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Journal Coaching Education Sports
https://doi.org/10.31599/jces.v7i1.4616
Vol. 7, No.1, May 2026, pp. 108-116
E-ISSN: 2722-3450 P-ISSN: 2775-3808

Analysis of Blood Glucose Profiles Based on Physical Activity Levels Among Residents

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Abstract

This study aims to analyze blood glucose profiles based on physical activity levels among residents of Waluyorejo Village, Puring District, Kebumen Regency, Indonesia. A total of 25 respondents participated in the study, which was conducted from July to August 2025. Assessment of physical activity levels was conducted through direct observation of the community's daily routines, including their main occupation, mobility habits, and frequency of physical activity. Short interviews were used as supporting data to strengthen the observation results, especially regarding the history of lifestyle habits, dietary patterns, and respondents' perceptions of their physical health. Blood glucose levels were measured using a glucometer with standard procedures to ensure accuracy of the results. Data were analyzed descriptively to identify the general picture of the glucose profile in each physical activity group. The results showed that the average blood glucose level of respondents was 110 mg/dL. 32% of respondents were in the normal category, 52% were in the prediabetes category, and 16% were in the diabetes category. These findings indicate that the majority of the community shows a tendency towards elevated blood glucose levels, which are at risk of developing into metabolic disorders if not properly managed. Overall, this study confirms the importance of physical activity as a protective factor for health, especially in rural communities with diverse lifestyles. Furthermore, the findings highlight the need for ongoing education on balanced diets and regular blood glucose monitoring as preventive measures in controlling non-communicable diseases. This research is expected to form the basis for more targeted public health interventions in Waluyorejo Village and similar areas.

Keywords: Physical Activity, Blood Glucose, Rural Community, Metabolic Health

corresponding author: galih.yoga@unsoed.ac.id
Artikel Info:
Submitted: **19/11/2025** Revised: **16/01/2026** Accepted: **30/04/2026** Published: **02/05/2026**

How to Cite: Santiko, G, Y., Darmawan, A., Pambudi, Y, T., Ramadha, I, F. (2026). Analysis of Blood Glucose Profiles Based on Physical Activity Levels Among Residents. *Journal Coaching Education Sports*, 7(1), 108-116. https://doi.org/10.31599/jces.v7i1.4616
Author's Contribution: a) Study design; b) Data collection; c) Statistical analysis; d) Manuscript writing – all performed by the autor

A. Introduction

Physical activity is one of the primary determinants in maintaining metabolic homeostasis, particularly in regulating blood glucose levels (Kusuma et al., 2024). Regular physical activity has been shown to improve insulin sensitivity in peripheral tissues, enhance glucose metabolism, and reduce the risk of insulin resistance, which is a major contributing factor to the development of type 2 diabetes mellitus (Małkowska, 2024; Syeda et al., 2023). Conversely, an imbalance between physical activity levels and dietary patterns can lead to the accumulation of glucose in the bloodstream, triggering hyperglycemia and increasing the risk of chronic metabolic disorders (World Health Organization [WHO], 2022).

From a contextual perspective, rural communities such as those in Waluyorejo Village, Puring Subdistrict, Kebumen Regency, generally engage in relatively high levels of physical activity due to the dominance of manual and agricultural occupations. However, despite this high level of physical activity, access to routine health screening and health education remains limited. This condition may lead to a mismatch between energy expenditure and nutritional intake, potentially resulting in suboptimal metabolic regulation (Kementerian Kesehatan Republik Indonesia [Kemenkes RI], 2022). Furthermore, dietary patterns in rural populations are often characterized by high consumption of simple carbohydrates, which may contribute to fluctuations in blood glucose levels when not balanced with adequate nutritional management.

Previous studies have extensively demonstrated the physiological relationship between physical activity and glucose regulation. Physical activity enhances glucose uptake by skeletal muscles and stimulates insulin-mediated glucose transport, particularly during muscle contraction (McGee & Hargreaves, 2024; Simatupang et al., 2025). Additionally, both aerobic and resistance exercises have been reported to improve insulin sensitivity by up to 40% within 24–48 hours post-exercise, indicating a significant adaptive effect on glycemic control (Bellini et al., 2024; Fobian et al., 2021). In contrast, individuals with low physical activity levels or sedentary lifestyles have a two- to three-fold higher risk of developing glucose intolerance and type 2 diabetes compared to physically active individuals (Hidayah et al., 2025; Syrjälä et al., 2025). (Yaribeygi et al., 2021) further reported that physical inactivity is positively associated with elevated fasting glucose levels and reduced muscle oxidative capacity.

Despite the substantial body of evidence on the relationship between physical activity and blood glucose regulation, most existing studies have been conducted in urban populations or controlled clinical settings. There remains a limited understanding of how these relationships manifest in rural communities, where physical activity patterns are naturally high but are not necessarily accompanied by optimal health monitoring or balanced nutritional intake. This gap highlights the need for context-specific research that captures real-world conditions in rural populations.

