



# Effect of Diabetic Gymnastics on Blood Glucose Levels in Diabetes Mellitus Patients at Patilanggio Public Health Center

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## ABSTRACT

*Diabetes is a chronic metabolic disease that, if not managed properly, will increase the occurrence of complications. The risk of disease complications can be exacerbated by the non-compliance of DM patients in controlling blood sugar, so intervention is needed in controlling blood sugar in the form of diabetic gymnastics intervention. This research used a quantitative design with the Quasi Experiment method including a Pretest-Posttest Control Group design. The population was all people suffering from type II DM without complications, and the sampling technique used was the Simple Random Sampling technique with a total of 59 samples. The instrument consisted of the questionnaire and paired t-test, obtained a value of 0.043 ( $<0.05$ ) in the intervention group, which means that there is an effect of diabetic gymnastics on reducing blood sugar levels during diabetes mellitus patients in the work area of the UPTD Puskesmas Patilanggio Subdistrict, Puhuwato Regency, and 0.161 ( $>0.05$ ) in the control group which means there is no effect of it. Puskesmas can use this research in preventive efforts through diabetic gymnastics and as a source of information for patients to maintain diabetes control.*

## 1. INTRODUCTION

Diabetes mellitus (DM) is defined as a chronic metabolic disorder of multifactorial etiology characterized by elevated blood glucose levels accompanied by disturbances in the metabolism of carbohydrates, lipids, and proteins due to insulin insufficiency. This insulin insufficiency may be caused by impaired or deficient insulin production by the beta cells of the pancreas or by the reduced responsiveness of body cells to insulin. In general, diabetes mellitus results from an unhealthy lifestyle that leads to the chronic and long-term accumulation of excess glucose in the blood (Sulastri., 2022). According to the World Health Organization (WHO, 2019), the global incidence of diabetes mellitus increased from 30 million in 1985 to 194 million in 2006. It is projected that by 2025, the number will rise to 333 million. The International Diabetes Federation (IDF, 2021) reported that Indonesia ranks second, with 19.5 million people aged 20 to 79 years affected by diabetes. Gorontalo Province ranks seventh among 35 provinces in Indonesia in terms of the number of diabetes mellitus cases, with the prevalence rising significantly from 1.13% in 2013 to 2.4% in 2018 (RISKESDAS, 2018).

Data from the Gorontalo Provincial Health Office shows that the prevalence of diabetes mellitus has increased annually: 3.5% in 2017, 5.1% in 2018, and 7.4% in 2019. In 2022, there were 18,074 cases of diabetes in the province, spread across several districts and cities, including Puhuwato Regency (Gorontalo Provincial Health Office, 2023). According to the 2022 and 2023 health profiles of the Puhuwato District Health Office, several sub-districts have experienced rising diabetes cases, including Patilanggio Subdistrict. In 2022, there were 48 cases of diabetes at Patilanggio Health Center, which increased to 59 in 2023 (Puhuwato District Health Office, 2023). According to data recorded by the Patilanggio Health Center in 2024, the number of diabetes mellitus cases by month were: March - 13 cases, April - 15 cases, May - 16 cases, June - 17 cases, July - 20 cases, and August - 22 cases. If this increasing trend is left unaddressed, it could

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result in complications involving various other diseases. Therefore, preventive efforts are urgently needed to avoid such complications.

Preventive measures must be taken to reduce the risk of diabetes complications. Blood glucose levels can be controlled through pharmacological and non-pharmacological therapies. Pharmacological control includes oral medications and insulin therapy. Non-pharmacological therapies include education, medical nutrition therapy, and physical exercise. Physical exercise is an effective approach to lowering blood glucose levels. One type of low-impact aerobic exercise is diabetic gymnastics. This form of physical activity is tailored to the age and physical condition of individuals and is part of DM treatment. Diabetic gymnastics helps reduce stress and anxiety, improve stamina, and maintain body weight. The recommended duration for adult participants is 30 minutes at least 3–4 times per week, and for children and adolescents, similar structured activities are advised (Lubis, 2021).

