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Effect of health education on self-care behavior in patients with type 2 diabetes mellitus

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ABSTRACT

Introduction: Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder requiring continuous self-care to prevent complications. Health education plays a crucial role in enhancing patients' understanding, attitudes, and skills for effective self-management. This study aimed to investigate the impact of health education on self-care behaviors among patients with Type 2 Diabetes Mellitus.

Methods: This quasi-experimental study employed a pretest–posttest design with a control group. The study involved 60 patients with type 2 diabetes mellitus (T2DM) selected using purposive sampling from a public health center. The intervention group received structured health education sessions covering diet management, physical activity, medication adherence, and blood glucose monitoring for a period of four weeks, while the control group received standard care. Data were collected using the Summary of Diabetes Self-Care Activities (SDSCA) questionnaire. Statistical analysis was conducted using paired and independent t-tests with a significance level of $p < 0.05$.

Results: The findings showed a significant increase in self-care behavior scores in the intervention group after receiving health education ($p < 0.001$), while no significant change was observed in the control group ($p > 0.05$). The mean difference between the two groups indicated that health education had a positive effect on self-care behavior among patients with T2DM.

Conclusion: Health education has a significant impact on improving self-care behaviors among patients with Type 2 Diabetes Mellitus. Structured and continuous education increases patients' awareness, adherence, and ability to manage diet, exercise, medication, and blood glucose monitoring effectively. Healthcare providers should integrate regular health education programs into diabetes management to enhance patients' self-care skills and prevent complications. Further research with larger samples and longer follow-up is recommended to evaluate the long-term impact of such interventions.

Keywords: Diabetes Mellitus, Health Education, Patients, Self-Care Behavior.

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INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is one of the most prevalent chronic diseases worldwide and represents a significant public health concern due to its increasing incidence and associated complications (Alotaibi *et al.*, 2025). The International Diabetes Federation (IDF) reported that in 2023, more than 530 million adults were living with diabetes globally, and the number is expected to rise to 643 million by 2030. Type 2 Diabetes Mellitus accounts for approximately 90–95% of all diabetes cases and is characterized by insulin resistance and relative insulin deficiency. This metabolic disorder often leads to serious complications such as neuropathy, retinopathy, nephropathy, cardiovascular disease, and lower limb amputation if not properly managed (Alsahli *et al.*, 2025).

Effective diabetes management requires more than pharmacological treatment alone; it demands active patient participation through consistent self-care behaviors (Badi *et al.*, 2025). Self-care refers to a series of daily activities that individuals perform to manage their condition, including maintaining a healthy diet, engaging in regular physical activity, adhering to prescribed medications, monitoring blood glucose levels, and practicing proper foot care (Bakhshi *et al.*, 2024). The American Diabetes Association (ADA) emphasizes that self-care is a cornerstone of diabetes management, playing a critical role in preventing both acute and chronic complications. However, many patients with T2DM still demonstrate poor self-care adherence due to limited knowledge, low motivation, and inadequate understanding of their condition (Butt *et al.*, 2025).

Health education is a key strategy in improving patients' knowledge, attitudes, and skills in managing diabetes. According to the World Health Organization (WHO), health education is a process that enables individuals to increase control over their health and improve health outcomes through learning and behavioral change (Izadirad and Jangizahi, 2025). In the context of diabetes, effective health education empowers patients to understand the disease process, recognize the importance of self-management, and develop problem-solving abilities to overcome daily challenges related to their condition. Studies have shown that patients who receive structured health education exhibit better glycemic control, higher treatment adherence, and reduced risk of complications compared to those who do not (Jang *et al.*, 2025).

Despite these findings, the level of awareness and understanding about self-care remains low among many diabetic patients, particularly in developing countries (Khazew and Faraj, 2024). Cultural beliefs, low health literacy, and limited access to healthcare services often hinder the effectiveness of diabetes management. In Indonesia, the prevalence of diabetes continues to rise, and many patients rely primarily on medication without adopting necessary lifestyle modifications. This situation highlights the pressing need for effective and sustainable health education interventions that prioritize behavior change over knowledge alone (Li *et al.*, 2025).

