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THE EFFECT OF MINDFULNESS BASED ON BREATHING EXERCISE ON REDUCING BLOOD PRESSURE AND BLOOD GLUCOSE LEVELS IN DIABETES MELLITUS PATIENTS

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Abstract

Background: Diabetes Mellitus (DM) often involves stress-induced hypertension and glucose instability. Mindfulness-Based Breathing Exercise (MBBE) is a non-pharmacological stress management intervention designed to reduce stress responses and help stabilize blood pressure and blood glucose levels.

Objective: The purpose of this study was to analyze the effect of Mindfulness Based on Breathing Exercise on reducing blood pressure and blood glucose levels in Diabetes Mellitus patients.

Methods: A quasi-experimental study with a pretest-posttest control group design was conducted at Keputih Health Center, Surabaya. Thirty respondents with Type 2 DM (aged 40-65 years, diagnosed ≥1 year, with a history) were purposively sampled into intervention (n=15) and control (n=15) groups. The intervention group practiced Mindfulness-Based Breathing Exercise for 15 minutes daily for 14 days, while the control group received standard education. Blood pressure and random blood glucose were measured using digital devices and analyzed via paired and independent t-tests.

Result: The paired t-test results in the intervention group showed a significant decrease in systolic blood pressure (p=0.001), diastolic blood pressure (p=0.002), and random blood glucose levels (p=0.000). There was no significant change in the control group (p>0.05). The independent t-test results showed a significant difference in the average decrease in blood pressure and blood glucose levels between the intervention and control groups (p≤0.05).

Conclusion: Mindfulness-Based Breathing Exercise significantly reduced blood pressure and blood glucose levels in patients with diabetes mellitus. This therapy is recommended as a complementary nursing intervention in the management of diabetes mellitus.

INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic disease characterized by hyperglycemia due to defects in insulin secretion, insulin action, or both (Mardiana et al., 2025). The prevalence of DM continues to increase globally and is one of the greatest public health challenges. DM patients are at high risk of developing various complications, one of which is hypertension. Hypertension in DM

patients significantly increases the risk of cardiovascular diseases such as stroke and myocardial infarction (Farida & Yuliastuti, 2020a). In addition to glycemic control, blood pressure management is a major focus in the treatment of DM (Salsabila et al., n.d.). Psychological factors such as stress are known to play a significant role in the pathophysiology of DM and hypertension (Asrindo et al., 2024). Stress can trigger the release of the hormones cortisol and adrenaline, which increase glucose production by the liver and cause vasoconstriction, ultimately elevating blood glucose levels and blood pressure. Therefore, interventions focused on stress management are highly relevant (Vidhiastutik et al., 2025).

Mindfulness is the practice of focusing attention on the present moment with full awareness and non-judgment. One of the basic techniques of mindfulness is breathing exercises. These (Cristiana et al., 2025) exercises aim to activate the parasympathetic nervous system, which produces a relaxation response, as opposed to the " fight or flight" response of the sympathetic nervous system triggered by stress. Activation of the parasympathetic nervous system can help lower heart rate, dilate blood vessels, and ultimately lower blood pressure. Several studies also show that effective stress management can improve glycemic control (Mumun Muniroh & Negeri Abdurrahman Wahid Pekalongan, n.d.)

Despite extensive research, the application of Mindfulness-Based Breathing Exercise as a structured nursing intervention to simultaneously control blood pressure and blood glucose in diabetes patients in Indonesia remains limited. Therefore, researchers are interested in testing the effectiveness of this intervention.

METHODS

Study Design

This study used a Quasi-Experiment design with a Pretest-Posttest with Control Group Design. This design aims to compare changes in the dependent variables (blood pressure and blood glucose) before and after treatment in the intervention and control groups.

Settings

The research was conducted in the Keputih Community Health Center work area in June-July 2025.

