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ORIGINAL ARTICLE

The Relationship Between Physical Activity and the Incidence of Diabetes Melitus

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ABSTRACT

Background: The highest prevalence of DM is at the Putri Ayu Community Health Center, Jambi City, with the highest number of DM sufferers who receive standard health services, namely 441 cases in 2022. The aim of this study is to determine the relationship between physical activity and the incidence of Diabetes Mellitus.

Method: This study employed a quantitative research method with an analytical case–control study design. Population and Control Population in this study were all DM sufferers in the working area of the Putri Ayu Community Health Center, Jambi City. the of samples in the case group was 90 respondents and the samples in the control group was 90 respondents. The total sample in this study was 180 respondents. Data collection techniques use questionnaires. Data analysis in this research is Univariate Analysis, and Bivariate Analysis uses Chi Square.

Result: The largest proportion of gender in the case and control groups was found to be women at 31,1%, the majority of ages in the case and control groups were in the early elderly age group (46-55 years) at 20%, the type of work in the case group was found the type of work was 48 housewives (26,7%) and 40 controls (22,2%). The statistical test used was the Chi Square test, resulting in a p-value of 0.000 ($p < 0.05$) (OR 6.417).

Conclusion: This study demonstrates that physical activity is an important factor associated with the incidence of diabetes mellitus in the working area of Putri Ayu Public Health Center, Jambi City, in 2024. Individuals with lower levels of physical activity were found to have a substantially higher risk of developing diabetes mellitus compared to those who engage in higher levels of physical activity. These findings highlight the importance of promoting regular physical activity as part of diabetes prevention and control efforts at the community level. Therefore, increasing regular physical activity in accordance with the recommendations of the American Diabetes Association should be emphasized as an effort to control and prevent diabetes mellitus.

Keywords: Physical Activity, Diabetes Mellitus, Age, Gender, Occupation

INTRODUCTION

Diabetes Mellitus also known as *diabetes*, is a chronic disease that can persist for a lifetime. DM is caused by metabolic disorders that occur in the pancreas, characterized by increased blood glucose levels or a condition commonly known as *hyperglycemia*, which results from a decreased amount of insulin produced by the pancreas. DM can lead to various complications, both macrovascular and microvascular. It can cause cardiovascular disorders, which are considered quite serious if not treated promptly, and may increase the risk of hypertension and heart infarction. (1)

According to the International Diabetes Federation (IDF), it is estimated that at least 463 million people (9.3%) worldwide aged 20–79 years suffer from DM. Indonesia ranks seventh among countries with the highest number of DM cases, following the United States, India, China, Pakistan, Mexico, and Brazil.(2) Based on the 2023 Basic Health Research (RISKESDAS) results, it is estimated that around 12 million Indonesians aged over 15 years suffer from DM, with 877,531 of them having been diagnosed by a doctor.(3)

Based on the 2023 Basic Health Research (RISKESDAS) results, it is estimated that around 12 million Indonesians aged over 15 years suffer from DM, with 877,531 of them having been diagnosed by a doctor.(4) in 2020 there were 11,447 cases (5) and in 2021 the number increased to 12,614 cases (6) By 2022, DM cases had risen significantly to 21,127 (7)

The factors influencing Diabetes Mellitus (DM) are divided into two categories. There are non-modifiable risk factors, such as age, family history of DM, a history of giving birth to a baby weighing more than 4000 grams, or a history of diabetes during pregnancy (gestational diabetes). Then, there are modifiable risk factors, including being overweight or obese (BMI > 23 kg/m^2), lack of physical activity, hypertension, and smoking.(8)

According to the World Health Organization (WHO**)**, *physical activity* is defined as any bodily movement produced by skeletal muscles that requires energy expenditure. It includes all movements performed during leisure time, transportation, or work-related activities. There are many ways to stay active, such as through sports, cycling, walking, active recreation, or play—at any skill level and for enjoyment.(9)

