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Impact of Mindfulness-Based Stress Reduction on Diabetes Mellitus Psychological Well-Being and Glycemic Control: A Systematic Review

Impacto de la reducción del estrés basada en atención plena en el bienestar psicológico y el control glucémico en la diabetes mellitus: Una revisión sistemática

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SUMMARY

Introduction: *It is a well-established fact that many diabetes mellitus patients grapple with psychological issues, which can often lead to depression if not properly managed. This systematic review was conducted to explore the impact of mindfulness therapies on the psychological well-being and blood glucose levels of those with diabetes mellitus.* **Methods:** *The systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) criteria. The keywords were type 2 diabetes mellitus, mindfulness-based stress reduction, glycemic control, blood glucose, glycated hemoglobin, and psychological well-being. Data sources were from Scopus, Web of Science, ScienceDirect, and Google Scholar. The articles used were published in English full text between 2014-2023 and were research articles.* **Results:** *Fifteen papers were found that addressed mindfulness therapy, with the majority focusing on Mindfulness-Based Stress Reduction (MBSR). Eight meetings were held where MBSR was presented directly by professionals or through communication. In patients with type 2 diabetes, mindfulness significantly lowers HbA1c and fasting blood sugar levels. Mindfulness improves psychological well-being by reducing depression and anxiety and increasing resilience and emotional health in patients with diabetes.* **Conclusion:** *The review concludes that MBSR therapy has the potential to significantly enhance psychological well-being and regulate blood sugar levels in diabetic patients. This*

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therapy can help patients become more aware of and accept their condition, and healthcare professionals play a crucial role in supporting them to manage self-manage through mindfulness, empowering both patients and professionals in the process.

Keywords: *Mindfulness-based stress reduction, glycemic control, psychological well-being, diabetes mellitus type 2, systematic review*

RESUMEN

Introducción: *La mayoría de los pacientes con diabetes mellitus tienen problemas psicológicos. Los pacientes que reciben un tratamiento inadecuado para los problemas psicológicos pueden ser más susceptibles a la depresión. El propósito de esta revisión sistemática fue determinar cómo las terapias de atención plena afectan el bienestar psicológico y los niveles de glucosa en sangre de los pacientes con diabetes mellitus.* **Métodos:** *Durante la revisión sistemática realizada en esta investigación se siguieron los criterios de los elementos de informe preferidos para revisiones sistemáticas y metaanálisis (PRISMA). Utilizando las palabras clave diabetes mellitus tipo 2, reducción del estrés basada en la atención plena, control glucémico, glucosa en sangre, hemoglobina glucosilada y bienestar psicológico, las fuentes de datos se tomaron de Scopus, Web of Science, Science Direct y Google Scholar. Los artículos utilizados se publicaron en inglés de texto completo entre 2014-2023 y fueron artículos de investigación.* **Resultados:** *Se encontraron quince artículos que abordaron la terapia de atención plena, la mayoría centrados en la reducción del estrés basada en la atención plena (MBSR). Se celebraron ocho reuniones en las que se presentó MBSR directamente por profesionales o a través de medios de comunicación. En pacientes con diabetes tipo 2, la atención plena reduce significativamente la HbA1c y los niveles de azúcar en sangre en ayunas. La atención plena mejora el bienestar psicológico al reducir la depresión y la ansiedad y aumentar la resiliencia y la salud emocional en pacientes con diabetes.* **Conclusión:** *Se ha demostrado que la terapia MBSR mejora el bienestar psicológico y regula los niveles de azúcar en sangre en pacientes diabéticos. Con esta terapia, los pacientes pueden volverse más conscientes y aceptar su condición. Los profesionales de la salud pueden ayudar a los pacientes a autogestionarse mediante la práctica de la atención plena.*

Palabras clave: *Reducción del estrés basada en la atención plena, control glucémico, bienestar psicológico, diabetes mellitus tipo 2, revisión sistemática,*

