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The Effect of Mindfulness Therapy on Treatment Adherence, Self-Efficacy, and Emotion Regulation in Patients with Type 2 Diabetes

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A B S T R A C T

Objective: This study aims to investigate the effect of mindfulness therapy on treatment adherence, self-efficacy, and emotion regulation in patients with type 2 diabetes.

Methods and Materials: This quasi-experimental study utilized a pretest-posttest follow-up design with a control group. Thirty patients with type 2 diabetes, referred to Sari medical centers, were selected through non-random convenience sampling and then randomly assigned to either the experimental group or the control group (15 participants each). Both groups completed measures of treatment adherence (Modanloo, 2013), self-efficacy (Sherer et al., 1982), and emotion dysregulation (Gratz & Roemer, 2004). The experimental group received 90-minute sessions of mindfulness therapy once a week for eight weeks, while the control group did not receive any intervention. Post-intervention assessments were conducted for both groups. Data were analyzed using covariance analysis and SPSS version 22 software.

Findings: The results indicated significant improvements in treatment adherence ($F=154.84$, $p<0.001$), self-efficacy ($F=59.45$, $p<0.001$), and emotion regulation ($F=144.42$, $p<0.001$) in patients with type 2 diabetes following mindfulness therapy.

Conclusion: Mindfulness therapy appears to enhance treatment adherence, self-efficacy, and emotion regulation in patients with type 2 diabetes.

Keywords: *Mindfulness Therapy, Type 2 Diabetes, Treatment Adherence, Self-Efficacy, Emotion Regulation.*

1. Introduction

Diabetes mellitus is characterized by chronic hyperglycemia and impaired metabolism of carbohydrates, proteins, and fats (Galicia-Garcia et al., 2020). It results from impaired insulin secretion, insulin action, or a combination of both (Lawrence et al., 2021). Long-term complications of diabetes are significant contributors to morbidity and mortality. The global prevalence of diabetes is increasing, imposing a substantial

economic burden (Elangwe et al., 2020). The two primary types of diabetes are type 1 diabetes (insulin-dependent) and type 2 diabetes (non-insulin-dependent). As of 2014, approximately 422 million people worldwide had diabetes, and this number is projected to rise to 645 million by 2040 (Lingvay et al., 2022).

According to the U.S. Centers for Disease Control and Prevention, 34.2 million people of all ages, or 10.5% of the total U.S. population, have diabetes (Cousin et al., 2022). In Iran, the prevalence of diabetes was about 7.7% in 2005, and it is projected to reach approximately 2.5 million cases by 2025 if current trends continue (Moshki et al., 2022). This disease is the leading cause of limb amputation, blindness, and chronic kidney failure, and it is a significant risk factor for heart disease (Butt, 2022). The Global Burden of Diseases, Injuries, and Risk Factors (GBD) study in 2017 reported that 1.37 million people die from diabetes annually worldwide. In Iran, the prevalence of diabetes increased by 63% from 2007 to 2017, making it one of the top ten causes of premature death and a major health problem and disability (Matin et al., 2019).

Diabetes is often associated with psychological problems and disorders, which reduce patients' ability to manage the disease effectively (Ngoatle et al., 2023). Proper diagnosis and medication prescription are crucial for managing type 2 diabetes, but so is adherence to treatment (Jannoo & Mamode Khan, 2019). Several factors influence treatment adherence, including psychological factors based on the biopsychosocial model and the integration of medical and psychological treatments, known as dominant models in health psychology. Factors such as the doctor-patient relationship, memory errors, locus of health control, metastasis, place of residence, age, and income of the patient are significant (Mogre et al., 2019). Empowerment programs that enhance critical thinking and skill development in patients and their caregivers have been reported to improve treatment adherence (Elangwe et al., 2020).

Type 2 diabetes and the associated psychological stress can lead to emotional disturbances (Coccaro et al., 2020). Individuals often blame themselves and others, engaging in rumination (Fatahi et al., 2021). Emotion regulation and the modification of emotional regulation strategies play a crucial role in adapting to stressful life events (Willem et al., 2019). Emotion regulation refers to the ability to understand emotions and moderate their experience and expression (Jones et al., 2023). Positive emotional experiences can improve responses to stressful situations and enhance social engagement (Motevalli et al., 2023). Deficits in emotion regulation are associated with endogenous disorders like anxiety and depression and exogenous disorders such as aggression and delinquency (Leukel et al., 2022). Focusing on positive emotion regulation strategies can improve understanding and management of emotions (Gratz & Roemer, 2004; Jones et al., 2023).

