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Self-Motivation and Educational Level Are Associated With Blood Glucose Levels in Older Adults: A Cross-Sectional Study

Aqilah Nafi'a Putri [1,*], Marta Putri Nabilah [2], Taurisma Aulia Nanda Wibisono [1], Cindy Calista [3], Ilham Akbar Hardiansyah [1]

[1]Department of Medicine, State University of Malang, Malang, Indonesia
[2]Department of Midwifery, State University of Malang, Malang, Indonesia
[3]Department of Nursery, State University of Malang, Malang, Indonesia

***Corresponding Author:**
Aqilah Nafi'a Putri
Email: aqilah.nafia.2510116@students.um.ac.id

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ABSTRACT

Background: Aging populations face increasing risks of impaired glucose metabolism. Self-motivation and educational attainment may influence health behaviors that support glycemic control, yet their community-level associations remain underexplored in Indonesian older adults.
Objective: To analyze the relationships between healthy life motivation and educational level with blood glucose levels among older adults in Sumbersari Urban Village, Malang City.
Methods: A quantitative cross-sectional study following STROBE guidelines was conducted among 50 older adults selected through purposive sampling. Data on motivation, education, and capillary blood glucose were collected. Bivariate analyses used Mann-Whitney U test and Spearman rank correlation with significance at $p<0.05$.
Results: Most participants had low motivation (72.0%) and senior high school education (48.0%). Median blood glucose was 132.00 mg/dL (range 77-399). Blood glucose differed significantly between motivation groups (median 146.0 vs 123.5 mg/dL; $p=0.032$). Educational level showed a strong negative correlation with glucose levels ($\rho=-0.775$; $p<0.001$)
Conclusion: Self-motivation and educational level are significantly associated with blood glucose levels among older adults. Strengthening motivation and providing targeted health education should be integrated into community-based promotive and preventive programs for healthy aging.

Key Points (Highlights):

- *Aging and low health literacy raise diabetes risks.*
- *Motivation and education lower elderly glucose.*
- *Integrate motivation and literacy in care.*

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INTRODUCTION

The demographic shift toward an aging population represents a critical public health challenge, particularly in Indonesia where the elderly population is projected to reach 11.8%, or nearly 34 million people, by early 2025 (Ong-Artborirak et al., 2023a). The aging process is characterized by progressive and irreversible physiological changes, including decreased insulin sensitivity, altered body composition, reduced physical activity, and shifting dietary patterns, all of which may contribute to impaired glucose tolerance and elevated blood glucose levels (Jang et al., 2024). These physiological vulnerabilities significantly increase the risk of chronic noncommunicable diseases, particularly diabetes mellitus, whose prevalence continues to rise globally and tends to be higher among older adults than younger age groups (Obayi et al., 2026). Diabetes mellitus in older adults requires special attention because it may increase the risk of various complications that affect bodily functions and quality of life (Abdallah et al., 2024). Blood glucose levels are therefore considered one of the key parameters for assessing metabolic status in this population, yet biological factors alone cannot fully explain the variability in glycemic outcomes observed among community-dwelling older adults (Minhat et al., 2023).

Beyond pharmacological interventions, psychological factors particularly self-motivation may play a pivotal role in sustaining the complex self-care behaviors required for glycemic control, including managing diet, engaging in physical activity, adhering to medication, and monitoring health status (Li et al., 2023). Motivation serves as an internal drive that can support individuals in maintaining consistent engagement in these health-related behaviors over time (Vitaliati & Maurida, 2024). Evidence from recent systematic reviews suggests that motivation-focused interventions may be associated with improvements in glycemic markers and self-management behaviors among adults with type 2 diabetes (Suksatan et al., 2021). Similarly, interventions integrating information, motivation, and behavioral skills have been reported to improve attitudes, self-efficacy, and medication adherence among older adults with diabetes (Rachmawati et al., 2019). However, the translation of motivation into tangible glycemic outcomes is not automatic; it is often mediated by an individual's cognitive capacity to process and apply health information effectively in daily life (Cui et al., 2025).

Educational attainment may fundamentally shape this cognitive capacity, serving as a primary determinant of health literacy (Camargo-Plazas et al., 2023). Individuals with higher educational levels tend to have better health awareness and may be more capable of obtaining, understanding, and applying health information related to disease prevention and healthy lifestyle behaviors (Akeren & Akeren, 2026). Low health literacy has been associated with suboptimal blood glucose control and an increased risk of complications, whereas higher health literacy may support glucose control and improve patients' quality of life (Wu et al., 2025). Structured diabetes self-management education has also been demonstrated to improve glycemic control, self-management behaviors, and psychosocial well-being in various populations, including older adults (Esferjani et al., 2022). Education thus acts as a potential protective buffer against poor glycemic control, yet its synergistic relationship with self-motivation in community-dwelling older adults remains inadequately quantified, particularly in local contexts where social characteristics and health behaviors may vary significantly (Iskandar et al., 2025).

