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Original Research

The Role of Physical Activity in Reducing Random Blood Glucose Levels Among Elderly Patients with Type 2 Diabetes Mellitus

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ABSTRACT

Introduction: *Physical activity is one of the factors that affect blood sugar levels in patients with diabetes mellitus. Decreased blood glucose caused by increased active muscle use. The purpose of this study was to determine the relationship between physical activity and random blood sugar levels in elderly patients with type 2 diabetes mellitus. The location of this study was at PKU Muhammadiyah Gamping Hospital.*

Methods: *The study was conducted quantitatively correlationally with a cross-sectional study approach. The sampling method used accidental sampling with the Slovin formula, obtaining a sample size of 75 respondents based on inclusion and exclusion criteria.*

Results: *The results showed that the majority of respondents had poor random blood sugar levels as many as 33 people (44%) and high physical activity as many as 36 people (48.0%). While respondents with high physical activity mostly had normal random blood sugar as many as 23 people (63.9%). The results of the Kendall Tau test showed that P = 0.000 (p <0.05) so Ho was rejected and Ha was accepted.*

Conclusion: *The conclusion of this study is that there is a relationship between physical activity and random blood sugar levels in elderly patients with type 2 diabetes mellitus at PKU Muhammadiyah Gamping Hospital. The closeness value obtained is -0.536, which means that both variables have a moderate relationship strength with a negative relationship direction. High physical activity has the potential to reduce blood sugar levels in elderly DM patients.*

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Introduction

Diabetes mellitus (DM) is a chronic disease caused by insulin resistance or dysfunction of insulin production (Perkumpulan Endrokinologi Indonesia, 2019). According to the World Health Organization (WHO), diabetes mellitus is a chronic metabolic disorder with multiple etiologies, characterized by elevated blood glucose levels and associated with disturbances in carbohydrate, lipid, and protein metabolism due to insufficient insulin function (WHO, 2020).

The International Diabetes Federation (IDF) estimates that the number of people with diabetes mellitus will rise to 578.4 million by 2030 and further increase to 700.2 million by 2045 (Rosita dkk., 2022). In Indonesia, WHO reports project an increase in DM cases from 8.4 million in 2020 to 21.3 million by 2030, making Indonesia the fourth-highest country in the world in terms of DM prevalence (Biologi dkk., 2021). Hospital data from the Province of Yogyakarta in 2021 showed that

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83,568 individuals were diagnosed with DM, based on the Integrated Disease Surveillance Report (STP) from hospitals in the region (Profil Kesehatan DIY, 2021).

A diabetes mellitus diagnosis is confirmed when random blood glucose exceeds 200 mg/dL and fasting blood glucose exceeds 126 mg/dL (Meilani dkk., 2022). Poorly controlled DM significantly increases the risk of complications, including hyperglycemia, macrovascular, and microvascular complications (Depkes, 2015). hese complications can lead to disability or even death, emphasizing the importance of maintaining blood glucose control. According to the IDF, blood glucose management in diabetic patients is supported by four key pillars: physical activity, dietary regulation, blood glucose monitoring, and foot care (Biologi dkk., 2021.).

Physical activity refers to any bodily movement that results in energy expenditure. This process involves skeletal muscle contractions that create movement and require energy output (Riyanto & Mudian, 2020) It is one of several factors that influence blood glucose levels in diabetic patients. During physical activity, blood glucose levels decrease due to increased utilization by active muscles (Kaunang dkk., 2021). keletal muscles uptake glucose from the bloodstream to meet energy demands, thereby contributing to the regulation of blood glucose levels (Alza dkk., 2020).

As described above, uncontrolled diabetes mellitus can lead to severe complications that impair cellular functions. One of the most affected systems is the cardiovascular system, resulting in conditions such as atherosclerosis and retinopathy due to persistent hyperglycemia (Milita dkk., 2021.) In addition, DM can impair kidney function and damage nerves (Meilani dkk., 2022). Diabetic patients are five times more likely to experience gangrene due to delayed wound healing caused by high blood glucose levels. DM-related complications contribute to 6.7% of all deaths, making it the third leading cause of mortality in Indonesia (Adi Soelistijo dkk., 2021). To address these complications, physical activity plays a crucial role in helping regulate blood glucose levels, particularly among elderly individuals with diabetes. Therefore, this study aims to investigate the relationship between physical activity and random blood glucose levels among elderly patients with type 2 diabetes mellitus at PKU Muhammadiyah Gamping Hospital.