Mindfulness may positively impact the health of individuals with type 2 diabetes by enhancing self-efficacy (Zhang et al., 2023). Self-efficacy refers to an individual's belief in their skills and abilities to perform tasks successfully. It influences the level of effort and performance (Hamidi et al., 2022) and is a critical factor in long-term disease management. High self-efficacy is associated with improved adaptive abilities (Lara-Cinisomo et al., 2022). In behavioral science, self-efficacy is considered a key prerequisite for behavioral performance (Inverso et al., 2022). It affects motivation and the adoption of health-promoting behaviors (Zulkarnaini et al., 2022).

Mindfulness therapy is one approach to improving treatment adherence, self-efficacy, and emotion regulation in individuals with type 2 diabetes (Bai et al., 2022). The inability to remain present can distance individuals from reality, preventing them from accurately understanding situations and responding appropriately (Fisher et al., 2023). Mindfulness helps individuals perceive internal and external realities without distortion and enhances their ability to face a wide range of thoughts, emotions, and experiences (Bao, 2022). Mindfulness, with components such as acceptance, presence, and avoidance of rumination, aims to promote well-being and awareness (Weng et al., 2022). Unlike many psychotherapeutic approaches, mindfulness focuses on increasing awareness of processes underlying traumatic mindsets rather than creating ideological changes (Weng et al., 2022). As a lifestyle consistent with human nature, mindfulness can influence emotional systems, promoting a compassionate and realistic acceptance of oneself, others, and the world (Koerner & Rechenberg, 2022).

Mindfulness is defined as a state of heightened attention and awareness of the present moment, fostering qualities like non-judgment, intentional awareness, and present-moment focus (Saito & Kumano, 2022). As a therapeutic method, mindfulness aims to reduce avoidance and increase the tolerance of unpleasant bodily sensations, emotions, and thoughts (Saito & Kumano, 2022). Studies indicate that mindfulness therapy can reduce pain, anxiety, depression, and stress. Kabat-Zinn's (2015) research demonstrated that mindfulness techniques are effective in increasing muscle relaxation and reducing anxiety and stress (Kabat-Zinn,

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2015). Thus, the present study aims to investigate the effect of mindfulness therapy on treatment adherence, self-efficacy, and emotion regulation in individuals with type 2 diabetes.

2. Methods and Materials

2.1. Study Design and Participants

The present study employed a quasi-experimental design with pretest, posttest, and follow-up assessments, including a control group. The statistical population comprised all patients aged 40 to 55 years with type 2 diabetes, confirmed through clinical and laboratory examinations. Thirty patients were selected through non-random convenience sampling and randomly assigned to either the experimental group (mindfulness therapy) or the control group (15 participants each). The experimental group participated in eight 90-minute weekly sessions of mindfulness therapy, while the control group remained on a waiting list without any intervention.

Ethical considerations ensured that participation was voluntary. Participants were informed about the project's details and regulations, and their attitudes and opinions were respected. Both experimental and control group members could withdraw at any stage. Control group members were offered the intervention post-study. Confidentiality of documents and records was maintained, and informed consent was obtained from all participants.

2.2. Measures

2.2.1. Adherence to Treatment

The Adherence to Treatment Questionnaire, designed and psychometrically evaluated by Modanloo (2012), includes 40 items across several domains: interest in treatment, willingness to participate, ability to adapt, integration of treatment with life, adherence to treatment, commitment to treatment, and planning in treatment implementation. Scores are converted to a 0-100 scale, with higher scores indicating better adherence (Esmaeil Ian et al., 2023; Jafarzadeh et al., 2023; Modanloo, 2013).

2.2.2. Self-Efficacy

This scale comprises 17 items rated on a Likert scale from "completely disagree" to "completely agree." The scale's construct validity and reliability have been established (Hamidi et al., 2022; Sherer & Adams, 1983).

2.2.3. Difficulty in Emotion Regulation

Developed by Gratz and Roemer (2004), this scale includes 36 items rated on a 5-point Likert scale. It has six subscales: inability to accept emotional responses, inability to act purposefully, impulse control problems, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. The scale has demonstrated good to excellent internal consistency and construct validity (Gratz & Roemer, 2004; Keyvanlo et al., 2022; Mohammadi Lapvandani et al., 2023).

2.3. Intervention

2.3.1. Mindfulness Therapy

Mindfulness therapy sessions were conducted over eight weekly 90-minute sessions (Kabat-Zinn, 2015).

Session 1: Introduction to Mindfulness

The first session introduces participants to the concept of mindfulness, including its definition and benefits. Participants are guided through basic mindfulness exercises, such as mindful breathing and body scan meditation. The importance of being present in the moment without judgment is emphasized. Participants are encouraged to practice these exercises at home and keep a diary of their experiences.