Physical activity contributes positively to human physiological and psychological growth and development, whether of light or moderate intensity. Regular physical activity has been proven to prevent and manage non-communicable diseases such as heart disease, diabetes, stroke, and certain types of cancer. It also helps maintain a healthy body weight, improves mental health, quality of life, and overall well-being.(9) A lack of physical activity is reported to cause 6% of global deaths and is identified as the fourth leading risk factor for global mortality, following high

blood pressure (13%), smoking (9%), and high blood glucose levels (6%). Insufficient physical activity increases the risk of DM up to three times compared to individuals who are adequately active. Furthermore, regular physical activity significantly improves insulin resistance.(10)

METHOD

This analytical case-control study aimed to identify risk factors associated with diabetes mellitus (DM) in the working area of Puskesmas Putri Ayu, Jambi City. The research was conducted from July to September 2024, chosen because this health center had the highest number of DM patients in the city. The study involved individuals aged 36–65 years, divided into case (DM) and control (non-DM) groups, selected using simple random sampling. Based on Slovin's formula, a total of 180 respondents (90 cases and 90 controls) were included. Data were collected through questionnaires and secondary data from the Health Office. Inclusion criteria included willingness to participate and age 36–65, while exclusions applied to incomplete data or comorbid diseases. Data were analyzed using univariate and bivariate methods, with the Chi-square test employed to assess the relationship between physical activity and DM incidence. during July–September 2024. The samples were selected using a simple random sampling method. A total of 180 samples met the inclusion and exclusion criteria of the study. The collected data were then analyzed and categorized according to their respective characteristics. The study has complied with ethical standards and received approval from the Ethics Committee under approval letter number 2071/UN21.8/PT.01.04/2024.

RESULT

This study was conducted on samples drawn from the population of patients at Puskesmas Putri Ayu, Jambi City.

Table 1. Characteristics of Respondents

Characteristics		Diabetes Mellitus				Total	
		Case		Control			
		n	%	n	%	n	%
Sex	Male	34	18,9	34	18,9	68	37,8
	Female	56	31,1	56	31,1	112	62,2
Age	Adult	32	17,8	32	17,8	64	35,6
	Early Eldery	36	20,0	36	20,0	72	40,0
	Late Eldery	22	12,2	22	12,2	44	24,4
Occupation	Trader	3	1,7	8	4,4	11	6,1
	Laborer/Farmer	16	8,9	15	8,3	31	17,2
	Civil Servant	12	6,7	16	8,9	28	15,6
	Retiree	6	3,3	3	1,7	9	5,0
	Enterpreneur	5	2,8	8	4,4	13	7,2
	Housewife	48	26,7	40	22,2	88	48,9
Total		90	50	90	50	180	100

Table 1 presents the demographic characteristics of the respondents. A total of 180 participants were included in this study, consisting of 90 diabetes mellitus cases and 90 controls. The majority of respondents were female, and most participants were categorized as early elderly. In terms of occupation, housewives represented the largest proportion of respondents. Further details regarding age, sex, and occupational distribution are shown in Table 1.

Tabel 2. Relationship Between Physical Activity and the Incidence of Diabetes Mellitus

Physical Activity	Diabetes Mellitus				Total		P value	OR
	Case		Control					
	n	%	n	%	n	%		
Light	63	35	24	13,3	87	48,3		
Moderate	27	15	66	36,7	93	51,7	0,000	6,417
Total	90	50	90	50	180	100		

Table 2 shows the association between physical activity and the incidence of diabetes mellitus. The Chi-square test indicated a statistically significant relationship between physical activity and diabetes mellitus in the working area of Putri Ayu Public Health Center ($p < 0.05$). Respondents with low physical activity were more likely to develop diabetes mellitus compared to those with higher levels of physical activity.

