

The relationship between physical activity and disease duration on stress levels in patients with Diabetes Mellitus at the Krobokan community health center

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Abstract

Background: Diabetes mellitus (DM) is a chronic metabolic disease that requires long-term management, in which psychological factors such as stress can worsen a patient's condition.

Objective: This study aims to determine the relationship between physical activity and disease duration on stress levels in DM patients at the Krobokan Community Health Center.

Methods: The study employed a quantitative correlational design with a cross-sectional approach involving 67 respondents selected using the Slovin formula. Research instruments included the Global Physical Activity Questionnaire (GPAQ) and the Perceived Stress Scale (PSS).

Results: The results showed that the majority of respondents were in the 45–60 age group (53.7%), were female (79.1%), and had moderate levels of physical activity (52.2%). The Spearman's rank correlation test revealed a significant positive relationship between physical activity and stress levels ($r = 0.385$; $p = 0.001$) as well as between treatment duration and stress levels ($r = 0.594$; $p = 0.000$).

Conclusion: As physical activity increases and the duration of treatment lengthens, stress levels tend to rise. Healthcare professionals are encouraged to provide psychological support and appropriate stress management education as part of physical activity management programs for patients with diabetes mellitus.

Keywords

diabetes mellitus; duration of disease; physical activity; stress level

1. Introduction

Diabetes mellitus (DM) is a group of chronic metabolic diseases characterized by elevated blood glucose levels (hyperglycemia) due to impaired insulin secretion, insulin action, or both (Schleicher et al., 2022). Insulin is a hormone produced by the pancreas that regulates blood glucose balance; when insulin is insufficient or ineffective, glucose accumulates in the blood. In DM, this dysfunction also affects the metabolism of carbohydrates, fats, and proteins, thereby impairing the function of various organs. Clinically, DM is often recognized by symptoms such as frequent urination, excessive thirst, constant hunger, and unexplained weight loss. In the long term, uncontrolled DM can cause chronic damage to the eyes, kidneys, nerves, heart, and blood vessels, making it one of the world's leading health problems (Satyam Mishra et al., 2024).

According to 2022 data from the International Diabetes Federation (IDF), there are 8.75 million people with DM worldwide. Results from the 2023 Indonesian Health Survey (SKI) indicate that the prevalence of diabetes mellitus, based on blood glucose level tests among individuals aged ≥ 15 years, is 11.7%. However, the prevalence of diabetes mellitus based on a doctor's diagnosis among the population aged 15 years and older was 2.2% (Ministry of Health of the Republic of Indonesia, 2023). The number of people with diabetes mellitus in Semarang City was 34,561 in 2024, a decrease compared to 2023, when the number was 41,468. All subdistricts in Semarang City have achieved 100% coverage for people with diabetes mellitus receiving health care services in accordance with standards. Based on data from the 2024 noncommunicable disease profile of the Krobokan Community Health Center, there were 688 people with diabetes mellitus in the Krobokan Community Health Center's service area, and 325 of them participated in the Prolanis program at the Krobokan Community Health Center (Semarang City Health Department, 2024).

One of the reasons for the high prevalence of diabetes mellitus in Semarang is stress, which can worsen patients' conditions (Ingrosso et al., 2023). Stress is the body's response to external demands that exceed an individual's ability to cope with and resolve those problems. Efforts to manage stress caused by the disease include accepting the reality of the situation, praying and worshipping God to seek help when facing a problem, and seeking moral support, understanding, and sympathy from others to alleviate feelings of discomfort. Effective and appropriate coping strategies will empower patients to adapt to or cope with stress (Saragih et al., 2024).