Session 2: Understanding Stress and Its Impact

This session focuses on understanding the nature of stress and its physiological and psychological impacts, especially in relation to type 2 diabetes. Participants learn how mindfulness can help manage stress and improve emotional regulation. The session includes practices such as mindful breathing and the three-minute breathing space to help participants become aware of their stress responses.

Session 3: Mindful Eating

Participants are introduced to the concept of mindful eating, which involves paying full attention to the experience of eating and drinking. This session includes exercises that involve eating a small piece of food mindfully, noticing the texture, taste, and sensations. The goal is to develop a healthier relationship with food, which can positively impact diabetes management.

Session 4: Body Awareness and Progressive Relaxation

In this session, participants learn about body awareness and progressive muscle relaxation techniques. The session involves guided practices that help participants become more aware of physical sensations and reduce muscle tension. Emphasis is placed on noticing areas of tension and

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relaxation in the body and using mindful breathing to promote relaxation.

Session 5: Managing Negative Thoughts and Emotions

This session addresses how to manage negative thoughts and emotions through mindfulness. Participants learn to identify and observe their thoughts and emotions without judgment, understanding the impermanence of these experiences. Techniques such as cognitive diffusion and the RAIN (Recognize, Allow, Investigate, Nurture) method are introduced to help manage emotional responses.

Session 6: Cultivating Self-Compassion

Participants are introduced to the concept of self-compassion and its role in emotional well-being. The session includes practices such as loving-kindness meditation and self-compassion exercises, encouraging participants to treat themselves with kindness and understanding, especially in challenging times. The goal is to foster a supportive inner dialogue and reduce self-criticism.

Session 7: Mindfulness in Daily Life

This session focuses on integrating mindfulness into daily activities. Participants learn how to bring mindful awareness to routine tasks such as walking, cleaning, and interacting with others. The session emphasizes the importance of consistent practice and finding opportunities to be mindful throughout the day.

Session 8: Review and Future Practice

The final session reviews the key concepts and practices learned throughout the program. Participants reflect on their experiences, discuss challenges, and share insights gained from the mindfulness practices. The session also provides guidance on how to continue practicing mindfulness independently, encouraging the incorporation of mindfulness into their ongoing self-care routine. Participants are encouraged to set personal goals for maintaining their mindfulness practice post-intervention.

2.4. Data Analysis

Descriptive statistics were calculated for each research variable. Inferential statistics were analyzed using repeated measures ANOVA and SPSS version 22 software.

3. Findings and Results

The frequency distribution of the sample based on gender shows that 63.4% of the participants are male, while 36.66% are female. In terms of educational attainment, most participants have a diploma, and the fewest have a master's degree. Regarding age, the majority of participants are aged 45-50 years, with the fewest participants aged 40-45 years.

Table 1

Descriptive Statistics for Research Variables

Variable	Group	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Follow-up Mean	Follow-up SD
Adherence to treatment	Experimental	15	93.18	2.05	113.50	7.25	120.43	7.53
	Control	15	94.19	2.72	100.20	1.82	109.27	2.15
Self-efficacy	Experimental	15	53.42	3.50	67.59	4.71	80.49	1.85
	Control	15	62.07	3.26	61.53	4.13	59.93	2.68
Emotion regulation	Experimental	15	68.33	6.10	126.80	45.04	120.93	4.63
	Control	15	128.60	9.94	127.80	5.56	124.73	10.32

According to the findings, Levene's test for post-test adherence to treatment, emotion regulation, and self-efficacy indicates that the assumption of homogeneity of variances between the experimental and control groups is confirmed. Therefore, the conditions for conducting a covariance analysis are met. The interaction effect between the pre-test and group for patients with type 2 diabetes was not significant ($p < 0.05$), supporting the hypothesis of homogeneity of regression slopes.

The results of repeated measures ANOVA for multiple variables among the groups in the body image and alexithymia variables showed a significant between-subjects effect, indicating differences between at least one of the groups. The within-subject effect (time) was also significant, indicating changes in at least one mean variable from pre-test to follow-up.