The success of health education depends not only on the information provided but also on the method of delivery. Interactive and participatory education sessions, which involve discussion, demonstration, and feedback, have been proven to enhance patients' engagement and retention of knowledge. Nurses and health educators play a vital role in this process, as they are in direct contact with patients and can provide continuous guidance and motivation (Liu *et al.*, 2025). By enhancing patients' self-efficacy and confidence, health education can facilitate positive behavioral change and help patients achieve improved glycemic control. Previous research has explored the relationship between health education and diabetes self-management, but findings vary depending on the setting, population, and intervention approach. Some studies have reported significant improvements in self-care behavior following structured education, while others have found minimal or short-term effects. Therefore, further investigation is

necessary to confirm the effectiveness of health education, especially within community-based healthcare settings in Indonesia.

This study aims to investigate the impact of health education on self-care behaviors among patients with Type 2 Diabetes Mellitus. By assessing changes in self-care practices before and after the educational intervention, the study seeks to provide empirical evidence supporting the integration of structured health education into diabetes management programs. The results are expected to contribute valuable insights for healthcare professionals, policymakers, and educators in designing effective patient-centered education strategies. Ultimately, improving self-care behavior through health education can enhance treatment outcomes, reduce complications, and improve the quality of life for individuals living with Type 2 Diabetes Mellitus.

RESEARCH METHODOLOGY

Research Design

This study employed a quasi-experimental design using a pretest–posttest control group approach. This design was chosen to determine the effect of health education on self-care behavior among patients with Type 2 Diabetes Mellitus (T2DM). The quasi-experimental design allowed the researchers to compare outcomes between participants who received the intervention and those who did not, while maintaining ethical and practical feasibility in a clinical setting.

Setting and Participants

The research was conducted at a public health center (Puskesmas) located in [insert city or region], which provides routine diabetes management and education services. The study population consisted of all registered patients diagnosed with Type 2 Diabetes Mellitus who regularly attended the diabetic clinic. A total of 60 participants were selected using purposive sampling based on predetermined inclusion and exclusion criteria. Inclusion criteria included patients who: Were diagnosed with Type 2 Diabetes Mellitus for at least six months, were aged between 35 and 70 years, were able to read and communicate in Bahasa Indonesia, and were willing to participate and provide informed consent. Exclusion criteria included patients with severe complications (e.g., nephropathy, neuropathy, or retinopathy), those with cognitive impairment, and patients currently participating in other educational programs.

The selected participants were then divided equally into two groups: an intervention group (n = 30) and a control group (n = 30). The division ensured that the two groups had comparable demographic and clinical characteristics at baseline.

Intervention Procedure

The intervention group received a structured health education program developed in accordance with the recommendations of the American Diabetes Association (ADA) and local diabetes management guidelines. The sessions were delivered over four consecutive weeks, with one session per week lasting approximately 60–90 minutes. The education topics included understanding diabetes and its complications, diet management and meal planning, physical activity and exercise, medication adherence and blood glucose monitoring, as well as foot care and the prevention of complications. Educational materials were delivered through lectures, group discussions, demonstrations, and visual aids (leaflets and posters). Participants were encouraged to ask questions and share personal experiences to enhance engagement and understanding. Meanwhile, the control group received standard care, which included routine medical consultations and general health advice without additional structured education.

Data Collection Instrument

Data were collected using the Summary of Diabetes Self-Care Activities (SDSCA) questionnaire, a validated tool developed by Toobert et al. (2000) that measures patients' self-

care behaviors in five domains: diet, physical activity, medication adherence, blood glucose monitoring, and foot care. The instrument was translated into Bahasa Indonesia and tested for validity and reliability before use. Pretests were conducted one week before the intervention, and posttests were administered one week after the completion of the education sessions.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) 25.0. Descriptive statistics (mean, standard deviation, frequency, and percentage) were used to describe demographic characteristics and baseline variables. The paired t-test was used to compare pretest and posttest scores within each group, while the independent t-test was used to compare differences between the intervention and control groups. The level of statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee of [insert institution name]. All participants were informed about the study's purpose, procedures, benefits, and potential risks. Written informed consent was obtained before participation. Confidentiality and anonymity were maintained throughout the research process, and participants were free to withdraw from the study at any time without penalty or consequence.