One way for people with diabetes to manage stress is through physical activity. Physical activity has been shown to reduce stress by lowering stress hormones (such as cortisol) and increasing "feel-good" hormones like endorphins and dopamine, thereby stabilizing mood (YILAI et al., 2025). Effective forms of exercise include brisk walking, jogging, swimming, cycling, and mind-body exercises such as yoga or qigong at a light-to-moderate intensity, for about 30–60 minutes, 3–5 times per week. Regular exercise helps reduce anxiety, depression, and stress in students, workers, and older adults, while also improving sleep quality and quality of life (Dwi Nugroho et al., 2025; Guerriero et al., 2025; Nugroho et al., 2023a). For better results, choose activities you enjoy and can do regularly, as programs that are too strenuous tend to be less effective than shorter, lighter, yet consistent workouts. Physical activity also trains the ability to manage emotions and perceive stress, so that over time, mental resilience to life's pressures increases (Sabri et al., 2023).

Diabetes mellitus is a disease whose incidence is increasing every year; this rise is driven by unhealthy lifestyle patterns. Characterized by elevated blood sugar levels, this condition is caused not only by pathophysiological factors but is also significantly influenced by other factors such as physical activity and stress. This study aims to investigate the relationship between physical activity and disease duration on stress levels in patients with diabetes mellitus.

2. Methods

2.1 Research Design

This study is a quantitative study using a correlational approach. The independent variables in this study include physical activity and duration of the disease, while the dependent variable is stress levels. This approach was used to analyze the relationship between the independent variables and the dependent variable.

2.2 Setting and Samples

The study was conducted in the service area of the Krobokan Community Health Center in Semarang in November 2025. The population for this study consisted of 80 diabetes mellitus patients who were regular visitors to the Krobokan Community Health Center. The sample for this study was determined using the Solfin formula, resulting in 67 respondents. Sample selection used the following inclusion and exclusion criteria: Inclusion criteria: Patients willing to serve as respondents; patients with diabetes mellitus (DM) who are capable of independent activities. Exclusion criteria: Patients with diabetes mellitus who do not attend Prolanis activities regularly; patients with DM who have acute illnesses or severe complications.

2.3 Measurement and data collection;

The instruments used in this study consisted of two main instruments: *the Perceived Stress Scale* (PSS) and the GPAQ (Global Physical Activity Questionnaire). *The Perceived Stress Scale* (PSS) is a questionnaire used to measure an individual's psychological stress levels. The PSS-10 questionnaire consists of 10 questions, including 6 negative questions and 4 positive questions. The negative questions are numbers 1, 2, 3, 6, 9, and 10, with a maximum score of 0–24 on the Perceived Stress Scale (PSS) questionnaire. The second questionnaire is the GPAQ (Global Physical Activity Questionnaire), which measures an individual's physical activity through 16 questions, consisting of: P1–P6 (Activities during study/work); P7–P9 (Travel to and from activity locations); P10–P15 (Recreational activities); and P16 (Sedentary activities).

2.4 Data analysis;

The validity of the PSS (*Perceived Stress Scale*) questionnaire was tested, yielding a calculated r value of 0.429. Based on a 5% significance level and a sample of 32 patients, the table r value was 0.349; therefore, based on Werdani's validity test, since the calculated r for the questionnaire items was greater than 0.349, it was determined that all questionnaire items are valid. Meanwhile, the reliability test using Cronbach's Alpha yielded a value of $\alpha = 0.950$. Therefore, the reliability test results indicate that the Perceived Stress Scale (PSS) questionnaire is reliable. Meanwhile, the GPAQ (Global Physical Activity Questionnaire) underwent a validity test, in which the 16 items to be administered yielded correlation indices ranging from 0.156 to 0.865, with a table r value of 0.113. The reliability coefficient was 0.754, meaning that *the Global Physical Activity Questionnaire* (GPAQ) was deemed reliable because it had a Cronbach's alpha value > 0.6 ; thus, it can be concluded that the instruments used in this study have high reliability.

2.5 Ethical Considerations.

An ethics review was conducted at Pekalongan University under number 029/B.02.01/KEPK/II/2026.

3. Results

3.1. Overview of the Study Location

The Krobokan Community Health Center (UPTD Puskesmas Krobokan) is located at Jalan Aribuana No. 1, Krobokan Village, West Semarang District, Semarang City. Administratively, its service area covers three neighborhoods: Krobokan, Tawangmas, and Tawang Sari. The

Krobokan Community Health Center's service area encompasses lowland neighborhoods spanning 543 hectares at an elevation of 2.5 meters above sea level.