While previous studies have examined motivation or education in isolation, there is a distinct lack of research analyzing their combined associations with blood glucose levels at the community level among Indonesian older adults (Izquierdo et al., 2022). This gap is important because social characteristics, educational attainment, access to information and health services, and health behaviors can vary across regions and may influence the health status of older adults differently in different settings. Sumbersari Urban Village in Malang City, with its substantial elderly population of 903 people as of 2023, provides a relevant setting to address this gap. Understanding these

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relationships at the local level is crucial for designing context-specific, holistic interventions that integrate psychological empowerment with educational strategies to optimize metabolic health and support healthy aging in community settings (Zhang et al., 2024). Therefore, this study aims to analyze the relationship between self-motivation and educational level with blood glucose levels among older adults in Sumbersari Urban Village, Malang City.

MATERIALS AND METHODS

Study Design and Setting

This quantitative analytical observational study utilized a cross-sectional design, adhering to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies. The research was conducted in Sumbersari Urban Village, Malang City, East Java, Indonesia, a community with a substantial elderly population (903 older adults as of 2023), making it representative for evaluating community-level metabolic health determinants. Data collection was executed in May 2026.

Participants and Sampling

The target population comprised older adults residing in Sumbersari Urban Village, Malang City. A purposive sampling technique was employed to select 50 respondents who met the inclusion criteria: older adults residing in Sumbersari Urban Village who were willing to participate as research respondents. Exclusion criteria included respondents who did not complete the research procedures or failed to complete the required data collection. The final sample consisted of 50 participants with complete data for all variables.

Variables and Measurements

The dependent variable was blood glucose level, measured via capillary blood sampling using a calibrated glucometer and expressed in mg/dL. Independent variables included healthy life motivation and educational level. Self-motivation was defined as an individual's internal drive to engage in and maintain health-related behaviors, measured using a questionnaire with dichotomous "Yes" (scored 1) and "No" (scored 0) responses. Total scores were summed and categorized into low and high motivation based on the median split. Educational level was defined as the highest level of formal education completed by the respondent, categorized ordinally from no formal education to undergraduate degree.

Data Collection Procedure

Trained researchers conducted face-to-face interviews following a standardized protocol. Data collection began with a comprehensive explanation of study objectives, procedures, benefits, and respondents' rights. Participants who agreed to participate provided written informed consent before any data collection. Subsequently, respondents completed the questionnaire regarding personal characteristics and self-motivation. After questionnaire completion, capillary blood glucose was measured using a glucometer in accordance with the device's operating procedures. All collected data were checked for completeness before processing and analysis.

Statistical Analysis

Data were analyzed using univariate and bivariate analyses. Univariate analysis described respondents' characteristics, educational levels, self-motivation levels, and blood glucose levels. Categorical data were presented as frequencies and percentages, while numerical data were presented as mean ± standard deviation for normally distributed data or median and interquartile range for non-normal distributions. Normality was assessed using the Shapiro-Wilk test. Bivariate analysis employed the Mann-Whitney U test to compare blood glucose levels between two motivation groups (low vs high) when data were not normally distributed. Spearman's rank correlation test was used to

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assess the association between educational level (ordinal) and blood glucose levels (continuous, non-normal). The level of statistical significance was set at $p < 0.05$ with a 95% confidence interval. All analyses were conducted after ethical clearance was obtained.

Ethical Considerations

This study adhered to research ethics principles by providing respondents with comprehensive information regarding study objectives, procedures, benefits, and their rights before data collection. All participants provided written informed consent. The confidentiality of respondents' identities and research data was maintained throughout the study, and collected data were used solely for research purposes. Ethical clearance for this study was obtained from the Health Research Ethics Committee of the State University of Malang.

RESULTS

A total of 50 older adults were included in the final analysis, with no missing data for the variables analyzed. The demographic characteristics, descriptive statistics, and bivariate associations are detailed in Table 1 and Table 2. The relationship between educational attainment, motivation, and blood glucose levels is visualized in Figure 1.