INTRODUCTION

Diabetes mellitus (DM) is a long-term condition brought on by persistent endocrine, metabolic abnormalities that interfere with the secretion and/or function of insulin, raising blood sugar levels (hyperglycemia) (1). Diabetes is a complex and debilitating disease that, if not properly controlled, will have negative health impacts (2). Patients with diabetes mellitus typically struggle with stress, depression, or diabetes-related distress (3). Diabetes causes psychological issues for around 66 % of type 2 DM patients, who also have an increased risk of depression (4). These psychological issues have an adverse effect on treatment outcomes, blood glucose levels, and the course of the disease (2). The World Health Organization (WHO) projects that 422 million people worldwide will have diabetes mellitus by 2023. According to data from the International Diabetes Federation, Indonesia has 19.5 million DM patients as of 2021, placing it as the fifth-ranked nation (5). It is projected that by 2045, there will be 28.6 million DM patients worldwide. With 21 992 cases worldwide in 2020, diabetes was among the top 10 diseases (6).

Patients with type 2 diabetes have numerous facets of self-management, including lifestyle modifications, education, and treatment. Patients encounter various obstacles and issues, such as dietary and exercise modifications upon diagnosis, lack of social support, and awareness of the disease's symptoms (7). Educational materials, physical, psychological, and social hurdles, rigorous treatment plans, low motivation, a lack of understanding of self-management, and a lack of knowledge on the part of healthcare professionals toward patients are some obstacles to self-management (8). Psychological issues can lead to decreased quality of life, poor glycemic control, mortality, and functional limitations in patients. They also affect their self-regulation and psychological well-being (2,9,10). The majority of individuals with diabetes mellitus have trouble controlling their emotions, especially when it comes to taking care of their illness (11). Diabetes patients may experience distress if they are unable to manage their diabetes (12). The typical HbA1c score of diabetes mellitus patients

is high, and most of them nevertheless have moderate psychological well-being.

Diabetes distress is defined as anxiety and depressive feelings associated with managing diabetes, living with the condition, and its complications (13). Patients with female gender, younger age, shorter duration of diabetes, high HbA1c levels, insulin use, smoking, difficulty adhering to dietary and medication recommendations, inadequate physical activity, and inability to monitor blood glucose levels are more likely to experience diabetes distress (14). Distress can reduce creativity, cause a shorter attention span, and cause inadequate coping and self-management (9). Being distressed might make learning new things, developing new abilities, and solving difficulties more difficult. Patients under distress also tend to form false personal beliefs, self-defeating judgments, and unrealistic expectations and ambitions (12).

Mindfulness-Based Stress Reduction (MBSR) is a set of mindfulness exercises de-signed to teach attention control over the present moment without the addition of judgment (15). People with chronic illnesses such as fibromyalgia, coronary artery disease, back pain, and arthritis can benefit from MBSR in terms of pain, anxiety, and stress (16). Low to moderate dosages of MBSR affect the management of psychological and physical symptoms in a range of chronic somatic illnesses, such as arthritis, cancer, and cardiovascular problems, according to systematic reviews (17,18). Previous systematic research has explored the influence of mindfulness on reducing stress, anxiety, and depression in great detail; however, information about psychological well-being is still lacking. This review aims to determine how mindfulness programs affect individuals with diabetes mellitus's ability to control their blood sugar levels and enhance their psychological well-being.

METHODS

The Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) guidelines were followed during the study's systematic review (19). According to PICOS, the following were included as inclusion criteria: English-language articles published between 2014 and 2023; patients with type 2 diabetes mellitus (Population); mindfulness intervention (Intervention); fasting blood glucose, HbA1c, stress, psychological distress, and psychological well-being (O); experimental-type quantitative research (S). Study protocols, conference proceedings, editorials, review articles, case reports, case series, and qualitative research were excluded.

Search Strategy

Academic databases were searched in November 2023. Four databases were searched: Scopus, Web of Science, and ScienceDirect, and we added articles using both direct searches from Google Scholar and manual search tactics. Boolean operators in the form of AND/OR were utilized to conduct the literature search, namely "diabetes mellitus type 2," "mindfulness-based stress reduction," "AND/OR," "glycemic control," "blood glucose," "glycated hemoglobin," and "psychological well-being." The terminology is modified in accordance with the Medical Subject Heading (MeSH).

Study Selection

Mendeley was used to select the articles. Researchers evaluated and screened the remaining publications in two stages: first, full-text screening, then screening for titles and abstracts. The entire manuscript was then examined independently by the writers. All voting in the screening process has to be done unthinkingly, so my peers won't be able to see my vote until they've cast their own, and vice versa. Conflicts or differences amongst reviewers were then settled by consensus-building talks or the involvement of a third reviewer.