3.2. Respondent Characteristics

The results of the study on respondent characteristics based on age show that the majority of respondents fall within the 45–60 age group, totaling 37 people (53.7%). The age group over 60 ranks second with 25 people (38.8%), while the 25–44 age group has the fewest respondents, totaling 5 people (7.5%).

By gender, the majority of respondents were women, totaling 53 (79.1%), while men numbered 14 (20.9%). In terms of highest level of education, the majority of respondents had a high school diploma or equivalent (39 people, 58.2%), followed by junior high school or equivalent (15 people, 22.4%), elementary school or equivalent (11 people, 16.4%), and the smallest group held an associate's or bachelor's degree (2 people, 3%). Based on duration of treatment, the majority of respondents had been undergoing treatment for less than 5 years (16 people, 23.9%), 6–10 years (48 respondents, 71.6%), while 3 people (4.5%) had been undergoing treatment for 11 years or more.

Based on the results of the study involving 67 respondents, physical activity levels were divided into three categories: light, moderate, and high. The majority of respondents engaged in moderate physical activity, totaling 35 people (52.2%). There were 29 respondents (43.3%) with high physical activity levels, while 3 respondents (4.5%) engaged in light physical activity.

3.3. The Relationship Between Physical Activity and Stress Levels in Patients with Diabetes Mellitus

Table 3 shows that of the 67 respondents, the majority reported moderate physical activity levels with moderate stress levels ($n = 20$), followed by high physical activity levels with high stress levels ($n = 19$) and moderate physical activity levels with high stress levels ($n = 10$). Spearman's correlation analysis revealed a significant positive relationship between physical activity level and stress level in patients with diabetes mellitus ($r = 0.385$, $p\text{-value} = 0.001$), indicating a moderate strength of correlation.

3.4. Relationship Between Duration of Treatment and Stress Levels in Patients with Diabetes Mellitus

Table 4 shows that of the 67 respondents, the majority had a treatment duration of ≤ 5 years with high stress levels ($n = 23$), followed by those with a treatment duration of ≤ 5 years and moderate stress levels ($n = 16$), and those with a treatment duration of 6–10 years and moderate stress levels ($n = 12$). Spearman's correlation analysis revealed a significant positive relationship between treatment duration and stress levels in patients with diabetes ($r = 0.594$, $p\text{-value} = 0.000$), indicating that there is a significant association between stress levels and treatment duration. The strength (coefficient) of the relationship falls into the "moderate" category, and the positive direction of the relationship indicates a direct correlation.

4. Discussion

The study was conducted in the service area of the Krobokan Community Health Center, which is an area with high population density and many unhealthy environments. Dense and unhealthy urban environments can affect both the physical and mental health of their residents. Various studies have shown that a combination of pollution, noise, building density, and a lack of green spaces increases the risk of stress, anxiety, and depressive disorders (Wang and Liu, 2023). Urban environmental profiles characterized by social deprivation, air pollution, dense road networks, and land density are associated with symptoms of depression, anxiety, and emotional instability, mediated by changes in brain volume in stress-processing areas (Xu et al., 2023).

The results of a study involving 67 respondents showed that the majority—37 people (53.7%)—were in the 45–60 age group. Age increases the risk of developing type 2 diabetes and makes its management and complications more complex. Aging alters metabolism and organ function, making blood sugar levels more prone to fluctuations. Among older adults with DM, complications such as heart and kidney disease, hypoglycemia, cognitive impairment, and a reduced quality of life occur more frequently. Therefore, in older adults, earlier prevention, close monitoring, and more careful, individualized treatment management are required (Ridha and Dwi Nugroho, 2025; Yan et al., 2023).