DISCUSSION

Physical activity plays an important role in preventing and controlling diabetes because lack of activity increases insulin resistance and worsens glycemic control, leading to chronic complications such as diabetic nephropathy.(11) Suzan et al. (2025) found that physical activity helps maintain a healthy body mass index (BMI), higher activity levels are associated with lower BMI. Regular physical activity not only helps control body weight but also reduces insulin resistance and the risk of type 2 diabetes, emphasizing the importance of an active lifestyle among students and the general population.(12) Muftahurrahmah et al. (2025) identified lack of physical activity as a major risk factor for type 2 diabetes. A sedentary lifestyle reduces insulin sensitivity and increases fat accumulation, leading to higher blood glucose levels and insulin resistance, which are key causes of type 2 diabetes.(13**)** Suzan et al. (2025) also found that low physical activity is associated with an increased risk of overweight status, which subsequently raises the risk of developing type 2 diabetes. (14)

Akmal et al. (2024) further supported these findings, stating that lack of physical activity leading to obesity increases the risk of type 2 diabetes and serious complications such as diabetic ulcers and secondary infections, particularly in the lower limbs, often caused by *Staphylococcus*

aureus. Low physical activity can trigger obesity, hypertension, and dyslipidemia, all of which increase blood glucose levels and nerve damage. Conversely, regular physical activity helps prevent obesity, lower blood pressure, and reduce diabetes complications.15 Low physical activity can trigger obesity, hypertension, and dyslipidemia, all of which increase blood glucose levels and nerve damage. Conversely, regular physical activity helps prevent obesity, lower blood pressure, and reduce diabetes complications.16 Low physical activity is significantly associated with an increased incidence of diabetes among centrally obese adults before controlling for confounding variables (OR = 1.161).(17) Afriyanti et al. (2022) showed that high blood pressure in diabetic nephropathy patients is related to increased sympathetic nervous activity due to insulin resistance, which explains how lack of exercise can worsen insulin resistance, elevate blood pressure, and increase chronic complications.(18) Puspitasari et al. (2021) also confirmed that uncontrolled blood pressure and glucose levels contribute significantly to kidney complications in diabetes patients, a condition strongly influenced by low physical activity.(19) Fairuz et al. (2020) found that controlling blood glucose through the antidiabetic effects of *P. malayana* Jack is enhanced by regular exercise, which improves insulin sensitivity and reduces the risk of complications. (20)

Physical exercise is a key component of diabetes self-management that helps lower blood glucose levels by increasing muscle glucose uptake, improving insulin utilization, enhancing blood circulation, and strengthening muscle tone. Endurance exercises, such as weightlifting, can increase muscle mass, boost metabolism, reduce stress, and promote well-being. Walking is also recommended for diabetic patients as it increases insulin binding to muscle cell receptors, enhances glucose regulation, and maintains energy balance during activity.(21)

However, many diabetes patients—especially older adults—are reluctant to exercise, often due to misconceptions that physical activity must resemble professional athletic training. Additionally, high blood sugar levels can make patients feel weak because the body cannot use insulin efficiently, preventing optimal energy production. Frequent urination and dehydration caused by high glucose levels further contribute to fatigue.(22) Family support and awareness play vital roles in motivating diabetes patients to exercise regularly, such as participating in group aerobics, which helps improve health and mood. Recommended exercise includes moderate-intensity activity 3–4 times per week for about 30 minutes, as well as incorporating daily movements like walking to the market. (23)

Managing diabetes effectively often faces challenges such as patient boredom

after dietary therapy and lack of family support. Without family encouragement, patients tend to be noncompliant with treatment and reluctant to exercise. Therefore, self-management knowledge is crucial for daily physical activity, glucose control, and minimizing disease impact.(24) The realization of exercise among diabetes patients cannot be separated from family support and awareness, as this encouragement motivates individuals to participate in group exercises to improve their health and live their days in a healthier and happier way. Recommended physical activity includes regular exercise (3–4 times per week for approximately 30 minutes) along with maintaining daily physical activities such as walking to the market and other routine movements.(25)

In the management of diabetes mellitus (DM), several challenges arise, such as patient fatigue after diet therapy and lack of family support. Without sufficient family encouragement, DM patients often fail to adhere to treatment regimens, resulting in poor disease control and low motivation to engage in physical activity.(26) Furthermore, a high level of knowledge is essential for daily physical activity among DM patients to help control and reduce the effects of the disease. This concept, known as *self-management*, is crucial in diabetes control.(27)