Researchers employed the PRISMA flowchart visual flow chart during the study selection process. This chart helps identify, select, and organize studies for inclusion in a systematic review or meta-analysis. The PRISMA flowchart guarantees that the process of choosing studies is visible and repeatable (Figure 1). We used the Joanna Briggs Institute, or JBI, to evaluate the quality of an article.

Data Analysis

Data extraction is the first step in data analysis. The inclusion criteria established in each paper were extracted using a Microsoft Excel sheet. Two separate researchers independently extracted the data. Two to three unbiased reviewers must oversee the extraction procedure. Text and PRISMA-based diagrams depict the search process and literature discoveries. A synopsis comprising the features of every investigation is provided as an overview of the evidence that will be utilized in the data synthesis. Both text and tables display descriptive data.

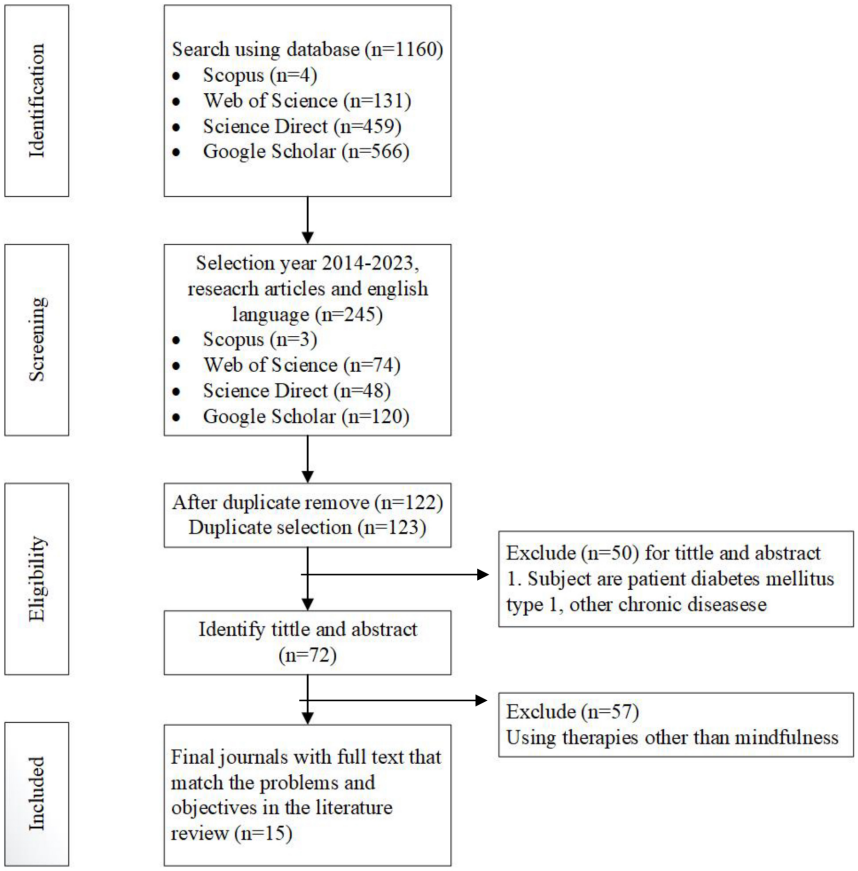

Figure 1. Flowchart with PRISMA Guidelines in the Research the Effect of Mindfulness-Based Stress Reduction on Glycemic Control and Psychological Well-being of Diabetes Mellitus Patients: A Review of Experimental Studies

RESULTS

Study Characteristics

A portion of the research on mindfulness was carried out in Asian nations, such as Saudi Arabia (20), Iran (21-26), India (27), and China (28,29). The United States (30-32), Canada (33) Australia (34) are among the nations that have studied mindfulness. Most researchers who study mindfulness utilize two groups: one for treatment (mindfulness alone or in conjunction with other therapies) and the other for control (education, routine care, physical activity, etc.) (20-23,28,30,34). Participants in the study had an average age range of 45.24 to 63.7 years old and were type 2 diabetic patients. Except for the study (20,23), which exclusively

included female respondents; the majority of respondents in this study were men and women. Based on a questionnaire with HbA1C values > 7 and at least six months of diabetes treatment, the study was done on type 2 DM patients who had previously been tested for psychological issues (diabetic discomfort, stress). According to Table 1, the study did not involve participants who had a medical diagnosis of mental illness.