The majority of diabetes mellitus patients in this study were women, totaling 53 individuals (79.1%), while men numbered 14 (20.9%). In terms of highest level of education, the majority of respondents had a high school diploma or equivalent, totaling 39 participants (58.2%); and based on duration of treatment, most respondents had been undergoing treatment for 6–10 years, totaling 48 participants (71.6%). Gender influences the age at onset of DM, obesity patterns, and the type and severity of complications, with women often bearing a greater burden of cardiovascular and psychological complications even though they are sometimes diagnosed later. Prevention and management of diabetes should ideally be tailored to age and gender, with special attention to obesity, blood pressure, lipids, and social factors (Asih et al., 2025; F. I. and H. C., 2025).

Physical activity levels were divided into three categories: light, moderate, and vigorous. The majority of respondents engaged in moderate physical activity, totaling 35 people (52.2%). There were 29 respondents (43.3%) with high physical activity levels, while 3 respondents (4.5%) engaged in light physical activity. Regular physical activity is strongly associated with better blood sugar control, a reduced risk of cardiovascular and microvascular complications, weight loss/BMI reduction, and improved quality of life. Regular aerobic exercise (alone or combined with strength training) serves as a safe and effective complement to medical therapy, provided it is performed with proper medication dosing and good blood glucose monitoring (Nugroho et al., 2023b; Shah et al., 2021).

In patients with diabetes, psychological stress and physical activity are interrelated with blood glucose control, quality of life, and disease burden. Higher levels of physical activity are consistently associated with lower levels of stress/psychological distress and better mental well-being. However, high stress is also associated with lower physical activity, so an ideal DM management program should combine interventions to increase physical activity and manage stress simultaneously (Mortensen et al., 2022).

Psychological distress in patients with diabetes is very common and is associated with blood glucose control and quality of life. The question is: does a longer duration of illness or treatment always mean higher stress levels? The duration of treatment or the length of time a person has had diabetes is indeed associated with stress levels, but this relationship is not straightforward and is heavily mediated by complications, type of therapy, blood glucose control, and psychosocial factors. This means that the clinical focus should not be solely on how long a patient has been ill, but on the clinical conditions and life burdens accompanying each phase of the disease course (Parsa et al., 2019; Authors et al., 2022; Siddharthan et al., 2021).

5. Implications and Limitations

5.1. Implications

a. For Healthcare Institutions

The results of this study are expected to enhance healthcare providers' education of patients with diabetes mellitus regarding the importance of regular physical activity and to provide psychological support to help patients manage stress during treatment.

b. For Widya Husada University, Semarang

This study is expected to contribute to advancements in the field of nursing science.

c. For People with Diabetes

- d. This study is expected to provide information to people with diabetes, their families, and the community so they can support people with diabetes in improving their quality of life.
- e. For Future Researchers
Future research is expected to examine other factors that may influence stress levels in patients with diabetes mellitus, such as family support, duration of the disease, adherence to treatment, and quality of life, thereby providing a more comprehensive picture of the psychological condition of patients with diabetes mellitus.

5.2. Limitations

This study has several limitations that should be considered when interpreting the results. First, the study used a cross-sectional design, so it can only describe the relationship between physical activity, duration of the disease, and stress levels at a single point in time, without being able to explain a cause-and-effect relationship. Second, the study was conducted only on diabetes patients receiving treatment at the Krobokan Community Health Center, so the results have limitations in terms of generalizability to the population of diabetes patients at other health facilities or in different regions. Third, the study did not account for several other factors that could potentially influence stress levels, such as glycemic control (HbA1c), the presence of diabetic complications, family support, socioeconomic status, comorbidities, and adherence to treatment. Therefore, future studies are recommended to use a longitudinal or cohort design with a broader sample size and to include these confounding variables in order to obtain a more comprehensive picture of the relationship.