Method

This study employed a quantitative correlational design using a cross-sectional approach. The study population consisted of elderly individuals aged 55–74 years who were outpatients diagnosed with type 2 diabetes mellitus at the internal medicine clinic of PKU Muhammadiyah Gamping Hospital. A total of 75 respondents were selected using accidental sampling. The inclusion criteria for this study were: elderly individuals aged 55–74 years, outpatients at PKU Muhammadiyah Gamping Hospital, and those who provided informed consent to participate. Exclusion criteria included: elderly individuals with dementia, those with a history of hospitalization within the last seven days, and those experiencing emergency medical conditions.

Data collection tools included a demographic questionnaire and a physical activity questionnaire. Physical activity data were measured using the Global Physical Activity Questionnaire (GPAQ), while random blood glucose levels were assessed using a glucometer. The results of blood glucose measurements were recorded on an observational laboratory sheet, which was integrated with the respondents' demographic data. Data were analyzed using the Kendall Tau correlation test to examine the relationship between the two variables. Ethical approval for this research was granted by the Health Research Ethics

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Committee of PKU Muhammadiyah Gamping Hospital under approval number 018/KEP-PKU/I/2025.

Results

The **Table 1.** Respondent Characteristics

Characterictic	Frequency (n)	Percentage (%)
Gender		
Male	31	41,3
Female	44	58,7
Age		
55 – 60 year	29	38,7
61 – 65 year	26	34,7
66 – 70 year	10	13,3
71 – 74 year	10	13,3
Occupation		
Farmer	4	5,3
Laborer	10	13,3
Trader	12	16,0
Unemployed	10	13,3
Housewife	22	29,3
Others	17	22,7
Duration of DM		
< 1 year	12	16,0
1 – 5 year	31	41,3
5 – 10 year	18	24,0
>10 year	14	18,7

Source: Primary Data, 2025

Table 1 shows that the majority of respondents were female (44 individuals or 58.7%). In terms of age, most respondents were between 55 and 60 years old (29 individuals or 38.7%). Regarding occupational characteristics, the highest number of respondents were housewives (22 individuals or 29.3%). A total of 31 respondents (41.3%) had been diagnosed with diabetes mellitus for 1 to 5 years.

Table 2. Distribution of Physical Activity Among DM Patients

Physical Activity Level	Frequency (n)	Percentage (%)
Low	12	16,0
Moderate	27	36,0
High	36	48,0
Total	**75**	**100,0**

Source: Primary Data, 2025

Table 2 indicates that the majority of respondents had high physical activity (36 individuals or 48.0%), followed by moderate physical activity (27 individuals or 36.0%), and low physical activity (12 individuals or 16.0%).

Table 3. Distribution of Random Blood Glucose Levels

RBG Category	Frequency (n)	Percentage (%)
Poor	33	44,0
Moderate	14	18,7
Normal	28	37,3
Total	**75**	**100,0**

Source: Primary Data, 2025

Table 3 shows that most respondents had poor random blood glucose (RBG) levels, with 33 individuals (44.0%).

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Table 4. The Relationship Between Physical Activity and Random Blood Glucose (RBG) Levels

Physical Activity	Random Blood Glucose Level						Total		*Kendall Tau P Value*	Correlation Strength
	Poor		Moderate		Normal					
	F	%	F	%	F	%	N	%		
Low	11	91,7	1	8,3	0	0,0	12	100,0	0,000 (<0,05)	-0,536 (Moderate)
Moderate	15	55,6	7	25,9	5	18,5	27	100,0		
High	7	19,4	6	16,7	23	63,9	36	100,0		
Total	33	44,0	14	18,7	28	37,3	75	100,0		

Source: Primary Data, 2025

Table 4 shows that most respondents with high physical activity had normal RBG levels (23 individuals or 63.9%), while most respondents with low physical activity had poor RBG levels (11 individuals or 91.7%). The Kendall Tau statistical test, a significant relationship was found between physical activity and random blood glucose levels with a p-value of 0.000 (<0.05). The correlation coefficient of -0.536 indicates a moderate negative correlation, meaning that as physical activity increases, random blood glucose levels tend to decrease, and vice versa.