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Table 2

Results of Repeated Measures ANOVA for Mindfulness Therapy on Treatment Adherence, Self-Efficacy, and Emotion Regulation

Variable	Source	Sum of Squares	df	Mean Square	F	p	Eta Squared
Adherence to treatment	Group * Time	90.80	1	90.80	3.53	0.71	0.11
	Group	1544.02	1	1544.02	154.84	0.01	0.55
Self-efficacy	Group * Time	6.28	1	6.28	0.54	0.49	0.02
	Group	1788.13	1	1788.13	59.45	1.00	0.51
Emotion regulation	Group * Time	5.67	1	5.67	0.08	0.77	0.003
	Group	1704.39	1	1704.39	144.42	0.00	0.42

The results in Table 2 show that the F-ratio for the group factor in treatment adherence ($p < 0.01$), self-efficacy ($p < 0.01$), and emotion regulation ($p < 0.01$) is significant, indicating that mindfulness training significantly affected these variables. A repeated measures ANOVA was conducted for the experimental group across three phases of the therapeutic intervention, revealing significant improvements in treatment adherence, self-efficacy, and emotion regulation ($p < 0.01$).

Table 3

Bonferroni Post Hoc Test Results for the Experimental Group

Variable	Time	Mean Difference	Standard Error	p
Adherence to treatment	Pre-test - Post-test	-32.39	2.50	0.001
	Pre-test - Follow-up	-25.54	2.51	0.001
	Post-test - Follow-up	7.72	2.44	0.001
Self-efficacy	Pre-test - Post-test	-17.39	2.50	0.001
	Pre-test - Follow-up	-15.07	2.63	0.001
	Post-test - Follow-up	-33.10	2.58	0.001
Emotion regulation	Pre-test - Post-test	-58.54	2.51	0.001
	Pre-test - Follow-up	-52.61	10.1	0.001
	Post-test - Follow-up	6.86	1.23	0.001

The changes over time for the experimental group, as shown in Table 3, indicate significant differences in treatment adherence, self-efficacy, and emotion regulation between the pre-test and post-test ($p < 0.001$), and between the follow-up phase and both the pre-test and post-test ($p < 0.001$).

4. Discussion and Conclusion

The present study aimed to investigate the effect of mindfulness therapy on treatment adherence, self-efficacy, and emotional regulation in patients with type 2 diabetes. The findings indicated that mindfulness therapy positively impacts these variables. These results align with the prior studies (Bao, 2022; Fatahi et al., 2021; Fisher et al., 2023; Koerner & Rechenberg, 2022; Kumar et al., 2022; Motevalli et al., 2023; Saito & Kumano, 2022; Vena, 2023; Weng et al., 2022), demonstrating the effectiveness of mindfulness therapy in patients with diabetes.

This finding can be explained by the practice of mindfulness, which involves moment-to-moment awareness and helps individuals gain insight into their thought patterns, emotions, and interactions with others. This insight allows individuals to respond skillfully and purposefully instead of reacting automatically in habitual and unconscious ways. Mindfulness also encourages individuals to revisit and analyze their life conditions, making conscious and non-habitual choices (Vena, 2023).

Moreover, mindfulness enhances successful and open relationships, positive emotional expression, love, appreciation, and self-respect in interactions with others. Mindfulness fosters mental awareness through meditation, allowing individuals to recognize and adjust their thoughts and reactions realistically and honestly (Kumar et al., 2022). By reducing unrealistic expectations from others and the environment, mindfulness improves relationships and life satisfaction. It also develops a broad and clear understanding of occurrences around us. One mechanism of mindfulness is "metacognitive awareness," referring to beliefs about thinking, which affect how individuals respond and organize their thoughts. This awareness significantly impacts

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treatment adherence, self-efficacy, and emotional regulation in type 2 diabetes patients.

The research shows that mindfulness therapy combines liveliness and clear perception, facilitating positive changes in treatment adherence, self-efficacy, and emotion regulation. This therapy encourages forgiveness and compassion towards oneself and others, promoting mental health and emotional balance (Bai et al., 2022). Mindfulness therapy enhances receptivity and acceptance of others without negative judgments and fosters kindness and sensitivity to others' needs.

Mindfulness involves purposeful, non-judgmental attention to the present moment. It requires behavioral, cognitive, and neurocognitive strategies to focus attention, preventing negative mood-thought spirals and fostering a new perspective and positive thoughts and emotions (Bao, 2022). Presence of mind helps control attention and enables individuals to return to the origin of their thought processes, promoting positive changes in treatment adherence, self-efficacy, and emotional regulation in type 2 diabetes patients.

5. Limitations & Suggestions

This research was conducted exclusively among patients with type 2 diabetes, so caution is needed when generalizing the results. Different outcomes may emerge in other populations. The age range of 40 to 55 years could significantly impact the results; thus, age groups should be more precisely separated. Further studies are suggested for non-diabetic populations to compare results. Conducting similar studies with more comprehensive samples, controlling demographic variables, utilizing individual interventions, and increasing the number of sessions are recommended.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this article.

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