Therefore, this study aims to analyze blood glucose profiles based

on physical activity levels among residents of Waluyorejo Village. This analysis is expected to provide an overview of the community's metabolic health status and serve as an evidence-based foundation for preventive strategies targeting metabolic diseases at the community level. In addition, the findings of this study are expected to support community-based health promotion programs focused on controlling risk factors for non-communicable diseases, particularly in rural settings.

B. Methods

This study employed a quantitative descriptive approach with a field survey design to describe the profile of blood glucose levels in the community based on physical activity levels. The descriptive approach was selected as it is appropriate for providing an empirical overview of community health conditions without direct intervention (Sugiyono, 2019).

The research subjects consisted of 25 residents of Waluyorejo Village, Puring Subdistrict, Kebumen Regency, selected using purposive sampling based on the criteria of being adults and willing to undergo blood glucose testing. Data were collected through direct observation and interviews to determine respondents' physical activity levels, which were classified into three categories: light, moderate, and vigorous. The classification of physical activity levels was based on indicators of frequency, duration, and intensity of daily physical activities, in accordance with the World Health Organization (WHO, 2020) guidelines for adult physical activity classification.

Blood glucose levels were measured using capillary blood sampling with a digital glucometer, following the fasting blood glucose (FPG) measurement procedure. This procedure was conducted in the morning after participants had fasted for at least eight hours to ensure accuracy and to minimize the influence of recent food intake on glucose levels (American Diabetes Association [ADA], 2023).

Data collection was carried out between July and August 2025 under the direct supervision of the researcher. The collected data were analyzed using descriptive quantitative methods, including the calculation of means, frequency distributions, and categorization of fasting blood glucose levels based on the standards of the American Diabetes Association (ADA, 2023), as follows:

1. < 100 mg/dL = Normal
2. 100–125 mg/dL = Prediabetes
3. ≥ 126 mg/dL = Diabetes

The results were analyzed and presented in tables and bar charts to illustrate the distribution of blood glucose levels across different physical activity categories, supported by narrative interpretation to explain the observed trends.

C. Result and Discussion

Based on the examination results of 25 respondents in Waluyorejo Village, blood glucose levels ranged from 85 mg/dL to 185 mg/dL, with an average value of 110 mg/dL. This mean value indicates that, in general, the metabolic condition of the community falls within the mild prediabetes category, suggesting a potential metabolic risk if lifestyle factors are not properly managed.

Table 1. Distribution of Blood Glucose Levels by Category

Category	Range (mg/dL)	Number of Respondents	Percentage (%)
Normal	< 100	8	32%
Prediabetes	100–125	13	52%
Diabetes	≥ 126	4	16%
Total		**25**	**100%**

The majority of the population falls within the prediabetes category (52%), followed by the normal category (32%) and the diabetes category (16%). This distribution indicates that a substantial proportion of respondents have experienced elevated blood glucose levels approaching the diabetic threshold, although they have not yet reached a pathological condition.

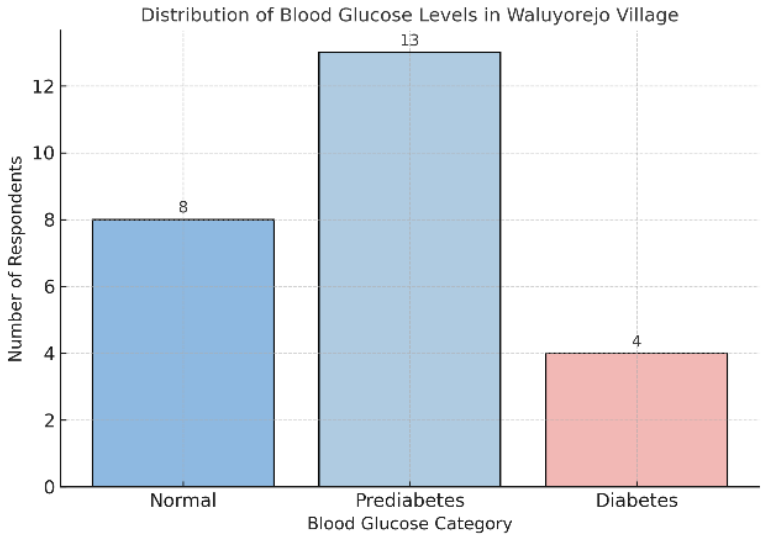

Figure 1. Distribution Graph of Blood Glucose Levels Among Residents of Waluyorejo Village
Source: Data Processing Results (2025)

The description of Figure 1 shows that:

1. A total of 8 respondents (32%) fall within the normal category (<100 mg/dL),
2. 13 respondents (52%) are classified as prediabetes (100–125 mg/dL), and
3. 4 respondents (16%) are categorized as diabetes (≥126 mg/dL).

Discussion

The data distribution indicates that the majority of the population is in a prediabetic condition, which represents an early stage toward the development of type 2 diabetes mellitus if lifestyle modifications and increased physical activity are not implemented (American Diabetes Association [ADA], 2023). These findings are consistent with the study by (Bayu Prasetyo & Setyoadi, 2025), which reported that low levels of physical activity are positively

correlated with increased blood glucose levels among rural populations in Central Java.