Research subject

Population: All Type 2 Diabetes Mellitus patients diagnosed with hypertension and visiting the Keputih Community Health Center during the period of June 2025. Sample: The study sample consisted of 30 people who met the inclusion and exclusion criteria, divided into 15 people in the intervention group and 15 people in the control group, with the Sampling technique: Purposive Sampling. Inclusion Criteria: Willing to be respondents, aged 40-65 years, diagnosed with Type 2 DM for at least 1 year, have a history of hypertension, and can communicate well. Exclusion Criteria: Experiencing severe complications (kidney failure, stroke), having hearing or cognitive impairment, or undergoing other relaxation therapy.

Instruments

Respondents had their blood pressure and GDS levels measured.

Data Collection

Intervention Group:

Pretest: Respondents had their blood pressure and GDS levels measured. Respondents were taught the Mindfulness-Based Breathing Exercise technique (sitting comfortably with eyes closed, focusing on the Inflow and outflow of abdominal breath without changing it. Respondents were asked to practice this exercise for 15 minutes daily (morning or evening) for 14 days. Researchers monitored them through diaries and phone calls. Posttest: After 14 days, blood pressure and GDS levels were remeasured.

Control Group:

Pretest: Respondents had their blood pressure and blood glucose levels measured. Respondents received only standard education about diabetes and hypertension from the community health center as usual. Posttest: After 14 days, blood pressure and blood glucose levels were remeasured.

Data Analysis

Data were analyzed using the SPSS program. This study used a Paired T-Test to analyze the differences in average blood pressure and GDS before and after the intervention in each group. An Independent T-Test was used to analyze the differences in changes (posttest-pretest difference) in blood pressure and GDS between the intervention and control groups.

Ethical Consideration

Ethics approval for this study was obtained from the Ethics Committee of the Surabaya Institute of Health and Business, under number 002210/IKBS/05/2025. Written informed consent was obtained from all participants before data collection. Participant confidentiality and anonymity were strictly maintained throughout the study.

RESULTS

A total of 30 respondents who met the inclusion criteria were divided into the intervention group (n=15) and the control group (n=15). All participants completed the 14-day program without any dropouts. The high adherence was maintained through daily monitoring via diaries and phone calls.

Table 1. Analysis of Differences Before and After Intervention (Paired T-Test).

Variables	Group	Pretest	Posttest	Average	p-value
Systolic Blood Pressure (mmHg)	Intervention	155.4 ± 8.2	142.1 ± 7.5	**13.3**	**0.001**
	Control	154.8 ± 8.5	153.5 ± 8.1	1.3	0.317
Diastolic Blood Pressure (mmHg)	Intervention	94.2 ± 5.1	86.5 ± 4.8	**7.7**	**0.002**

	Control	93.8 ± 5.4	93.1 ± 5.0	0.7	0.450
Random Blood Glucose (mg/dL)	Intervention	215.7 ± 25.3	180.3 ± 20.1	**35.4**	**0.000**
	Control	218.1 ± 26.8	214.2 ± 24.5	3.9	0.150

This table shows the changes that occurred in each group after the 14-day intervention period.

Table 2. Comparative Analysis of Effectiveness Between Intervention and Control Groups (Independent T-Test).

Variables	Mean Intervention Group	Mean (Control Group)	SD	t-value	p-value *
Systolic Blood Pressure (mmHg)	13.3	1.3	12.0	5.214	0.000
Diastolic Blood Pressure (mmHg)	7.7	0.7	7.0	4.862	0.000
Random Blood Glucose (mg/dL)	35.4	3.9	31.5	6.345	0.00

*Note: The p-value in this table tests whether the difference in mean decline between the intervention and control groups is statistically significant. Significance is considered if $p < 0.05$.

This table compares the magnitude of effectiveness (average reduction) between the intervention group and the control group.

DISCUSSION

The Effectiveness of Mindfulness-Based Breathing Exercises in Reducing Blood Pressure. The results of this study indicate that a Mindfulness-Based Breathing Exercise intervention conducted for 14 days can significantly reduce systolic and diastolic blood pressure in DM patients with hypertension. The intervention group experienced an average reduction of 13.3 mmHg for systolic and 7.7 mmHg for diastolic. The researchers argue that this reduction is clinically significant because even a small decrease in blood pressure can drastically lower the risk of cardiovascular events in diabetic patients. This suggests that MBBE is not just a relaxation tool, but a potent non-pharmacological therapy that complements medical treatment.