Mindfulness Intervention

Mindfulness-Based Stress Reduction (MBSR) is the form of mindfulness intervention that has been employed in the majority of study (21,23,25,27-33). Four weeks (low dose) (31), eight weeks (21,29,30,32-34) and twelve weeks (23) have been allocated for MBSR. Trained specialists teach mindfulness, which is then reinforced through communication channels such as WhatsApp (25), CDs (32,34) or mobile application (30).

Glycemic Control in Type 2 DM Patients Treated with Mindfulness

HbA1c and fasting blood sugar levels were used to evaluate how well mindfulness controlled glycemic levels in Type 2 DM patients. Pre-intervention, mid-intervention, post-intervention, and many months after the intervention (3 months post-intervention) (21) (6 months post-intervention) (30) were all measured. Except for the study (24,27,34) where the HbA1c value was significant after measurements were made at week 12. The research results demonstrated a substantial benefit of mindfulness in managing blood sugar and HbA1c levels in type 2 DM patients.

The Effect of Mindfulness on Psychological Well-being

The patient's psychological issues, particularly those involving poor self-management, can be controlled by practicing mindfulness. The implementation of MBSR programs has been shown to improve the well-being of patients with type 2 diabetes (21), specifically through the reduction of depression (30,31), anxiety (HARS, and HDRS scores with $p< 0.05$), stress and depression (34), resilience and psychological well-being (22,28), and emotional health (33). Psychological effects are measured with instruments designed to measure psychological circumstances and laboratory data, namely cortisol levels. According to research (Table 1) (20), women's cortisol levels were significantly regulated by mindfulness.

DISCUSSION

Being mindful is being aware of how experiences unfold moment by minute while doing so consciously, in the present, and without passing judgment. The ability to pay attention to present experiences without passing judgment or making any assessments is referred to as mindfulness (35). A mindfulness-based intervention was created to help individuals with long-term medical issues manage their pain, depression, and anxiety connected to their health (36). To assist in overcoming emotional issues, Mindfulness-Based Stress Reduction (MBSR) is a systematic program that incorporates bodily awareness, non-judgmental acceptance, meditation practices, and emotional regulation tactics. Eight weekly group sessions (typically lasting 2.5 hours each) are part of a normal MBSR intervention, which lasts eight weeks, with an all-day retreat between weeks six and seven (31). With a focus on physical and emotional discomfort, mindfulness training aims to develop acceptance of various states of consciousness. It also teaches individuals to observe their emotional, bodily, and cognitive states without unintentionally reacting (22).

Mindfulness is awareness that is non-judgmental and cannot be expressed in words. It is based on an individual's experience within the limits of their attention at a particular moment. In addition, this concept includes acceptance of these experiences and increased mindfulness to improve psychological well-being. This is as explained in Kian et al. and Hosseini et al. research (21,22), where mindfulness therapy is effective in improving psychological well-being. Acknowledgment, comprehension, and personal development are useful elements that enable