According to (Aufan & Handoko, 2024), regular physical activity can improve insulin sensitivity, accelerate glucose transport into muscle cells, and enhance glucose homeostasis. However, according (Zahalka et al., 2000) when physical activity is not balanced with adequate nutritional intake or is accompanied by excessive consumption of simple carbohydrates, the risk of elevated blood glucose levels remains high, even in individuals who appear physically active.

Other factors that may influence blood glucose levels include age, dietary habits, stress, and daily activity levels ('Good to Know', 2018). In the context of Waluyorejo Village, interview results revealed that most respondents work in the agricultural sector with relatively high levels of physical activity; however, not all individuals pay attention to meal timing and balanced nutritional intake. As a result, blood glucose levels do not always correspond with physical activity levels.

This condition highlights the need for regular health screening programs, structured physical activity education, and balanced nutrition guidance at the community level. A community-based approach is strongly recommended for the prevention of chronic metabolic diseases (WHO, 2020). Through health education programs and routine monitoring of blood glucose levels, the community is expected to gain a better understanding of the relationship between physical activity, dietary patterns, and overall metabolic health.

The findings of this study show that the average blood glucose level among residents of Waluyorejo Village is 110 mg/dL, with the majority of respondents (52%) classified as prediabetic, 32% as normal, and 16% as diabetic. This condition indicates that most individuals have experienced elevated blood glucose levels above the normal range, although they have not yet reached the stage of diabetes mellitus. This phenomenon reflects a potential risk of metabolic disorders resulting from an imbalance between physical activity, nutritional intake, and lifestyle habits within rural communities.

According to the American Diabetes Association (ADA, 2023), fasting blood glucose levels above 100 mg/dL serve as an early indicator of insulin resistance, a condition in which body cells are unable to respond effectively to insulin, resulting in increased blood glucose levels. Insulin resistance is often associated with low physical activity, overweight conditions, or excessive intake of simple carbohydrates. However, in rural communities such as Waluyorejo, the contributing factors may be more complex, involving high levels of physical labor that are not balanced with adequate nutritional intake and limited access to regular health monitoring (Kemenkes RI, 2022).

Physical activity plays a crucial role in improving insulin sensitivity and glucose metabolism. During muscle contraction, glucose uptake into muscle cells increases through insulin-independent pathways (Hawley & Lessard, 2008). This mechanism explains why regular physical activity can reduce blood glucose levels and prevent the

progression of prediabetes into diabetes mellitus. (Lan et al., 2025) further emphasize that consistent aerobic and resistance training can improve insulin sensitivity by up to 40% within 48 hours after exercise.

However, the findings of this study indicate that although most residents of Waluyorejo Village engage in moderate to high levels of physical activity, their blood glucose levels remain within the prediabetic range. This condition may be influenced by unbalanced dietary patterns, irregular meal timing, and a lack of knowledge regarding post-activity nutritional management. (Aji et al., 2024) explain that intense physical activity without adequate energy intake, particularly from complex carbohydrates, may lead to metabolic stress, which in the long term can disrupt insulin and glucagon balance.

In addition, age and lifestyle habits also contribute to elevated blood glucose levels. (Shur et al., 2021) suggest that aging is associated with decreased muscle mass and increased visceral fat, both of which are strongly linked to insulin resistance. In rural communities, factors such as insufficient rest, excessive consumption of coffee or sugary foods, and limited routine health check-ups further exacerbate this condition.

Based on the findings and existing theoretical frameworks, it can be concluded that physical activity has a positive influence on blood glucose levels; however, its effectiveness is highly dependent on overall lifestyle quality, including dietary patterns, stress management, and regular health monitoring. Therefore, a community-based health promotion approach is essential. The World Health Organization (WHO, 2020) recommends that health interventions in rural areas focus on improving nutritional literacy, promoting moderate-to-vigorous physical activity, and providing accessible blood glucose screening facilities for early detection of prediabetes.

Thus, this study provides practical implications that physical activity must be complemented by balanced nutrition, awareness of regular health check-ups, and strong social support systems in order to function optimally in maintaining metabolic balance among rural populations such as those in Waluyorejo Village.

D. Conclusion

This study shows that residents of Waluyorejo Village have an average fasting blood glucose level of 110 mg/dL, with the majority of respondents classified as prediabetic (52%). This condition indicates the need for greater attention to lifestyle patterns and physical activity among rural communities. Proper regulation of physical activity, along with education on balanced nutrition, is expected to help prevent increases in blood glucose levels and reduce the risk of diabetes mellitus in rural populations.

E. Acknowledgment

The authors would like to express their sincere gratitude to the residents of Waluyorejo Village, Puring Subdistrict, Kebumen Regency, for their willingness to participate in the blood glucose testing and interviews related to physical activity. The authors also extend their appreciation to Universitas Jenderal Soedirman,

particularly the Faculty of Health Sciences and the Physical Education Study Program, for providing facilities and research permission. Special thanks are also given to fellow researchers and students who contributed to the data collection process.

F. Conflict of Interest

No conflict of interest.

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