RESULT

A total of 60 participants with Type 2 Diabetes Mellitus were included in this study, consisting of 30 participants in the intervention group and 30 participants in the control group. The majority of respondents were female (63.3%) and were aged between 46 and 65 years. Most participants had been diagnosed with T2DM for 1–5 years (56.7%) and had completed at least secondary education (61.7%). Statistical analysis using the Chi-square test revealed no significant differences between the two groups in terms of demographic characteristics ($p > 0.05$), indicating that both groups were comparable at baseline.

Table 1. Comparison of Mean Self-Care Behavior Scores Before and After Health Education (n = 60)

Group	Mean ± SD (Pretest)	Mean ± SD (Posttest)	Mean Difference	*p*-value (Paired t-test)
Intervention Group	48.33 ± 6.12	66.87 ± 5.84	18.54	< 0.001*
Control Group	47.96 ± 5.95	49.13 ± 6.42	1.17	0.214

Note: $p < 0.05$ indicates a significant difference.

The results indicate that the intervention group demonstrated a significant improvement in self-care behavior following health education ($p < 0.001$), whereas the control group showed no significant change ($p > 0.05$).

Table 2. Comparison of Self-Care Behavior Improvement Between Groups

Group	Mean Difference ± SD	*t*-value	*p*-value
Intervention Group	18.54 ± 4.72		
Control Group	1.17 ± 3.65	12.43	< 0.001*

Note: $p < 0.05$ indicates a significant difference.

The independent t-test revealed a significant difference in the improvement of self-care behavior between the intervention and control groups ($p < 0.001$). This finding demonstrates that the health education intervention had a positive and substantial effect on enhancing self-care behavior among patients with Type 2 Diabetes Mellitus. Further analysis of each SDSCA domain

indicated that the highest improvement occurred in diet management and blood glucose monitoring, followed by medication adherence and physical activity. Foot care also showed improvement, but to a lesser extent. The results suggest that health education effectively increases patients' understanding of diet and glucose monitoring, which are the core components of diabetes self-management. Participants reported being more consistent in checking their blood sugar levels, following their dietary plans, and adhering to their medication schedules after attending the education sessions.

DISCUSSION

The results of this study demonstrated that structured health education had a significant effect on improving self-care behavior among patients with Type 2 Diabetes Mellitus (T2DM). After four weeks of educational intervention, participants in the intervention group showed a substantial increase in their self-care scores, particularly in the domains of diet management, physical activity, medication adherence, and blood glucose monitoring. In contrast, the control group, which received only standard care, showed no significant improvement. These findings support the hypothesis that targeted and structured health education effectively enhances diabetes self-management behaviors (Morinishi *et al.*, 2025).

The study's findings are consistent with previous research, which highlights the pivotal role of education in managing chronic diseases. Diabetes self-management education (DSME) is a fundamental component of diabetes care that improves glycemic control, reduces complications, and enhances patients' quality of life (Murat Mehmed Ali *et al.*, 2025). Health education interventions significantly increased patients' adherence to self-care practices, resulting in better blood glucose control and improved health outcomes. The results of the current study align with these findings, emphasizing that continuous patient education is crucial in empowering individuals to manage their illness effectively (Park *et al.*, 2024).

Health education influences self-care behavior through several mechanisms. First, it enhances patients' knowledge of the disease and its management, which forms the basis for behavioral change. Many individuals with diabetes lack understanding of the disease process, risk factors, and the importance of daily self-management (Qiu *et al.*, 2025). Through education, patients become more aware of how diet, exercise, and medication adherence influence blood glucose levels, which encourages more consistent self-care behaviors. Second, education improves self-efficacy, or patients' confidence in their ability to perform self-care activities. Individuals who believe in their capacity to manage specific behaviors are more likely to adopt and maintain them. The interactive teaching sessions conducted in this study, which combined lectures, discussions, and demonstrations, helped build participants' self-efficacy by allowing them to practice skills and receive feedback (Sasarari, Rahagia, and Suprapto, 2025).