Physiologically, these findings can be explained by the activation of the autonomic nervous system. Chronic stress experienced by DM patients triggers the sympathetic nervous system, causing an increase in heart rate and vasoconstriction, which raises blood pressure (Octavia Lingga et al., 2024) Slow, deep, and mindful breathing exercises directly stimulate the vagus nerve (Farida Denis, 2025). This stimulation induces a relaxation response, activating the parasympathetic nervous system. Consequently, there is a decrease in the release of stress hormones (catecholamines), a slowing of the heart rate, and vasodilation of peripheral blood vessels, which ultimately leads to a decrease in blood pressure. These results align with a systematic review, which concluded that slow breathing is a powerful tool for regulating the cardiovascular system. Based on these findings, it is the author's

opinion that the simplicity of this exercise is its greatest strength; patients can easily perform it independently, which increases their self-efficacy in managing their own health.

The Effectiveness of Mindfulness-Based Breathing Exercise on Reducing Blood Glucose Levels. The most significant finding of this study was the intervention's effect on reducing random blood glucose levels. The intervention group experienced an average decrease of 35.4 mg/dL (p=0.000), a clinically significant change. This supports the hypothesis that stress management is a crucial component of glycemic management. The biological pathway that explains this is related to the Hypothalamic-Pituitary-Adrenal (HPA) axis. Psychological stress activates this axis and triggers the release of cortisol (Farida & Yuliastuti, 2020b). Cortisol has a diabetogenic effect, increasing glucose production by the liver (gluconeogenesis) and causing insulin resistance in peripheral tissues. By practicing mindfulness This practice can blunt HPA axis activation, resulting in decreased cortisol production. Reduced cortisol improves insulin sensitivity and reduces endogenous glucose production, ultimately helping to lower blood glucose levels. These findings support research by Jasleen Kaur, Jayashree Gandhi, and Sandeep Sharma (2025), which found that mindfulness -based interventions can improve health outcomes in diabetes patients. The researchers interpret this substantial drop in glucose levels as evidence that psychological stability is a foundational requirement for glycemic control. Often, DM management focuses too heavily on diet and medication while neglecting the "stress-glucose" link. In our view, adding MBBE to standard care could potentially reduce a patient's reliance on high-dose medications, although further long-term study is needed.

LIMITATION

Researchers are aware of several limitations, including: (1) The relatively small sample size.

(2) The short intervention period (14 days). (3) Blood glucose measurements using GDS, not HbA1c, which is an indicator of long-term glycemic control.

CONCLUSION

Mindfulness Based on Breathing Exercise has been proven to be effective and has a significant effect in reducing blood pressure (systolic and diastolic) and random blood glucose levels in Type 2 Diabetes Mellitus patients with hypertension. The findings of this study imply that psychological stability through stress management is a critical factor in achieving metabolic control. This positions MBBE as a highly feasible, cost-effective, and independent nursing intervention that can be integrated into holistic diabetes care to prevent further cardiovascular complications. It is suggested that nursing staff at community health centers (Puskesmas) receive training in MBBE to provide structured non-pharmacological education to DM patients. For future researchers, it is recommended to conduct studies with a longer intervention period and use more stable glycemic indicators, such as HbA1c, to evaluate the long-term sustainability of the effects.

AUTHOR CONTRIBUTION

Denis Farida : Conceptualization and Study Design, Data Collection, Data Analysis, Manuscript Writing, Conceptualization and Study Design, Manuscript Writing, Review and Editing, Supervision.

Octo Zulkarnain : Conceptualization and Study Design, Manuscript Writing, Review and Editing, Supervision.

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CONFLICT OF INTEREST

In carrying out this research, there was no conflict of interest.

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