BRISK WALKING EXERCISE ON ANXIETY IN PATIENTS WITH TYPE 2 DIABETES MELLITUS: AN EXPERIMENTAL STUDY

Naura Almaghfira Asy'ghotillah[1], Upik Rahmi[2], Sehabudin Salasa[3]
[1,2,3]Program Studi Keperawatan; Fakultas Pendidikan Olahraga dan Kesehatan; Universitas Pendidikan Indonesia
*e-mail: *naura.almaghfira17@upi.edu*

ABSTRACT

Anxiety is a psychological problem commonly experienced by patients with type 2 diabetes mellitus (T2DM) and can worsen glycemic control and increase the risk of complications. Brisk walking exercise, as a simple form of aerobic physical activity, is known to have potential metabolic and psychological benefits. However, empirical evidence regarding its implementation in primary healthcare settings is still limited. This study aimed to analyze the role of brisk walking exercise on anxiety levels in patients with T2DM. This study employed a quantitative method with a quasi-experimental pretest-posttest with control group design. The sample was selected using a purposive sampling technique, consisting of 40 respondents, divided into an intervention group (n=20) and a control group (n=20). The sample size was determined based on sample size calculation for experimental design. The intervention group received a brisk walking exercise program three times per week for eight weeks. Anxiety levels were measured using the Depression Anxiety Stress Scale-42 (DASS-42) questionnaire. Data were analyzed using paired t-test and independent t-test. The results showed that brisk walking exercise was associated with a reduction in anxiety levels in patients with T2DM compared to the control group. Brisk walking exercise can be considered as an effective nursing intervention to reduce anxiety in patients with T2DM.

Keywords: Brisk walking exercise; Type 2 diabetes mellitus; Anxiety

INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic diseases characterized by chronic hyperglycemia resulting from impaired insulin secretion, insulin resistance, or a combination of both (Kumar et al., 2020). Type 2 diabetes mellitus (T2DM) is the most dominant form, accounting for more than 95% of all diabetes cases globally (WHO, 2024). The burden of T2DM has increased significantly among older adults. Global data show that the prevalence of diabetes in individuals aged 65 years and older exceeds 20% and continues to rise with advancing age (GBD 2021 Diabetes Collaborators, 2023). The International Diabetes Federation (2021) reported that 537 million adults were living with diabetes in 2021, and this number is projected to increase to 783 million by 2045 if prevention and control efforts are not optimally implemented.

The increasing prevalence of T2DM among adults and older populations is closely associated with age-related physiological changes that contribute to insulin resistance and the development of T2DM (Zhao & Yue, 2024). According to the American Diabetes Association (2022), these changes include decreased insulin sensitivity, reduced muscle mass, increased visceral fat accumulation, and

low levels of physical activity, all of which contribute to poor glycemic control in patients with T2DM. As a result, the management of T2DM in adults and older individuals becomes more complex and requires long-term adaptation, not only physically but also psychologically (Alwhaibi, 2024).

One of the most common psychological problems experienced by patients with T2DM is anxiety (Khan et al., 2019). Anxiety typically arises as a response to chronic illness, including concerns about long-term complications, the burden of lifelong disease management, and unstable blood glucose levels (Alwhaibi, 2024). Women are reported to have a higher prevalence of anxiety than men, influenced by biological factors such as fluctuations in estrogen and progesterone hormones, psychological factors including a greater tendency to express emotions, and social factors related to role demands within the family (Remes et al., 2016).

McInerney et al. (2022) reported that anxiety is a common psychological issue among patients with T2DM, with a prevalence ranging from 30% to 46.5%. Untreated anxiety can negatively affect glycemic control, reduce adherence to therapy, and increase the risk of chronic complications such as visual impairment, kidney damage, and amputation (Kodakandla et al., 2016). Therefore, the management of T2DM requires a comprehensive approach that not only focuses on pharmacological therapy but also includes non-pharmacological interventions that address both physical and psychological aspects, particularly in late adulthood and older populations (Tang et al., 2025).