The improvement observed in dietary management and blood glucose monitoring domains reflects the practical impact of tailored health education. These areas often require specific knowledge and technical skills that patients can only acquire through guided instruction (Seng *et al.*, 2025). The education materials provided, such as dietary charts and glucose monitoring guides, likely contributed to participants' improved performance in these domains. Structured nutrition education has been shown to significantly improve dietary compliance and glycemic control among diabetic patients. Additionally, the focus on practical demonstrations may have enhanced retention and application of information, leading to sustained behavioral changes (Suprapto, 2020).

Although all domains of self-care improved, foot care showed the least increase in mean score. This finding aligns with several previous studies that have identified foot care as one of the

most neglected aspects of diabetes self-management (Suprapto, 2024). Many patients are unaware of the importance of daily foot inspection and proper footwear in preventing ulcers and amputations. This suggests that health education programs should allocate more time and emphasis on preventive aspects such as foot care and early complication detection. The absence of significant improvement in the control group underscores the importance of structured education over relying solely on standard clinical counseling. Routine medical consultations often focus on medication and laboratory results, providing limited time for in-depth behavioral guidance. As a result, patients may not fully understand or effectively practice self-care behaviors. By contrast, educational interventions allow for more interactive and personalized communication, which can motivate patients to take an active role in managing their health (Suprapto *et al.*, 2025).

Moreover, this study supports the notion that continuous and community-based education is more effective than one-time counseling. Diabetes is a lifelong condition that requires long-term management; therefore, ongoing educational support is crucial for sustaining behavioral change (Syaharuddin and Fardi, 2025). Integrating diabetes education into primary healthcare services improves patient outcomes and reduces the global burden of non-communicable diseases. The findings of this study thus highlight the need for institutional policies that promote regular and structured health education within community health centers. Another factor contributing to the success of the intervention was the multidisciplinary approach. The involvement of nurses, nutritionists, and physicians ensured that participants received comprehensive information covering all aspects of diabetes care. Multidisciplinary education programs lead to better adherence to self-care and reduced hospitalizations compared to single-provider interventions. Therefore, collaborative health education should be encouraged in diabetes management programs (Terkes, Bektas and Aydemir, 2025).

While the results of this study are encouraging, several limitations must be acknowledged. The quasi-experimental design limits the ability to establish a definitive causal relationship, and the relatively small sample size may affect the generalizability of the findings (Yao *et al.*, 2025). The study was conducted in a single health center, and self-care behaviors were self-reported, which may introduce response bias (Yan *et al.*, 2025). Furthermore, the short follow-up period (four weeks) does not allow for assessment of long-term behavioral sustainability. Future research should involve larger sample sizes, multiple healthcare settings, and more extended observation periods to evaluate the persistence of behavioral changes and their impact on glycemic control. Despite these limitations, the present study provides valuable insights into the positive effects of structured health education on diabetes self-management (Zhang *et al.*, 2024). The findings reaffirm that education is not merely an adjunct to medical treatment but a core component of comprehensive diabetes care. By enhancing patients' knowledge, motivation, and confidence, health education empowers individuals to take ownership of their health, resulting in improved outcomes and reduced complications (Tsai *et al.*, 2024).

The study highlights the importance of integrating regular, structured, and interactive health education programs into diabetes management services at the primary care level. Healthcare institutions and policymakers should support such initiatives to ensure the sustainability and accessibility of care for all patients with Type 2 Diabetes Mellitus. Ultimately, empowering patients through education is one of the most effective strategies to combat the growing burden of diabetes worldwide.

CONCLUSION

This study concludes that structured health education has a significant impact on enhancing self-care behavior among patients with Type 2 Diabetes Mellitus. The intervention improved patients' knowledge, motivation, and adherence in managing diet, physical activity, medication, and blood glucose monitoring. These findings confirm that health education is a crucial component of diabetes management, enabling patients to achieve better self-control, prevent complications, and enhance their quality of life. It is recommended that primary healthcare services integrate regular, patient-centered health education into diabetes care programs. Healthcare professionals, especially nurses, should play an active role in delivering continuous and interactive education to strengthen patients' self-management abilities. Further research with larger samples and more extended follow-up periods is encouraged to assess the long-term impact of health education on diabetes outcomes.