A study conducted by Sari I.P. (2020) found that individuals with diabetes who engage in physical activity burn glucose into energy, increasing insulin sensitivity and improving blood circulation, which can reduce the risk of type 2 DM by up to 50% (Furiyani, 2019). Regular physical activity also helps improve lipid profiles, reduce cholesterol, and control blood sugar levels. Sari's study concluded that performing diabetic gymnastics for 15–30 minutes significantly lowers blood glucose levels. Additionally, such exercise improves glucose, fatty acid, and ketone body metabolism and stimulates glycogen synthesis when performed routinely.

Research has shown that consistent physical activity, combined with dietary planning and weight loss, helps control blood sugar. This aligns with the study by Wasludin (2019). A preliminary interview with five diabetic patients at Patilanggio Health Center revealed that they were unaware of diabetic gymnastics or its effects on lowering blood glucose levels. An interview with the Prolanis program coordinator at the health center indicated that diabetic gymnastics had not been implemented because the program primarily focused on pharmacological therapy. Based on this background, the researchers were motivated to study the effect of diabetic gymnastics on blood glucose levels in diabetes mellitus patients at the UPTD Patilanggio Health Center.

## 2. METHODS

This research is a quantitative study using a quasi-experimental method, aimed at explaining or clarifying causal relationships that can serve as a basis for predicting a phenomenon (Hidayat, 2017). In this study, both the experimental and control groups were selected randomly, following a Pretest-Posttest Control Group Design.

The population in this study consisted of all individuals diagnosed with type II diabetes mellitus without complications, totaling 59 people. The sampling method used was Simple Random Sampling within the working area of the UPTD Patilanggio Community Health Center. Thus, the sample for this study consisted of 59 individuals suffering from type II diabetes mellitus without complications in that area.

## 3. RESULTS AND DISCUSSION

### General Overview of Research Location

Patilanggio Health Center is the main community health center located within the administrative region of Patilanggio Subdistrict, situated in Dulomo Village, with a total area of 380 mm<sup>2</sup>. The total working area of Patilanggio Health Center spans 7.33 hectares, comprising six villages. The population in the working area of Patilanggio Health Center, Pohuwato Regency, tends to increase every year. Based on data from the Department of Population and Civil Registration of Pohuwato Regency in 2022, the total population was 9,982 people, consisting of 5,203 males and 4,779 females.

## Respondent Characteristics

In this study, a total of 58 respondents were selected from the working area of Patilanggio Health Center. The characteristics observed include age, duration of illness, and physical activity. These can be seen in the following table:

Karakteristik	Control		Intervention	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
<b>Age</b>				
36-45 Years	6	20,7	7	24,1
46-55 Years	17	58,6	18	62,1
56-65 Years	6	20,7	4	13,8
<b>Duration of illness</b>				
<5 Years	10	34,5	11	37,9
5-10 Years	13	44,8	14	48,3
>10 years	6	20,7	4	13,8
<b>Physical Activity</b>				
Never	3	10,3	3	10,3
Once per week	26	89,7	26	89,7
	29	100	29	100

**Source:** Data Primer, 2024

From the results of the study, the distribution of respondents based on age is known that of the 29 respondents, the largest age group is 46-55 years old, both in the control group and the intervention group, with a total of 17 respondents (58.6%) in the control group and 18 respondents (62.1%) in the intervention group. The distribution of respondents based on the duration of suffering is known that of the 29 respondents, the longest duration of suffering is 5-10 years, both in the control group and the intervention group, with a total of 13 respondents (44.8%) in the control group and 14 respondents (48.3%) in the intervention group. The distribution of respondents based on physical activity is known that of the 29 respondents, the most physical activity is 1x/week, both in the control group and the intervention group, with a total of 26 respondents (89.7%)

Table 2. Blood Glucose Levels in the Control Group Before the Intervention

Blood Glucose Level	Control Group	
	Frequency (n)	Percentage (%)
Hight	29	100
Normal	0	0
Total	29	100

**Source:** Primary Data, 2024

Table 3: Univariate Analysis of Blood Sugar Levels in the Control Group After Treatment

Blood Glucose Level	Control Group	
	Frequency (n)	Percentage (%)
Hight	27	93,1
Normal	2	6,9
Total	29	100

**Source:** Primary Data, 2024

Table 4. Univariate analysis of pre-treatment blood sugar levels in the intervention group.