Table 1. Literature Analysis

No	Title	Author, Year	Design	Participants and Settings	Type of intervention		Outcomes	Results
					Intervention group	Control Group		
1	Impact of Mindfulness-Based Stress Reduction on Emotional Well-Being and Glycemic Control in Type 2 Diabetes Mellitus Patients	Kian, 2018	Randomized controlled trial	T2DM patients with hemoglobin A1c higher than 7.	Eight sessions of MBSR	Ordinary care	Fasting blood sugar, HbA1c, mental health, depression and anxiety.	Reductions in Fasting Blood Glucose, HbA1C, HARS, and HDRS scores ($p < 0/05$).
2	Effectiveness of Mindfulness-Based Therapy on Resilience, Psychological Well-Being, and Blood Sugar Levels in Type II Diabetes Sufferers	Hoseini, 2021	Semi-experimental with a pre-posttest control group design.	All patients with type II diabetes were referred to a health center in Tehran in 2018.	Ten sessions of mindfulness treatment.	The control group remained on the waiting list.	Resilience, Psychological Well-Being, and Blood Sugar.	Improving resilience ($p<0.001$), psychological well-being ($p<0.001$), and blood sugar ($p<0.001$) in DMT2.
3	The Effect of Mindfulness on Psychological Distress and HbA1c in Diabetes Sufferers.	Pearson et al., 2018	Randomized controlled trial.	18 years or older, does not meet glycemic control targets, T2DM with vascular complications (diabetic nephropathy or microalbuminuria, eGFR < 60 ml/min/1.73 m2 regardless of HbA1c.	Mindfulness giving by CD, performed for 30 minutes daily by patients at home over 8 weeks.	Participants are given a CD that does not contain IMP (blank).	Psychological distress, HbA1c, systolic and diastolic blood pressure and diabetes self-management.	Reducing depression ($p = 0.02$) and stress ($p = 0.03$). There was an overall improvement in blood glucose monitoring; However, this was not significant ($p = 0.06$). HbA1c measurements decreased significantly over 12 weeks of follow-up by 0.48 units (time × group interaction: $p = 0.02$).
4	Evaluation of the Effect of Mindfulness-Based Stress Reduction for 12 Weeks on Glycemic Control and Mental Health Index in Women Suffering from Type 2 Diabetes Mellitus	Ravari, 2020	Randomized controlled trial, pre-post test	Adult women (age range 30–59 years) with DMT2, having DM at least 6 months, and hemoglobin A1C (HbA1c) between 7% and 9%.	MBSR (12-week MBSR program): The intervention group received eight sessions (2 hours each) of group mindfulness training by a certified instructor once a week and then practiced at home for 4 weeks. Weekly self-reports were presented on home practice.	Usual care (being treated regularly by a healthcare system according to national guidelines for diabetes care).	Depression, anxiety, stress score, fasting blood sugar (FBS) and hemoglobin A1C (HbA1C).	The mean HbA1C, FBS, and depression, anxiety, and stress scores improved significantly after the intervention.
5	Feasibility of Mindfulness-Based Interventions for Aboriginal Adults with Type 2 Diabetes.	Dreger, 2015	Quasi-experimental design.	Aged over 18 years, reported a diagnosis of Type 2 Diabetes, self-identified as Aboriginal, and did not report suicidal ideation, substance abuse, or active psychosis.	Intervention (mindfulness-based program for 8 weeks three times, modified MBSR program).		HbA1c levels, MAP, and self-report data (physical and emotional health, diabetes self-care behavior, and alertness) using repeated measures analysis of variance with 3 assessments.	Significant reduction in blood sugar (HbA1c reduced by 0.43%, $p = 0.02$; $d = 0.37$) and blood pressure (mean arterial pressure reduced by 7.91 mm Hg, $p = 0.05$; $d = 0.85$). They also reported significant improvements in emotional health.