One of the recommended non-pharmacological interventions for patients with T2DM is aerobic physical exercise. Sivapuram et al. (2020) stated that aerobic exercise in adults and older patients with T2DM plays a role in improving insulin sensitivity, enhancing glycemic control, and reducing the risk of cardiovascular complications. In addition to its metabolic benefits, aerobic exercise also contributes to reducing anxiety through neurobiological mechanisms, including increased release of endorphins, serotonin, dopamine, and gamma-aminobutyric acid (GABA), which are involved in mood regulation and stress response (Lin & Gao, 2023).

Aerobic exercise can be performed in various forms with light to moderate intensity. In adults with T2DM, the selection of exercise type should consider safety, feasibility, and sustainability. One form of moderate-intensity aerobic exercise that meets these criteria is brisk walking exercise, defined as walking at a faster pace than usual, characterized by increased step frequency and active body movement (Indarto et al., 2018; Kasmad et al., 2022). This type of exercise does not require special equipment and can be performed independently, making it suitable for implementation in primary healthcare settings. A study by Opoku et al. (2023) showed that an eight-week brisk walking program significantly reduced fasting blood glucose levels in patients with T2DM. From a psychological perspective, brisk walking has also been reported to contribute to anxiety reduction through regulation of the hypothalamic–pituitary–adrenal (HPA) axis, decreased cortisol levels, and increased endorphin release, which support psychological well-being (Maharaj & Nuhu, 2023).

Based on the above background, this study aims to analyze the role of brisk walking exercise on anxiety levels in patients with type 2 diabetes mellitus using a quasi-experimental pretest-posttest with control group approach.

Article History:
Received: January 24, 2026; Revised: March 25, 2026; Accepted: April 14, 2026

METHODS

This study employed a quantitative approach with a quasi-experimental design using a pretest–posttest control group. The study was conducted at UPTD Puskesmas Kujangsari, Bandung City, from September to December 2025, including the processes of administrative approval, intervention implementation, and outcome evaluation. The study population consisted of all patients with type 2 diabetes mellitus (T2DM) registered at the health center, totaling 560 individuals.

The study sample was selected using a purposive sampling technique. The sample size was determined using the Federer formula for experimental studies, $(t-1)(n-1) \geq 15$. With two groups ($t = 2$), the minimum required sample size was 16 participants per group. To account for potential dropouts and to enhance the statistical power, the sample size was increased to 20 participants per group, resulting in a total of 40 participants.

A total of 40 participants who met the inclusion criteria were enrolled in this study. The inclusion criteria were: aged ≥18 years, diagnosed with T2DM without gangrene complications, and having fasting blood glucose levels ≥126 mg/dL. The exclusion criteria included patients who were pregnant or planning pregnancy, currently participating in other physical exercise programs, or having severe mobility impairments that could hinder participation. Participants were then randomly assigned into two groups: an intervention group (n=20) and a control group (n=20).

The intervention group received a brisk walking exercise program for eight weeks, conducted three times per week. The exercise was performed at a pace of approximately 100 steps per minute, with progressively increasing duration: 12 minutes per session during weeks 1–4, 15 minutes during weeks 5–6, and 20 minutes during weeks 7–8. This gradual increase in duration was based on the study by Opoku et al. (2023), which demonstrated that a moderate-intensity brisk walking program with progressive duration is safe for patients with T2DM. The control group did not receive any structured exercise intervention but continued routine care and assessments according to the study schedule.

Data collection was conducted in two phases: before the intervention (pretest) and after completion of the intervention (posttest). Anxiety levels were measured using the Indonesian version of the Depression Anxiety Stress Scale-42 (DASS-42). The DASS-42, developed by Lovibond & Lovibond (1995), consists of three subscales: depression, anxiety, and stress, each comprising 14 items. In this study, only the anxiety subscale was used.