Blood Glucose Level	Intervention Group	
	Frequency (n)	Percentage (%)
Hight	28	96,6
Normal	1	3,4
Total	29	100

Source: Primary Data, 2024

Table 5 shows univariate analysis of blood sugar levels after treatment in the intervention group.

Blood Glucose Level	Intervention Group	
	Frequency (n)	Percentage (%)
Hight	24	82,8
Normal	5	17,2
Total	29	100

Source: Primary Data, 2024

### Bivariate Analysis

Bivariate analysis was conducted to determine the effect of diabetes exercise on reducing random blood sugar levels in diabetes mellitus patients in the Patilanggio Community Health Center (UPTD) working area, Patilanggio District, Pohuwato Regency.

Table 6. Effect of diabetes exercise on reducing random blood sugar levels in diabetes mellitus patients in the Patilanggio Community Health Center working area, Patilanggio District

Blood Glucose Level	Control				P value	Intervention				P value
	Before		After			Before		After		
	n	%	n	%		n	%	n	%	
Hight	29	100	27	93.1	0,161	28	96.6	24	82.8	0,043
Normal	0	0.0	2	6.9		1	3.4	5	17.2	
total	29	100	29	100		29	100	29	100	

Source: Primary Data, 2024

Based on the results of the study, it shows the effect of diabetes exercise on reducing random blood sugar levels in diabetes mellitus patients in the working area of UPTD Patilanggio Health Center, Patilanggio District, Pohuwato Regency, the paired t-test results were obtained 0.043 ( $<0.05$ ) in the intervention group, which means there is an effect of diabetes exercise on reducing random blood sugar levels in diabetes mellitus patients in the working area of UPTD Patilanggio Health Center, Patilanggio District, Pohuwato Regency and 0.161 ( $>0.05$ ) in the control group, which means there is no effect of diabetes exercise on reducing random blood sugar levels in diabetes mellitus patients in the working area of UPTD Patilanggio Health Center, Patilanggio District, Pohuwato Regency.

## 4. DISCUSSION

### Random Blood Glucose Levels in the Control Group Before and After Intervention at UPTD Patilanggio Health Center, Patilanggio Subdistrict, Pohuwato Regency

Based on the univariate analysis, it was found that 100% (29 respondents) in the control group had high blood glucose levels before the intervention. Several factors may have contributed to the high blood glucose levels, such as limited physical activity—26 respondents (89.7%) reported engaging in physical activity only once a week. Physical activity plays a crucial role in blood sugar

control. When a person engages in physical activity, glucose is converted into energy, which helps reduce insulin resistance and, in turn, lowers blood glucose levels. Obesity is also a contributing factor, which can result from unhealthy lifestyle choices, such as poor diet and lack of physical activity. This can increase the risk of developing type 2 diabetes (Masi & Oroh, 2018).

Physical activity is directly related to the body's ability to supply glucose to the muscles. During physical activity, muscles break down stored glucose (glycogen) for energy, reducing both stored glucose and glucose circulating in the bloodstream (Istianah et al., 2020). According to Damayanti (2015), during physical exercise, insulin works more efficiently. However, this effect wears off after 48 hours, so physical activity should be done at least every two days or three times per week. Lack of exercise can lead to insulin resistance, while consistent physical activity helps activate insulin binding and receptors on cell membranes, lowering blood glucose levels.

Additionally, most respondents in the control group were aged 46–55 years (58.6%). Advancing age is associated with a decline in vital organ functions, including pancreatic function, which plays a direct role in insulin production and blood glucose regulation (Rahmasari & Wahyuni, 2019). Damayanti (2015) notes that individuals over 30 experience anatomical, physiological, and biochemical changes. After age 30, fasting blood glucose levels rise by 1–2 mg% annually and increase by 6–13 mg% two hours after eating. From this, the researcher concludes that high blood glucose levels are influenced by factors such as lack of physical activity and older age. However, other unexamined factors may also contribute, including diet adherence, stress management, and medication compliance.