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No	Title	Author, Year	Design	Participants and Settings	Type of intervention		Outcomes	Results
					Intervention group	Control Group		
6	Effects of an integrated mindfulness intervention for veterans with diabetes distress: a randomized controlled trial	Dinardo, 2022	.Randomized controlled trial.	Veterans (N=132) with type 1 or 2 diabetes, diagnosed diabetes, positive DD screen, HbA1C >7%, and willing to be randomized.	(MindSTRIDE integrated with DSMES) a one-session mindfulness intervention integrated into an existing diabetes self-management education and support (DSMES) program plus one booster session and 24-week home practice supported by a mobile app.	DSMES (one 3-hour comprehensive DSMES group session).	Diabetes distress, self-care behavior, diabetes self-efficacy, posttraumatic stress disorder (PTSD), depression, alertness, hemoglobin A1C (HbA1C), body weight, and blood pressure.	.The HbA1C, PTSD, depression, and diabetes self-efficacy of both groups significantly improved without a significant effect from the intervention. The body weight and mindfulness did not alter in either group.
7	Effect of aerobic exercise, slow deep breathing, and mindful meditation on cortisol and glucose levels in women with type 2 diabetes mellitus: a randomized controlled trial	Obaya et al., 2023	Randomized controlled trial.	The study included adult female participants (≥18 years old) who had been diagnosed with type 2 diabetes (T2DM) for at least 5 years but were in a medically stable state at that point. When registering, they revealed a moderate to high level of stress.	The group engaged in mindfulness meditation instruction, aerobic exercise, and slow, deep diaphragmatic breathing. For a period of six weeks, three sessions a week were dedicated to each intervention technique.	The group that only did aerobic exercise.	Cortisol and fasting blood glucose.	Compared to the aerobic training group, the group that combined six weeks of aerobic exercise with deep, calm breathing and mindfulness meditation showed significantly lower levels of cortisol ($p = 0.01$) and fasting blood sugar ($p = 0.001$).
8	Reduces diabetes distress and improves mindful self-management.	White Bird, 2017.	Single-arm pilot study.	Type 2 diabetes and had two Hemoglobin (Hb)A1c values ≥ 8.0% in the previous 16 months, with the most recent HbA1c value > 8% in the last 3 months.	Teaches an 8-week course at MBSR that consists of light Hatha yoga and four types of meditation: sitting, standing, walking, and supine. The lecturer teaches the participants memory techniques, which they can then practice at home with the help of an audio series (CD/MP3)		Stress, mental health (general mental health, anxiety, depression), social support, diabetes-related stress and self-management, HbA1c and blood pressure	The study participants exhibited noteworthy enhancements in their psychosocial self-efficacy (Cohen's d.80, p <.001), glucose control (Cohen's d –.79, p < 001), and diabetes-related distress (Cohen's d –.71, p <.002). There were also notable gains in coping, self-compassion, sadness, anxiety, stress, and social support.
9	A feasibility study of a low-dose mindfulness-based stress reduction interven-	Xia, 2022	One-arm mixed method.	18 years of age or older, fluent in English, and receiving a diagnosis of prediabetes or	The low dose MBSR intervention was given in a group se-		Recruitment, adherence, dropout rates, participant satisfaction,	Eleven participants' qualitative data revealed that 90.9% of them had a good experience with low-dose

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No	Title	Author, Year	Design	Participants and Settings	Type of intervention		Outcomes	Results
					Intervention group	Control Group		
	tion among prediabetes and diabetes patients.			diabetes. When an individual's HbA1c fell between 5.7% and 6.4% or fell below 6.5%, they were classified as prediabetic or diabetic.	tting in four waves, lasting eight to ten hours each and comprising eight sessions spread over six to eight weeks.		motivation, and barriers to low-dose MBSR. Psychological, behavioral, and physical actions.	MBSR. Depression scores significantly decreased (mean drop = 5.04, SD = 7.66, p = 0.02), attendance exercises were completed by a larger percentage of participants (42.86% vs. 85.71%, p = 0.01), and glycosylated hemoglobin (HbA1c) levels were significantly lower (mean decrease = 1.43%, SD = 2.54%, p = 0.03) at the post-intervention period.
10	Effectiveness of a nurse-led mindfulness stress reduction intervention on diabetes distress, diabetes self-management, and HbA1c levels among people with type 2 diabetes: A randomized controlled trial	Guo, 2021	Randomized controlled trial.	Patients with type 2 diabetes who are older than eighteen, have a DDS-17 score greater than three, can use a smartphone with the WeChat app, can read and write Chinese, and have been hospitalized for at least eight days.	Nurse-led MBSR therapy + regular. diabetes education.	Regular diabetes education.	Diabetes distress, self-efficacy, diabetes self-management, HbA1c.	In individuals with type II diabetes, the intervention dramatically lowers blood sugar (p<0.001), psychological well-being (p<0.001), and resilience (p<0.001).
11	Beneficial effects of mindfulness-based stress reduction (MBSR) on biophysiological and psychological parameters among type 2 diabetics.	Sasikumar, 2022	Randomized controlled trial.	This study was conducted on 138 type 2 diabetes mellitus patients living in a rural area of Bengaluru, India. Eligible samples were PSS ≥15 and CEDS ≤ 20 on the subscale, fasting blood glucose ≥ 110 mg/dL, systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg.	The intervention group received 20-30 minutes of MBSR practice weekly for 5 days over 8 weeks, including mindfulness breathing, body scan, sounds, and mindfulness of feelings and thoughts.	Ordinary care.	Stress, depression, mindfulness, blood glucose, HbA1C, blood pressure.	MBSR has a significant effect on HbA1C, blood pressure, BMI, stress, depression and mindfulness in diabetes mellitus patients.
12	The effect of mindfulness-based stress reduction in depression and blood sugar reduction diabetic patients with BIS type of personality	Shirmahaleh et al., 2017	Quasi-experimental study.	Thirty diabetes mellitus patients aged 20-50 years who experienced depression.	MBSR eight sessions of 120 minutes.	Ordinary care.	Personality, depression, fasting blood glucose, HbA1c.	Mindfulness-based training positively reduces stress and blood sugar in patients with type 2 diabetes.
13	The effect of mindfulness-based stress reduction (MBSR) training on serum cortisol levels, depression, stress, and anxiety in type 2 diabetic older adults during the COVID-19 outbreak	Sayadi et al., 2022	Randomized controlled trial.	The participants were 56 older adult patients with type 2 diabetes.	Eight MBSR online training sessions	Routine clinical care.	Anxiety, stress, depression, and cortisol levels.	There were significant differences in stress, anxiety and cortisol levels before and after the intervention. However, there were no significant differences between the treatment and control groups.