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Conflict of Interest

There are no potential conflicts of interest relevant to this article.

References

Alotaibi, H. M. *et al.* (2025) 'Evaluation of depressive symptoms and their association with diabetes self-care among patients with Type 2 Diabetes Mellitus in Jouf Region, Saudi Arabia', *Endocrine and Metabolic Science*, 19, p. 100278. doi: https://doi.org/10.1016/j.endmts.2025.100278.

Alsahli, M. *et al.* (2025) 'Effectiveness of Patients' Education and Telenursing Follow-Ups on Self-Care Practices of Patients With Diabetes Mellitus: Cross-Sectional and Quasi-Experimental Study', *JMIR Nursing*, 8. doi: https://doi.org/10.2196/67339.

Badi, S. *et al.* (2025) 'Impact of clinical pharmacist video-based education on self-care and glycemic control in Sudanese adults with type 2 diabetes: A pre-post interventional study', *Exploratory Research in Clinical and Social Pharmacy*, 19, p. 100617. doi: https://doi.org/10.1016/j.rcsop.2025.100617.

Bakhshi, F. *et al.* (2024) 'Exploring medication adherence and self-care behaviors among diabetes patients in comprehensive rural health service centers in northern Iran', *International Journal of Africa Nursing Sciences*, 21, p. 100814. doi: https://doi.org/10.1016/j.ijans.2025.100814.

Butt, M. D. *et al.* (2025) 'Empowering Diabetes Care Through Pharmacist-Led Education: A Randomized Controlled Trial in a Low-Resource Setting', *Endocrine Practice*, 31(11), pp. 1414–1425. doi: https://doi.org/10.1016/j.eprac.2025.06.022.

Izadirad, H. and Jangizahi, Z. (2025) 'Sustainable effects of a hybrid self-care education program on diet quality and cardiovascular risk in patients with chronic conditions: A randomized controlled trial', *International Journal of Cardiology Cardiovascular Risk and Prevention*, 27, p. 200479. doi: https://doi.org/10.1016/j.ijcrp.2025.200479.

Jang, M. K. *et al.* (2025) 'Impact of smart watch mobile application on the risk treatment of type 2 diabetes mellitus (iSMART-DM)', *Primary Care Diabetes*. doi: https://doi.org/10.1016/j.pcd.2025.10.008.

Khazew, H. R. and Faraj, R. K. (2024) 'Illness acceptance and its relationship to health-behaviors among patients with type 2 diabetes: A mediating role of self-hardiness', *Current Problems in Cardiology*, 49(8), p. 102606. doi: https://doi.org/10.1016/j.cpcardiol.2024.102606.

Li, F. *et al.* (2025) 'Effectiveness of health education based on Behavior Change Wheel theory combined with teach-back method for self-management of community-dwelling empty nesters with hypertension combined with type 2 diabetes mellitus: a randomized controlled trial', *Geriatric Nursing*, 65, p. 103458. doi: https://doi.org/10.1016/j.gerinurse.2025.103458.

Liu, W. *et al.* (2025) 'Self-management knowledge, attitudes, and behaviors among patients with type 2 diabetes mellitus in a community of western China: A cross-sectional study', *Geriatric Nursing*, 61, pp. 34–40. doi: https://doi.org/10.1016/j.gerinurse.2024.10.075.

Morinishi, K. *et al.* (2025) 'Relationship Between Autonomous Motivation for Dietary Self-Care Behaviors and Quality of Life in People with Type 2 Diabetes: A Structural Equation Modeling Approach', *Asian Nursing Research*. doi: https://doi.org/10.1016/j.anr.2025.08.001.