The Indonesian version of the DASS-42 was adapted and validated by Damanik (2011), who assessed its validity and reliability in both clinical and non-clinical populations. The instrument demonstrated excellent internal consistency, with a Cronbach's Alpha of 0.948. Specifically, the anxiety subscale showed high reliability, with a Cronbach's Alpha of 0.852, indicating good internal consistency. Item validity analysis also showed adequate item-total correlations across all items in the anxiety subscale. Therefore, the Indonesian version of the DASS-42 is considered valid and reliable for measuring anxiety levels in Indonesian populations.

The anxiety subscale consists of 14 items rated on a 4-point Likert scale (0–3), resulting in a total score ranging from 0 to 42. The scores were categorized according to the DASS guidelines as follows: normal (0–7), mild (8–9), moderate (10–14), severe (15–19), and extremely severe (≥20).

Data analysis was performed using SPSS software. Normality testing was conducted using the Shapiro–Wilk test. Differences in anxiety levels before and after the intervention within each group were analyzed using the paired t-test, while comparisons between groups were analyzed using the independent t-test. All statistical analyses were conducted at a significance level of 0.05. This study received ethical approval with the number 097/KEPK/FITKes-Unjani/XII/2025.

RESULTS

Table 1. Respondent Characteristics

Characteristics	Intervention		Control		Total	
	n=20	%	n=20	%	n=40	%
Gender						
Male	3	15	7	35	10	25
Female	17	85	13	65	30	75
Age						
Early Adulthood (26-35)	0	0	1	5	1	2,5
Mid-Adulthood (36 – 45)	1	5	2	10	3	7,5
Early Adults (46 – 55)	5	25	6	30	11	27,5
Late elderly (56 – 65)	7	35	6	30	13	32,5
Older adults (≥65)	7	35	4	20	11	27,5

Based on Table 1, the majority of respondents were female (75%), with similar patterns observed in both the intervention group (85%) and the control group (65%). In terms of age distribution, most respondents were aged 56–65 years (32.5%), followed by those aged 46–55 years and ≥65 years, each accounting for 27.5% of the total sample.

Table 2. Distribution of Fasting Blood Glucose Levels Before and After Intervention

Group	N	Min (mg/dL)	Max (mg/dL)	Mean (mg/dL)	SD
Intervention					
FBG Pre-test	20	126	428	183,20	81,53
FBG Post-test	20	81	288	148,10	61,26
Kontrol					
FBG Pre-test	20	128	500	242,15	96,08
FBG Post-test	20	114	500	223,30	107,94

Based on Table 2, the intervention group showed a decrease in the mean fasting blood glucose level from 183.20 ± 81.53 mg/dL to 148.10 ± 61.26 mg/dL after the intervention. Meanwhile, the control group also experienced a reduction; however, the decrease was smaller, from 242.15 ± 96.08 mg/dL to 223.30 ± 107.94 mg/dL.

Article History:
Received: January 24, 2026; Revised: March 25, 2026; Accepted: April 14, 2026

Table 3. Anxiety Levels of Respondents Before and After Intervention

Anxiety Level	Intervention		Control	
	n=20	%	n=20	%
Pre-test				
Normal	5	25	6	30
Mild	4	20	2	10
Moderate	9	45	10	50
Severe	2	10	2	10
Extreme Severe	0	0	0	0
Post-test				
Normal	13	65	3	15
Mild	6	30	4	20
Moderate	1	5	10	50
Severe	0	0	3	15
Extreme Severe	0	0	0	0

Based on Table 3, before the intervention, the majority of respondents in both the intervention and control groups were at a moderate level of anxiety, accounting for 45% and 50%, respectively. After the intervention, the intervention group showed improvement, indicated by an increase in the proportion of respondents with normal anxiety levels to 65% and mild anxiety to 30%, along with a decrease in moderate anxiety to 5%, with no severe anxiety observed. Meanwhile, in the control group, moderate anxiety remained the most dominant category at 50%, with only minimal changes observed in other categories.