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No	Title	Author, Year	Design	Participants and Settings	Type of intervention		Outcomes	Results
					Intervention group	Control Group		
14	The Effect of Mindfulness-Based Stress Reduction Counseling on Blood Glucose and Perceived Stress in Women with Gestational Diabetes	Zeinabeh et al.,	Quasi-experimental interventional study.	78 women with gestational diabetes (Being in the first half of pregnancy (< 20 weeks) and under treatment with a gestational diabetes diet).	The researcher conducted the MBSR counseling program in 8 sessions of 90 minutes twice a week.	Routine pregnancy care	Fasting blood glucose, two hours fasting blood sugar, stress.	There were significant differences in fasting blood sugar, two hours fasting blood sugar and stress levels between the treatment and control groups before and after the intervention.
15	The effects of mindfulness-based stress reduction therapy combined with intensive education on the effectiveness of the care and the awareness rate in patients with arthritis and diabetes	Chen et al., 2021	Randomized controlled trial.	Ninety-four patients with diabetes and arthritis.	BSR for 8 weeks and an intensive education program.	Eight-week-long intensive education program.	Anxiety, Depression, Coping Style, quality of life scale (DSQL), and cortisol levels.	The combination of MBSR and an intensive education program can improve patient symptoms, reduce anxiety/depression, increase coping levels, quality of life, and cortisol levels Quality of life and cortisol levels in the treatment group in weeks 2, 4, 6 and 8 were lower compared to the control ($p < 0.05$).

the person to react naturally and thoughtfully to situations without any reflection or analysis. In addition, they support individuals in identifying, handling, and resolving everyday issues. As well as lowering anxiety, sadness, and psychological symptoms, numerous research have demonstrated the positive effects of increased mindfulness on psychological well-being, life satisfaction, optimism, and self-esteem (37).

Mindfulness can help change behavior, especially if targeted at specific behaviors such as diet, physical activity, glucose monitoring, and medication management. According to certain research, focused interventions like portion control can lower energy and calorie intake (38). Mindfulness training may aid glucose regulation through its effects on emotional regulation and stress reduction. Hypothalamic-pituitary-adrenal (HPA) axis modulation and stress pathways are two possible mechanisms or pathways that could account for this HbA1c shift. Behavioral modifications and stress-reducing effects on the HPA axis are also possible explanations. A study (20) revealed that DM patients' cortisol levels were lowered by mindfulness training. A study (28,38) observed reduced HbA1c levels and improved patient capacity to handle stress, emotional stress, and quality of life. Consistent with other research, mindfulness has been shown to enhance diabetes patients' psychological coping mechanisms (39,40).

CONCLUSION

Mindfulness-Based Stress Reduction (MBSR) uses a set of mindfulness techniques to teach people to regulate their attention to the present moment without passing judgment on it. Mindfulness can also help with glycemic management and mitigate the impact of psychological issues. As a supportive therapy for DM patients, mindfulness can be employed.

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