Murat Mehmed Ali, M. *et al.* (2025) 'Bridging illness uncertainty and self-care: The role of cognitive emotion regulation in type 2 diabetes management', *Primary Care Diabetes*, 19(4), pp. 375–382. doi: https://doi.org/10.1016/j.pcd.2025.04.001.

Park, G. *et al.* (2024) 'Automated Personalized Self-care Program for Patients With Type 2 Diabetes Mellitus: A Pilot Trial', *Asian Nursing Research*, 18(2), pp. 114–124. doi: https://doi.org/10.1016/j.anr.2024.04.003.

Qiu, Y. *et al.* (2025) 'The effect of online health management on type 2 diabetes mellitus: A systematic review and meta-analysis', *Primary Care Diabetes*. doi: https://doi.org/10.1016/j.pcd.2025.08.010.

Sasarari, Z. A., Rahagia, R. and Suprapto, S. (2025) 'Self-care management education for diabetes mellitus patients based on disease perception and length of suffering', *Jurnal Pengabdian Masyarakat Edukasi Indonesia*, 2(3), pp. 103–111. doi: https://dx.doi.org/10.61099/jpmei.v2i3.125.

Seng, J. J. B. *et al.* (2025) 'Health Coaching and Its Impact in the Remote Management of Patients With Type 2 Diabetes Mellitus: Scoping Review of the Literature', *Journal of Medical Internet Research*, 27. doi: https://doi.org/10.2196/60703.

Suprapto, S. (2020) 'Nurse Compliance using Basic Personal Protective Equipment in Providing Health Services Nursing Actions', *International Journal of Medicine and Public Health*, 10(3), pp. 119–121. doi: https://dx.doi.org/10.5530/ijmedph.2020.3.25.

Suprapto, S. (2024) 'Optimization of public health through counseling on diabetes mellitus', *Jurnal Pengabdian Masyarakat Edukasi Indonesia*, 1(1), pp. 01–08. doi: https://dx.doi.org/10.61099/jpmei.v1i1.31.

Suprapto, S. *et al.* (2025) 'How is Quality in Homecare Services Created? A Qualitative Study of Health Professional Perspectives', *Jurnal Kesehatan Masyarakat*, 21(2), pp. 485–496. doi: https://dx.doi.org/10.15294/kemas.v21i2.31257.

Syaharuddin, S., Fardi, F. and Damayanti, T. (2025) 'Monitoring 30° Head Elevation to Enhance Cerebral Perfusion in Traumatic Brain Injury Patients', *Jurnal Ilmiah Kesehatan Sandi Husada*, 14(1), pp. 55–63. doi: https://dx.doi.org/10.35816/jiskh.v14i1.1247.

Terkes, N., Bektas, H. and Aydemir, M. (2025) 'Effectiveness of structured distance education on metabolic control, self-care, and health literacy in newly diagnosed type 2 diabetes: A randomized controlled trial', *Primary Care Diabetes*. doi: https://doi.org/10.1016/j.pcd.2025.09.002.

Tsai, C.-C. *et al.* (2024) 'Structural equation modeling of dispositional mindfulness, internal environmental factors, external environmental factors, and self-care behaviors in people with type 2 diabetes', *Applied Nursing Research*, 77, p. 151799. doi: https://doi.org/10.1016/j.apnr.2024.151799.

Yan, F. *et al.* (2025) 'Identifying decision-making biases in self-care behaviours among patients

with type 2 diabetes mellitus: A qualitative study from a behavioural economics perspective', *International Journal of Nursing Studies*, 171, p. 105182. doi: https://doi.org/10.1016/j.ijnurstu.2025.105182.

Yao, T. *et al.* (2025) 'The mediating role of expectations regarding aging between diabetes distress and self-management behaviors in older adults with type 2 diabetes mellitus', *Geriatric Nursing*, 63, pp. 362–369. doi: https://doi.org/10.1016/j.gerinurse.2025.03.033.

Zhang, Q. *et al.* (2024) 'Effects of nudge strategy-based dietary education intervention in patients with type 2 diabetes mellitus: A cluster randomized controlled trial', *Diabetes & Metabolism*, 50(5), p. 101563. doi: https://doi.org/10.1016/j.diabet.2024.101563.