Table 1. Demographic Characteristics and Descriptive Statistics of Study Variables (N=50)

Variable	Category/Statistic	n (%) or Value	Mean ± SD / Median
Healthy Lifestyle Motivation	Low	36 (72.0%)	-
	High	14 (28.0%)	
Educational Level	No Formal Education	3 (6.0%)	-
	Elementary School	13 (26.0%)	
	Junior High School	8 (16.0%)	
	Senior High School	24 (48.0%)	
	Undergraduate	2 (4.0%)	
Blood Glucose (mg/dL)	Overall (n=50)	100%	159.14 ± 76.53 / 132.00
	Range	-	77 - 399
	IQR	-	77.75
	Shapiro-Wilk p	-	
Blood Glucose by Motivation	Low motivation (n=36)	72.0%	Median: 146.0; IQR: 135.25
	High motivation (n=14)	28.0%	Median: 123.5; IQR: 19.75

Table 2. Bivariate Analysis of Associations Between Independent Variables and Blood Glucose Levels

Analysis	Variables Compared	Test Statistic	Effect Size	p-value	Interpretation
Mann-Whitney U Test	Blood glucose: Low vs High motivation	U = 152.50; Z = -2.150	Mean rank: 28.26 vs 18.39	0.032	Significant difference; high motivation associated with lower glucose
Spearman Rank Correlation	Educational level vs Blood	ρ = -0.775	Strong negative correlation	<0.001	Higher education associated with lower blood glucose

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glucose

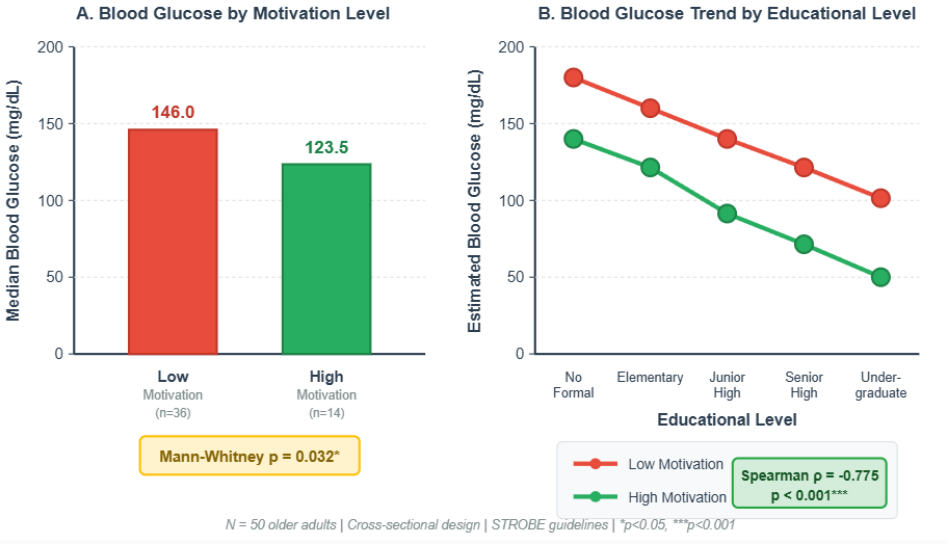


Figure 1. Association Between Self-Motivation, Education Level, and Blood Glucose Levels

Figure 1. Visual summary of the bivariate associations between self-motivation, educational level, and blood glucose levels among older adults in Sumbersari Urban Village (N=50). **Panel A** shows the comparison of median blood glucose levels between low motivation (146.0 mg/dL) and high motivation (123.5 mg/dL) groups, with a statistically significant difference (Mann-Whitney U test, p=0.032). **Panel B** illustrates the estimated trend of blood glucose levels across five educational levels, stratified by motivation status, demonstrating a strong negative correlation between educational attainment and blood glucose (Spearman ρ=-0.775, p<0.001). Higher education and higher motivation are both associated with lower blood glucose**.**

DISCUSSION

This study demonstrates that both educational attainment and healthy life motivation are significantly associated with blood glucose levels among older adults in Sumbersari Urban Village. The bivariate analyses revealed that older adults with high motivation had significantly lower blood glucose levels compared to those with low motivation (median 123.5 vs 146.0 mg/dL; p=0.032), and educational level showed a strong negative correlation with blood glucose (ρ=-0.775; p.

The significant association between self-motivation and blood glucose levels aligns with global evidence emphasizing the role of internal psychological drives in sustaining complex self-care behaviors (Abdallah et al., 2024). Motivation acts as the catalyst that translates health awareness into consistent action, such as dietary adherence, physical activity, medication compliance, and glucose monitoring. When older adults possess high self-motivation, they are more likely to overcome the physical and cognitive barriers associated with aging, thereby maintaining better glycemic control through sustained lifestyle modifications (Izquierdo et al., 2022). This finding is consistent with systematic reviews demonstrating that motivation-based interventions significantly improve HbA1c, fasting plasma glucose, and self-management behaviors among adults with type 2 diabetes (Ong-Artborirak et al., 2023b).

