients to replace irrational behaviors, feelings, attitudes, beliefs, and irregular behaviors with realism, a sense of efficiency, and increased activity (28). Cognitive-behavioral interventions help patients with type 2 diabetes recover during or after treatment, and behavioral interventions play a major role in optimizing the immune system during a vulnerable period. In group cognitive-behavioral therapy sessions, changes in maladaptive ways of thinking and feeling enable patients to pay attention, reinterpret pain, ignore pain, and talk to themselves. In behavioral practices, patients learn to increase activity. Some methods, such as modeling, gaining successful experiences, and social reinforcement, are commonly used in HbA1C cognitive-behavioral programs (29). It is therefore acceptable that HbA1C levels in people with type 2 diabetes improve as a result of cognitive-behavioral therapy.

The research design was quasi-experimental; therefore, it did not provide the benefits of real experimental designs. The role of interfering and disturbing variables, such as supportive roles of family and friends and the severity of the disease, were not investigated due to sampling limitations. Prolonged follow-up of patients can lead to more complete findings in terms of the impact on diabetes self-management and HbA1C levels. Nonetheless, in this study, time and space limitations did not allow longer follow-up. Moreover, in future investigations, it is suggested that researchers use a specialist as a therapist to reduce the possibility of bias. According to the findings of the present study, mental health professionals and people working in the field of health can be advised to increase the mental health of patients with type 2 diabetes by designing and applying appropriate methods inspired by cognitive-behavioral therapy.

Conclusion

According to the findings of this study, cognitive-behavioral treatment was beneficial in improving diabetes self-management and HbA1C levels in patients with type 2 diabetes.

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Conflicts of Interest

There are no conflicts of interest.

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