Regular physical activity can reduce body weight, decrease insulin resistance, and ultimately help control blood glucose levels. Even low-intensity exercise can improve muscle insulin sensitivity in individuals with prediabetes or diabetes mellitus. Exercise also helps lower blood lipid levels, blood pressure, and low-density lipoprotein (LDL) cholesterol, while increasing high-density lipoprotein (HDL) cholesterol, improving blood circulation, and preventing complications. These benefits depend on the frequency, intensity, duration, and type of exercise that suit the patient's time, place, preferences, interests, and health condition.(28)

There are key differences in exercise management between individuals with diabetes mellitus (DM) and those without DM. For DM patients, blood glucose must be controlled before exercising. If blood sugar levels are high (>250–300 mg/dL), exercise should be postponed until levels are reduced to avoid weakness and excessive sweating. Conversely, if blood sugar levels are low (<100 mg/dL), a snack should be consumed before exercising to prevent hypoglycemia. Non-diabetic individuals do not have these restrictions and can start exercising without prior glucose monitoring. (29) DM patients are advised to engage in moderate-intensity exercise for about 30 minutes, five times a week. In contrast, non-diabetic individuals can perform physical activities of varying intensity, from light to vigorous, depending on personal preference and fitness goals.(21)

Hypoglycemia (low blood glucose) is a major risk for DM patients, especially those

taking insulin or glucose-lowering medications. Preventing hypoglycemia involves consuming complex carbohydrates before exercise and having quick sources of glucose ready if needed. Non-diabetic individuals do not face the same hypoglycemia risk but still need to manage nutrition and hydration before and during exercise. Therefore, people with diabetes must be more careful in monitoring their blood sugar, selecting appropriate exercise intensity and duration, and being prepared to manage the risks of both hypoglycemia and hyperglycemia. Meanwhile, non-diabetic individuals have greater flexibility in choosing exercise types and intensities.(29)

It is important to check blood glucose levels before starting physical activity. The ideal range before exercising is between 100–250 mg/dL. If levels exceed 250 mg/dL, exercise should be delayed until they are under control. If levels are below 100 mg/dL, diabetic individuals should consume carbohydrate-containing snacks prior to exercising. After exercise, blood glucose should also be monitored to ensure no significant drops occur, especially after high-intensity or prolonged activity.(30)

In summary, type 2 diabetes is the most common form of diabetes and can be prevented by maintaining a healthy lifestyle—consuming nutritious foods and engaging in regular physical activity. Moreover, effective diabetes management requires active involvement from the individual, family members, healthcare professionals, and the surrounding environment. To achieve better outcomes, diabetic individuals should receive comprehensive education about the disease and its management to prevent complications and treatment failure. Insulin therapy is prescribed for type 2 diabetes patients who, despite oral antidiabetic medication, still have glycated hemoglobin (HbA1c) levels above 7.5%. Insulin is also indicated for those with HbA1c levels above 9%, accompanied by weight loss, diabetic ketoacidosis, or poor response to combination therapy.(31)

This study has several limitations. First, the case–control design limits the ability to establish a causal relationship between physical activity and the incidence of diabetes mellitus. Second, physical activity data were collected using self-reported questionnaires, which may be subject to recall bias and affect the accuracy of the information provided. Nevertheless, these limitations do not diminish the importance of the findings, as the results provide valuable evidence on the role of physical activity in diabetes prevention and may serve as a reference for future studies and community-based health interventions.

CONCLUSION

Based on the results of the study, it can be concluded that there is a significant relationship between physical activity and the incidence of diabetes mellitus in the

working area of Putri Ayu Public Health Center, Jambi City, in 2024. Individuals with low levels of physical activity have a 6.417 times higher risk of developing diabetes mellitus compared to those with high physical activity levels. Therefore, it is recommended that the community engage in regular physical activity for at least 30 minutes each day, such as walking, cycling, or exercising, to help maintain balanced blood sugar levels and prevent the occurrence of diabetes mellitus.

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