Similarly, the strong inverse relationship between educational level and blood glucose underscores the importance of health literacy as a protective factor. Higher educational attainment equips individuals with the cognitive tools necessary to comprehend complex medical information, evaluate

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dietary choices, understand disease mechanisms, and navigate healthcare systems effectively (Suksatan et al., 2021). Educated older adults are better positioned to understand the long-term consequences of poor glycemic control, enabling them to make informed, proactive decisions regarding their daily health routines (Almutairi et al., 2020). This finding supports evidence that diabetes self-management education significantly improves glycemic control and quality of life, particularly when interventions are tailored to individuals' educational backgrounds and learning capacities (Butayeva et al., 2023).

The conceptual framework presented in Figure 1 illustrates how education and motivation operate as parallel pathways influencing blood glucose levels. While these variables were analyzed separately in bivariate tests, they likely interact synergistically in real-world settings (Izquierdo et al., 2022). Education provides the knowledge foundation, while motivation drives the behavioral implementation. Older adults with both high education and high motivation may represent the most resilient group for glycemic management, whereas those with low levels of both factors may require intensive, multifaceted support (Akeren & Akeren, 2026). Understanding these dynamics is crucial for designing targeted interventions that address both cognitive and psychological barriers to healthy aging.

Limitation

Despite these findings, this study has several important limitations that must be acknowledged. First, the cross-sectional design precludes causal inference; we cannot determine whether low motivation and education cause elevated glucose levels, or whether poor glycemic control diminishes motivation. Second, the relatively small sample size (n=50) limits statistical power and generalizability, particularly for subgroup analyses. Third, the study collected only two independent variables (motivation and education), preventing adjustment for important confounders such as age, gender, body mass index, physical activity, dietary patterns, medication use, and duration of diabetes. Fourth, motivation was measured using a self-report questionnaire susceptible to social desirability bias, and the categorization into low/high groups may have reduced statistical precision. Fifth, blood glucose was measured at a single time point without standardization of fasting status, introducing measurement variability. Finally, conducting the study in a single urban village limits applicability to rural or institutionalized elderly populations with different socioeconomic contexts.

Future research should employ longitudinal designs to establish temporal relationships and causal pathways between motivation, education, and glycemic outcomes. Larger, multi-center studies with diverse populations are needed to enhance generalizability and enable multivariate modeling with adequate confounder adjustment. Qualitative research could explore the mechanisms through which motivation and education influence self-care behaviors in older adults. From a policy perspective, these findings strongly advocate for the integration of motivational enhancement strategies and tailored health literacy programs into community-based elderly care initiatives, such as integrated healthcare posts (posyandu lansia) in Indonesia. Policymakers must recognize that clinical interventions alone are insufficient; fostering cognitive empowerment and psychological resilience through education and motivation-building programs is equally vital for sustainable healthy aging and optimal metabolic outcomes in the rapidly growing elderly population.

CONCLUSIONS

Educational attainment and healthy life motivation are significantly associated with blood glucose levels among older adults in Sumbersari Urban Village, with higher levels of both factors linked to lower glycemia. These bivariate findings underscore the necessity of shifting from purely clinical interventions to holistic, community-based strategies that integrate motivational enhancement and targeted health literacy education. Policymakers and healthcare providers must prioritize these psychosocial and cognitive determinants in promotive and preventive programs to foster sustainable

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healthy aging and optimize metabolic outcomes in the growing elderly population, while acknowledging the need for longitudinal research to establish causal relationships and multivariate studies to account for confounding factors.

DECLARATIONS

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2. Ethical Approval and Informed Consent

This study was approved by the Health Research Ethics Committee of the State University of Malang. Written informed consent was obtained from all participants prior to their participation in the study.

3. Data Availability Statement

The datasets generated and/or analyzed during the current study are not publicly available due to privacy and ethical restrictions regarding the identity of older adult respondents, but are available from the corresponding author on reasonable request.

4. Funding

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5. Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

6. Authors' Contributions

Conceptualization: A.N.P., M.P.N.; Methodology: A.N.P., T.A.N.W.; Formal analysis and investigation: A.N.P., I.A.H.; Writing - original draft preparation: A.N.P., M.P.N., C.C.; Writing - review and editing: T.A.N.W., I.A.H.; Funding acquisition: A.N.P.; Resources: M.P.N., C.C.; Supervision: A.N.P.

7. AI Disclosure

During the preparation of this work, the authors used AI tools in order to improve language readability and grammar. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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