Discussion

The characteristics of the respondents indicated that most individuals with type 2 diabetes mellitus were aged 55–60 years, accounting for 38.7%. The risk of developing diabetes tends to increase with age but begins to decline after the age of 65 (Karolus Siregar et al., 2023). Aging is a contributing factor to diabetes mellitus, as it induces structural and functional changes in pancreatic beta cells. This results in decreased insulin sensitivity, leading to uncontrolled blood glucose levels (Savitri et al., 2021).

The results showed that the majority of respondents were female, totaling 44 individuals (58.7%). This finding is consistent with the study by Amran & Rahman, (2021) hich also reported a predominance of female respondents. Women are at a higher risk of developing diabetes, partly due to body mass index (BMI) and hormonal changes associated with the menstrual cycle. After menopause, women tend to accumulate body fat more easily due to hormonal fluctuations (Muhammad Akbar et al., 2025).

urthermore, the study revealed that most respondents were housewives, totaling 22 individuals (29.3%). This finding aligns with the study by Salome Naba et al. (2021) which also reported that most respondents were housewives. Housewives are at risk of developing diabetes due to stress. Chronic daily stress activates the pituitary-adrenal-cortical system, prompting the hypothalamus to stimulate the pituitary gland to produce cortisol. Elevated cortisol levels promote gluconeogenesis and glycogenesis, which contribute to insulin resistance and, subsequently, increased blood glucose levels (Muhammad et al., 2025).

he findings also showed that most respondents had been diagnosed with diabetes mellitus for 1–5 years, totaling 31 individuals (41.3%). This is consistent with Agustina et al., (2022) who reported that 69% of respondents had been diagnosed within the same timeframe. The longer someone has diabetes, the greater the risk of complications due to unstable blood glucose levels (Setianto et al., 2023). According to Lathifah (2022), a longer duration of diabetes results in greater insulin resistance due to the prolonged and demanding nature of treatment. If blood glucose levels remain uncontrolled, medication doses tend to increase (Perkumpulan Endrokinologi Indonesia, 2019). Chronic hyperglycemia is detrimental to health, reducing physical activity, increasing economic burden, lowering quality of life, and elevating the risk of other degenerative disease (Pranata et al., 2022).

Table 2 shows that most respondents engaged in high levels of physical activity, totaling 36 individuals (48.0%). This is consistent with the study by Tri Astuti et al. (2022),

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which also found that most respondents had high physical activity levels. Physical activity affects blood glucose levels by utilizing stored glucose in muscles during movement or exercise. However, these findings contrast with those of Rohmah (2021), who reported that physical activity among diabetes patients was generally irregular and low, increasing the risk of complications. According to Larasati (2016), physical activity must meet specific criteria to be effective ideally performed 3 to 4 times per week for at least 30 minutes per session. Physical activity does not have to be strenuous; for instance, a 30-minute morning walk while enjoying the scenery qualifies as good physical activity.

Dedi Saputra & Muflihatin, (2020) found that housewives tend to engage in less physical activity than individuals who are active outside the home. This inactivity limits the body's ability to convert food intake into energy, leading to carbohydrate buildup, which may trigger diabetes. Excess weight hampers glucose transport into cells, resulting in glucose accumulation in the bloodstream. In addition, fat accumulation can impair insulin function (Tandra, 2018).

Random blood glucose testing can provide a quick overview of glucose fluctuations, whether in hyperglycemic, hypoglycemic, or normal conditions (Lestari dkk., 2022). he findings of this study showed that most respondents had poor random blood glucose levels (≥ 200 mg/dl), with 33 individuals (44.0%). This suggests low awareness among the respondents regarding their blood glucose levels. This is supported by Alidya (2022), who also found that most respondents had poor glycemic control.