After the observation period, 27 respondents (93.1%) in the control group still had high blood glucose levels, while 2 respondents (6.9%) had normal levels even without any intervention. These two individuals stated that they regularly visited the elderly health post (*posyandu lansia*), took their medication regularly, and performed physical activities such as farming. According to Mpila et al. (2023), medication adherence is associated with normal blood glucose levels.

### **Random Blood Glucose Levels in the Intervention Group Before and After Diabetic Gymnastics at UPTD Patilanggio Health Center, Patilanggio Subdistrict, Pohuwato Regency.**

Before the intervention, 28 respondents (96.6%) in the intervention group had high blood glucose levels, and only 1 respondent (3.4%) had normal levels. According to that respondent, they consistently maintained a regulated eating pattern and adhered to a low-carbohydrate diet. Kurniasari (2020) explains that diet plays a crucial role in blood glucose regulation. Food consumed is digested and converted into glucose, and glucose absorption in the body increases blood sugar levels and insulin secretion. This study aimed to explore the relationship between diet and blood glucose levels in patients with type 2 diabetes mellitus.

After the intervention (diabetic gymnastics), 24 respondents (82.8%) still had high blood glucose levels, while 5 respondents (17.2%) had normal levels. This result aligns with a study by Kartika Wahyu (2011) on members of PERSADIA Ciputat Jaya, who investigated the effect of diabetic gymnastics on random blood glucose in DM patients using a pretest-posttest experimental design. A paired t-test showed a significant decrease in blood glucose levels ( $p = 0.013$ ) with an average reduction of 31.92 mg/dL in the intervention group (12 participants) and 27 mg/dL in the control group ( $p = 0.023$ ). Similarly, a study by Febriana (2010) at PERSADIA Salatiga branch showed a significant reduction in blood glucose levels after diabetic gymnastics, with a p-value of 0.000 using a one-group pretest-posttest quasi-experimental design involving 242 respondents. Another study by Nanda et al. (2015) in Botung Village, Kotanopan District, Mandailing Natal Regency, reported an average blood glucose reduction of 49.182 mg/dL after diabetic gymnastics.

In the present study, 72.4% of respondents in the intervention group experienced a decrease in blood glucose levels because they performed diabetic gymnastics according to the procedure (3 times per week) and participated regularly and correctly. In contrast, most of the control group respondents still had high blood glucose levels, with some not performing any physical activity during the week. This result is consistent with a study by

Indriyani, Supriyanto, and Santoso (2017), which examined the impact of aerobic gymnastics on blood glucose reduction in type 2 DM patients at Bukateja Health Center, Purbalingga. The study was conducted over 4 weeks with participants exercising 3 times per week. After the intervention, the average blood glucose level dropped to 210.14 mg% (SD = 15.93), with an average decrease of 30.14 mg% ( $p = 0.0001$ ). According to the researcher's assumption, while a reduction in blood glucose occurred, 24 respondents still had high levels, possibly because their pre-intervention glucose was excessively high, and diabetic gymnastics alone was not enough to bring it down significantly.

**The effect of diabetes exercise on reducing random blood sugar levels in diabetes mellitus patients before and after performing diabetes exercise at the Patilanggio Community Health Center (UPTD), Patilanggio District, Pohuwato Regency.**

The results of the study indicate the effect of diabetes exercise on reducing random blood sugar levels in diabetes mellitus patients in the UPTD Patilanggio Community Health Center (UPTD) work area, Patilanggio District, Pohuwato Regency. The paired t-test obtained a value of 0.043 ( $<0.05$ ) in the intervention group, indicating that diabetes exercise affected reducing random blood sugar levels in diabetes mellitus patients in the UPTD Patilanggio Community Health Center (UPTD), Patilanggio District, Pohuwato Regency, and 0.161 ( $>0.05$ ) in the control group, indicating that there was no effect of diabetes exercise on reducing random blood sugar levels in diabetes mellitus patients in the UPTD Patilanggio Community Health Center (UPTD), Patilanggio District, Pohuwato Regency.