Normality and Homogeneity Tests

Based on the results of the Shapiro–Wilk normality test presented in Table 4, all anxiety level data in both the intervention and control groups were normally distributed, as indicated by p-values greater than 0.05. In the intervention group, the p-values were 0.304 for the pre-test and 0.071 for the post-test. Meanwhile, in the control group, the p-values were 0.126 for the pre-test and 0.617 for the post-test. In addition, the results of the homogeneity of variance test using Levene's Test showed a significance value of 0.818 ($p > 0.05$), indicating that the variance of anxiety levels between the intervention and control groups was homogeneous. Therefore, the data in this study met the assumptions of normality and homogeneity of variance and were appropriate for further analysis using parametric statistical tests.

Table 5. Paired Samples t-Test Results

Group	N	Mean ± SD	Mean Difference	P-Value
Intervention				
Pre-test	20	9.60 ± 3.331	3.850	0.001
Post-test	20	5.75 ± 2.863		
Control				
Pre-test	20	9.85 ± 3.829	-1.100	0.138
Post-test	20	10.95 ± 3.203		

Based on the paired samples t-test results presented in Table 5, the intervention group showed a statistically significant reduction in anxiety levels, from 9.60 ± 3.331 at pre-test to 5.75 ± 2.863 at post-test, with a mean difference of 3.850 and a p-value of 0.001 ($p < 0.05$). In contrast, the control

group did not show a statistically significant change in anxiety levels, with a p-value of 0.138 ($p > 0.05$), indicating no meaningful difference between pre-test and post-test scores.

Table 6. Independent Samples t-Test Results

Group	N	Mean ± SD	Mean Difference	P-Value
Intervention	20	3.85 ± 3.031	4.950	0.001
Control	20	-1.10 ± 3.177		

Based on the independent samples t-test results presented in Table 6, the mean change in anxiety levels in the intervention group was 3.85 ± 3.031, whereas in the control group it was -1.10 ± 3.177. The statistical analysis showed a p-value of < 0.001, indicating a significant difference in the change of anxiety levels between the intervention and control groups.

DISCUSSION

The results of this study showed that the majority of respondents in both the intervention and control groups were female. In addition, most respondents were categorized as older adults, particularly within the early elderly to late elderly age groups. This reflects that the study involved a population at high risk for metabolic disorders and psychological problems, such as anxiety, in patients with type 2 diabetes mellitus.

Based on fasting blood glucose measurements, the intervention group demonstrated an improvement in glycemic control following the intervention, whereas the control group showed only minimal changes during the observation period. These findings suggest that the intervention contributed to improvements in the respondents' metabolic condition. Furthermore, the distribution of anxiety levels indicated that, prior to the intervention, the majority of respondents in both groups were in the moderate anxiety category.

After the intervention, the intervention group experienced a shift toward lower anxiety levels, as evidenced by an increased proportion of respondents with normal and mild anxiety and a decrease in moderate anxiety, with no cases of severe anxiety observed. In contrast, the control group remained dominated by moderate anxiety levels, with relatively limited changes.

The difference in changes in anxiety levels between the intervention and control groups indicates that brisk walking exercise is associated with a reduction in anxiety levels among patients with type 2 diabetes mellitus. Without structured physical activity interventions, changes in anxiety levels tend to be less optimal.

These findings are consistent with previous studies. Remes et al. (2016) reported that patients with chronic illnesses, including type 2 diabetes mellitus, are more vulnerable to anxiety. Women are known to have a higher prevalence of anxiety compared to men, influenced by biological, psychological, and social factors. In addition, older adults are more susceptible to anxiety due to declining physical function, increased dependence on healthcare services, and concerns about disease complications (Wolitzky-taylor et al., 2010). This highlights that patients with type 2 diabetes mellitus require attention not only to physical aspects but also to psychological well-being.

Moreover, Maulasari (2020) stated that anxiety in patients with type 2 diabetes mellitus is often associated with concerns about fluctuations in blood glucose levels and the risk of complications, such as neuropathy, visual

Article History:
Received: January 24, 2026; Revised: March 25, 2026; Accepted: April 14, 2026

impairment, and cardiovascular disease. These conditions may influence patients' perceived control over their illness and reinforce anxiety responses. Therefore, interventions that can improve both physical and psychological conditions are essential in the management of type 2 diabetes mellitus.