Elevated blood glucose levels in diabetes patients may be triggered by several factors, including lifestyle changes, medication use, physical inactivity, aging, pregnancy, smoking, and stress (Adam et al., 2021). This is consistent with Ananda (2024), who reported that most diabetes patients had poor or uncontrolled blood glucose levels. Proper glucose control relies heavily on patient lifestyle, particularly diet and physical activity. It is crucial for diabetes patients to understand how to manage their blood glucose effectively. Controlled glucose levels help reduce the risk of complications (Nur Susanti, 2020).

The study conducted at PKU Muhammadiyah Gamping Hospital among 75 respondents showed, based on Kendall Tau statistical analysis, a p-value of 0.00 (< 0.05), indicating that H0 is rejected and Ha is accepted. Therefore, there is a significant relationship between physical activity and random blood glucose levels among elderly patients with diabetes mellitus at PKU Muhammadiyah Gamping Hospital. This aligns with the findings of Leseila & Paembonan (2022), who also reported a significant relationship between physical activity and random blood glucose (p = 0.000).

mong the respondents, 36 (48.0%) had high physical activity levels. Additionally, 28 (37.3%) had normal random blood glucose levels, and 14 (18.7%) had moderate levels. The high physical activity reported is consistent with both normal and moderate glucose levels (Ananda, 2024). Hal ini sejalan dengan penelitian yang dilakukan ole These findings are also supported by Karolus Siregar et al. (2023) who found a significant relationship between physical activity and blood glucose levels in diabetes patients (p = 0.000). Regular physical activity can help lower blood glucose levels. However, elevated glucose levels, despite high activity, may also be influenced by factors such as age and occupation (Sundayana et al., 2021). This study was predominantly composed of housewives who engaged in moderate activity interspersed with extended periods of rest. According to theory, long rest periods following physical activity reduce its effectiveness in lowering blood glucose. Reduced movement may also decrease cell sensitivity to insulin. The purpose of physical activity is to stimulate insulin sensitivity, reduce central fat, and enhance muscle tissue function (Azitha et al., 2018).

These findings are consistent with Nuryati (2018), who also reported a significant relationship between physical activity and random blood glucose levels (p = 0.000). Physical activity improves insulin receptor sensitivity, allowing glucose to be metabolized

into energy (Tandra, 2018). One key benefit of physical activity is its role in reducing blood glucose levels among individuals with diabetes mellitus, preventing obesity, and mitigating complications, lipid disorders, and elevated blood pressure (Muhammad Akbar et al., 2025). Muscle glucose utilization increases during high physical activity, as the body boosts endogenous glucose production to maintain glucose balance in the bloodstream (Ananda, 2024).

According to Leseila & Paembonan, (2022), engaging in regular exercise can enhance receptor sensitivity and is directly associated with the rate of muscle blood glucose recovery. Infrequent physical activity or exercise can lead to abnormal blood glucose levels. This condition occurs when the body lacks sufficient insulin or experiences insulin resistance—a condition in which the hormone released by the pancreas becomes less effective (Yuni & Ayu Putu, 2020). Insulin functions to distribute glucose in the bloodstream to body cells for energy production. Therefore, when physical activity is insufficient, unused glucose accumulates in the blood, resulting in elevated blood glucose levels. This is because nearly all bodily functions require energy derived from blood glucose. This condition is commonly experienced by individuals with diabetes who are unable to maintain a healthy lifestyle, such as those who exercise infrequently, are physically inactive, or forget to take their diabetes medication or insulin (Kemenkes, 2021).

However, this finding contrasts with the study by Anggraeni & Rachmawati (2024), which reported no significant relationship between physical activity and blood glucose levels ($p = 0.220$). Aside from physical activity, other factors contribute to maintaining normal blood glucose levels in older adults, such as a nutritious and balanced diet. The level of physical activity among the elderly tends to be relatively similar due to aging and health conditions. As a result, older adults often engage in limited physical activity or only light exercise (Yuni & Ayu Putu, 2020).

Conclusion

Based on the research findings, it can be concluded that the majority of patients with diabetes mellitus had poor blood glucose levels, with 33 respondents (44.0%), and high physical activity levels, with 36 respondents (48.0%). The Kendall Tau hypothesis test yielded a p-value of 0.00 ($p < 0.05$), indicating a significant relationship between physical activity and random blood glucose levels among elderly patients with diabetes mellitus. The correlation coefficient was -0.536, suggesting a moderate negative relationship.

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