6. Conclusion

- a. The majority of respondents were in the pre-elderly group (45–59 years old), were female, and had completed high school or its equivalent.
- b. Most patients with diabetes mellitus had a moderate level of physical activity.
- c. The majority of respondents had been receiving treatment for diabetes mellitus for less than 5 years.
- d. Most respondents experienced high levels of stress, followed by moderate stress, and only a small proportion experienced low stress.
- e. Spearman's correlation test revealed a significant relationship between physical activity and stress levels ($r = 0.385$; $p = 0.001$). This positive relationship indicates that the higher the respondents' physical activity, the higher their stress levels.
- f. The results of the Spearman correlation test also showed a significant relationship between duration of treatment and stress levels ($r = 0.594$; $p < 0.001$). This relationship was of moderate strength and positive in direction, meaning that the longer the treatment, the higher the respondents' stress levels tended to be.

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Author Contributions

The first author was responsible for conceptualizing the research, developing the methodology, collecting data, analyzing and interpreting the data, drafting the initial manuscript, visualizing the data, and revising the manuscript. Meanwhile, the second author was responsible for conceptualizing the research, providing supervision, validating the methodology and analysis results, providing scientific input, critically reviewing and editing the manuscript, and giving final approval for the manuscript to be published.

Conflict of Interest

The authors declare that there are no conflicts of interest in the research, writing, or publication of this article. The relationship between students and faculty members in this study is part of the academic advising process in accordance with the applicable regulations at the institution and does not affect the objectivity of the research or the reporting of research results.

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Table

Table 1. Distribution of Characteristics of Patients with Diabetes Mellitus (n=67)

Respondent Characteristics		Frequency	Percentage (%)
Age	12–24 Years	0	0
	25–44 years	5	7.5
	45–60 years	37	53.7
	> 60 years	25	38.8
Gender	Male	14	20.9
	Female	53	79.1
Highest Level of Education	Elementary School/Equivalent	11	16.4
	Junior High School/Equivalent	15	22.4
	High School or Equivalent	39	58.2
	Diploma/Bachelor's Degree	2	3
Duration of Treatment	≤ 5 years	16	23.9
	6–10 years	48	71.6
	≥ 11 years	3	4.5
Total		67	100

Table 2. Distribution of Characteristics of Patients with Diabetes Mellitus (n=67)

Respondent Characteristics		Frequency	Percentage (%)
Age	12–24 Years	0	0
	25–44 years	5	7.5
	45–60 years	37	53.7
	> 60 years	25	38.8
Gender	Male	14	20.9
	Female	53	79.1
Highest Level of Education	Elementary School/Equivalent	11	16.4
	Junior High School/Equivalent	15	22.4
	High School or Equivalent	39	58.2
	Diploma/Bachelor's Degree	2	3
Duration of Treatment	≤ 5 years	16	23.9
	6–10 years	48	71.6
	≥ 11 years	3	4.5
Total		67	100

Table 3 Distribution of Characteristics of Diabetes Mellitus Patients Based on Physical Activity Level (n=67)

Respondents' Physical Activity Levels	f	%
Light Activity	3	4.5
Moderate Activity	35	52.2
High Activity	29	43.3
Total	67	100

Table 4. Spearman's Rank Correlation Test of the Relationship Between Activity Level and Stress Level (n=67)

Stress Levels of Diabetes Mellitus Patients											
Variable	Category	Patients						Total		P-value	r
		Mild		Moderate		High					
		f	%	f	%	f	%	f	%		
Physical Activity Level	Low	1	66.7	1	0	1	33.3	3	100	0.001	0.385
	Moderate	5	14.3	20	60	10	25.7	35	100		
	Tall	2	10.3	8	20.7	19	69	29	100		
Total		8	14.9	29	40.3	30	44.8	67	100		

Table 5. Results of the Spearman Rank Test on the Relationship Between Duration of Treatment and Stress Levels (n = 67)

Variable	Category	Stress Levels of Diabetes Mellitus Patients								<i>P-value</i>	<i>r</i>
		Mild		Moderate		High		Total			
		f	%	f	%	f	%	f	%		
Treatment Duration	≤ 5 Years	7	10.4	16	23.8	23	34.3	46	68.6	0.000	0.594
	6–10 Years	1	1.5	12	17.9	6	8.9	19	28.3		
	≥ 11 years	0	0	1	1.5	1	1.5	2	3.1		
Total		8	11.9	29	43.3	30	44.8	67	100		