Brisk walking exercise, as a form of moderate-intensity aerobic physical activity, is known to provide metabolic benefits, such as improving insulin sensitivity and enhancing glucose uptake by skeletal muscles, thereby helping to reduce blood glucose levels (Opoku et al., 2023). Improved glycemic control may indirectly contribute to reduced anxiety, as patients develop a better perception of their health condition.

In addition, aerobic physical activity plays a role in improving emotional regulation and individual coping abilities. Regular exercise has been shown to enhance self-efficacy, defined as an individual's belief in their ability to manage their health condition, which is associated with reduced psychological distress and anxiety (Ataya et al., 2024). In patients with type 2 diabetes mellitus, increased self-efficacy may help individuals feel more capable of controlling their condition, thereby reducing excessive anxiety.

From a neurobiological perspective, aerobic physical activity such as brisk walking can influence the central nervous system by reducing the activity of the hypothalamic–pituitary–adrenal (HPA) axis and lowering cortisol levels. In addition, physical exercise increases the release of neurotransmitters such as serotonin, dopamine, and norepinephrine, which play important roles in mood stabilization and anxiety regulation (Stubbs et al., 2016; Lin & Gao, 2023). These mechanisms explain how physical activity can provide psychological benefits for patients with chronic diseases.

The findings also showed that the control group, which did not receive structured physical activity intervention, did not experience meaningful changes in anxiety levels. This suggests that routine management without additional non-pharmacological interventions may not be sufficient to optimally address the psychological aspects of patients. This result is consistent with the study by Reza et al. (2019), which demonstrated that structured aerobic exercise can reduce anxiety and improve psychological well-being in patients with type 2 diabetes mellitus.

Clinically, brisk walking exercise is a simple, safe, low-cost, and easily implementable intervention in primary healthcare settings. It can be integrated into promotive and preventive programs as part of holistic nursing care to improve both physical and mental health outcomes in patients with type 2 diabetes mellitus.

STUDY LIMITATIONS

This study has several limitations. One of the main limitations is the imbalance in gender distribution between the intervention and control groups, with female respondents being more dominant in both groups. Theoretically, women tend to have higher levels of anxiety compared to men, which may have influenced the study results. This imbalance in respondent characteristics could act as a confounding factor in interpreting changes in anxiety levels. Therefore, future studies are recommended to consider a more balanced gender distribution to enhance representativeness and improve internal validity.

CONCLUSION AND RECOMMENDATIONS

This study demonstrates that brisk walking exercise has a significant effect on reducing anxiety levels in patients with type 2 diabetes mellitus at UPTD Puskesmas Kujangsari, Bandung. Patients who participated in structured brisk walking exercise showed greater improvement in psychological condition compared to those who only received routine diabetes management without planned physical activity interventions.

In addition to its psychological benefits, brisk walking exercise also has the potential to improve blood glucose control through enhanced insulin sensitivity and better metabolic regulation. These findings indicate that a simple physical activity intervention can provide dual benefits, addressing both the physical and mental health aspects of patients with type 2 diabetes mellitus.

Future studies are recommended to involve larger sample sizes and longer intervention durations to evaluate the long-term effects of brisk walking exercise on anxiety levels and glycemic control in patients with type 2 diabetes mellitus. Furthermore, future research may consider assessing additional variables such as daily physical activity levels, self-efficacy, social support, and quality of life to provide a more comprehensive understanding of the mechanisms underlying anxiety reduction in this population.

ACKNOWLEDGMENT

The authors would like to express their gratitude to their family for providing financial support for this study.

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Article History:
Received: January 24, 2026; Revised: March 25, 2026; Accepted: April 14, 2026

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Article History:
Received: January 24, 2026; Revised: March 25, 2026; Accepted: April 14, 2026