The primary goal of diabetes therapy is to normalize insulin activity and blood glucose levels in an effort to reduce the occurrence of vascular and neuropathic complications. The therapeutic goal for each type of diabetes is to achieve normal blood glucose levels (euglycemia) without hypoglycemia and serious disruption to the patient's activity patterns. Treatment for diabetes mellitus patients, while also preventing complications, involves controlling diabetes, one of which is regular exercise. Exercise is expected to improve insulin sensitivity, thereby improving blood sugar levels. Another frequently recommended physical activity is diabetes mellitus exercise. Diabetes exercise is a form of physical exercise designed to prevent and control diabetes and is one of the pillars of diabetes mellitus management, alongside education, nutritional therapy, and pharmacological interventions. The benefits of exercise for diabetes mellitus patients include improving blood sugar levels and preventing obesity by burning calories, allowing blood glucose to be used for energy. This can lower blood sugar levels. Diabetes exercise can cause a decrease in blood glucose levels because physical exercise increases glucose utilization by muscles. Furthermore, increased blood flow causes more capillaries to open, resulting in more insulin receptors being available and more active, lowering blood glucose (Wiwit Unairawati, 2011).

Diabetes exercises are performed to lower and control blood sugar levels in people with diabetes mellitus. After receiving diabetes education, almost all people with diabetes mellitus experienced a decrease in blood sugar levels. This is because exercise increases glucose utilization by muscles. Exercise also burns calories, allowing blood glucose to be used for energy. Controlling and lowering blood sugar levels is influenced by several other factors, such as weight, education, and age. These factors include controlling diet, increasing health knowledge, and providing physical exercise, specifically diabetes exercises, which can control and lower blood sugar levels as a secondary treatment. However, physical exercise alone is not sufficient; it must also be combined with a diabetes diet, choosing foods that do not increase blood sugar levels, providing education about diabetes, and taking medication. Exercise is only a supplement; it would be beneficial if these were also included for optimal results. This aligns with research conducted by Sunaryo in 2013 on the effect of diabetes exercise on lowering blood sugar levels, where patients who participated in diabetes exercise had a one-fold reduced risk of diabetes compared to those who did not participate. Participation in diabetes exercise was based on several reasons, including patient awareness of the need to improve health and control blood sugar, a busy schedule, and a doctor's recommendations. This was influenced by several factors, including knowledge or

perceptions of diabetes management and care, self-motivation, and information. In this study, changes in blood sugar levels were found in the pre- and post-test after diabetes mellitus exercise. According to the researchers, the decrease in blood sugar levels was likely due to the regularity of diabetes exercise activities and adherence to diet and medication. The researchers assumed that the more frequently respondents engaged in exercise or physical activity, the lower their blood sugar levels.

## 5. CONCLUSION

The effect of diabetes exercise on reducing random blood sugar levels in diabetes mellitus patients before and after performing diabetes exercise at the Patilanggio Community Health Center (UPTD), Patilanggio District, Pohuwato Regency. The results of the study indicate that diabetes exercise has an effect on reducing random blood sugar levels in diabetes mellitus patients in the UPTD Patilanggio Community Health Center (UPTD) work area, Patilanggio District, Pohuwato Regency. The paired t-test results obtained were 0.043 ( $<0.05$ ) in the intervention group, indicating that diabetes exercise has an effect on reducing random blood sugar levels in diabetes mellitus patients in the UPTD Patilanggio Community Health Center (UPTD) work area, Patilanggio District, Pohuwato Regency, and 0.161 ( $>0.05$ ) in the control group, indicating that there is no effect of diabetes exercise on reducing random blood sugar levels in diabetes mellitus patients in the UPTD Patilanggio Community Health Center (UPTD) work area, Patilanggio District, Pohuwato Regency. Patilanggio, Pohuwato Regency.

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