

Integrated Education to Improve Treatment Adherence for Type 2 Diabetes Mellitus Patients in Makassar

Suprpto^{1*}, Karlyna Bte Muhammad², Rahman², M. Khalid Fredy Saputra³

¹ Department of Nursing, Politeknik Sandi Karsa, South Sulawesi, Indonesia

² Safety Techniques, ITEKES Tri Tunas Nasional, South Sulawesi, Indonesia

³ Department of Nursing, STIKes Baitul Hikmah, Lampung, Indonesia

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ABSTRACT

Treatment adherence remains a major challenge in the management of Type 2 Diabetes Mellitus (T2DM), particularly in community and primary health care settings. In Makassar, Indonesia, inadequate patient knowledge, negative attitudes toward long-term therapy, and fragmented health education contribute to suboptimal adherence and increase the risk of diabetes-related complications. This community service program aimed to improve treatment adherence among patients with T2DM through an integrated education approach. The program was implemented using a structured, participatory method involving five stages: situational analysis and coordination, participant recruitment and baseline assessment, integrated education intervention, mentoring and reinforcement, and evaluation and reflection. A total of 30 adult patients with T2DM participated in the program. Educational activities were delivered through interactive lectures, group discussions, practical demonstrations, and individualized counseling, focusing on medication adherence, dosage and administration, nutritional support, supplement safety, and the role of micronutrients in diabetes management. Program effectiveness was evaluated using pre- and post-intervention assessments of participants' knowledge and adherence-related understanding. The results demonstrated a substantial improvement in knowledge across all assessed domains following the intervention. These findings indicate that integrated education is an effective strategy for strengthening patient understanding and supporting improved treatment adherence among individuals with Type 2 Diabetes Mellitus at the community level.



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*Corresponding author:

Suprpto

Department of Nursing, Politeknik Sandi Karsa, South Sulawesi, Indonesia

Email: atoenurse@gmail.com



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INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is one of the most prevalent non-communicable diseases worldwide and represents a major public health challenge, particularly in low- and middle-income countries (Abbas et al., 2025). In Indonesia, the prevalence of T2DM continues to increase in line with rapid urbanization, lifestyle changes, population aging, and suboptimal disease management. Makassar, as a metropolitan city in Eastern Indonesia, reflects this national trend, with a growing number of individuals diagnosed with T2DM who require long-term, comprehensive care. Effective management of T2DM relies not only on pharmacological therapy but also on sustained treatment adherence, including medication use, dietary regulation, physical activity, regular monitoring, and follow-up visits (Alam et al., 2024).

Despite the availability of treatment guidelines and health services, treatment adherence among patients with T2DM remains suboptimal. Poor adherence is a critical problem because it directly affects glycemic control, increases the risk of acute and chronic complications, reduces quality of life, and contributes to higher health care costs (Alotaibi et al., 2025). Evidence from community and primary health care settings indicates that many patients discontinue medication, take drugs inconsistently, or fail to follow recommended lifestyle modifications. This situation underscores the need for more effective, patient-centered approaches to diabetes management at the community level (Caballero Mateos et al., 2025).

One of the key problems contributing to low treatment adherence is inadequate patient knowledge about T2DM and its management. Many patients have limited understanding of the disease process, the importance of long-term therapy, potential complications, and the consequences of non-adherence (Chong et al., 2025). Misconceptions about diabetes being a temporary or curable condition often led patients to stop medication once symptoms improve. In addition, complex treatment regimens, fear of side effects, and lack of clear explanations from health providers further reduce adherence. Without sufficient knowledge, patients are less likely to perceive the benefits of consistent treatment and more likely to engage in irregular or inappropriate self-care practices (Debnath et al., 2025).

In addition to knowledge gaps, patients' attitudes and beliefs play a significant role in shaping treatment adherence. Negative attitudes toward lifelong medication, low motivation, denial of illness, and fatalistic beliefs about diabetes outcomes can hinder adherence behaviors (Garg & Yanadaiah, 2025). Some patients perceive treatment as burdensome or unnecessary, especially when they feel physically well. Others may experience emotional distress, stigma, or lack of family and social support, which further weakens their commitment to treatment. These attitudinal factors are often overlooked in routine clinical care, where the focus tends to be on prescribing medication rather than addressing behavioral and psychosocial determinants (Gieroba et al., 2025).

Structural and systemic factors also contribute to the problem. Limited consultation time, inconsistent health education, and inadequate follow-up reduce opportunities for meaningful patient engagement. Health education is often delivered in a fragmented manner, without integration between medication counseling, lifestyle guidance, and psychosocial support. As a result, patients receive information that is incomplete, inconsistent, or difficult to apply in daily life. This fragmented approach limits the effectiveness of education interventions and fails to produce sustained behavior change (Jang et al., 2025).

To address these challenges, integrated education emerges as a strategic and sustainable solution. Integrated education refers to a comprehensive, coordinated educational approach that combines knowledge enhancement, attitude transformation, and practical skills development. This approach emphasizes the integration of medical information, lifestyle counseling, behavioral support, and patient empowerment within a single, coherent framework. By delivering education in an interactive and culturally appropriate manner, integrated education helps patients understand not only what they should do, but also why and how they should do it. Low treatment adherence among patients with T2DM in Makassar is a multifaceted problem influenced by inadequate knowledge, negative attitudes, and fragmented health education. Integrated education offers a holistic solution by addressing cognitive, behavioral, and psychosocial factors simultaneously. Through well-designed community-based educational interventions, treatment adherence can be improved, leading to better glycemic control, reduced complications, and improved quality of life for patients with Type 2 Diabetes Mellitus.

METHOD

This community service program was designed using a structured and participatory approach to improve treatment adherence among patients with Type 2 Diabetes Mellitus (T2DM) through integrated education. The activity was conducted in Makassar, Indonesia, and involved 30 adult participants diagnosed with T2DM. The method consisted of five sequential stages, ensuring systematic planning, implementation, and evaluation of the program.

Stage	Activity Stage	Objectives	Main Activities	Participants	Outputs
1	Situational Analysis and Coordination	To identify adherence-related problems and align the program with local needs	Situational assessment, informal interviews with health workers, coordination with health centers and community leaders	Program team, health workers	Identified key problems, implementation plan, approved schedule
2	Participant Recruitment and Baseline Assessment	To select eligible participants and obtain baseline data	Recruitment of T2DM patients, informed consent, pre-test assessment of knowledge, attitudes, and treatment adherence	30 T2DM patients	Baseline data on knowledge, attitude, and adherence
3	Integrated Education Intervention	To improve knowledge and attitudes toward treatment adherence	Interactive lectures, group discussions, demonstrations on medication use, lifestyle modification, and complication prevention	30 T2DM patients	Increased understanding and positive attitudes toward adherence
4	Mentoring and Reinforcement	To strengthen behavior, change and self-efficacy	Individual/small group counseling, problem-solving, reinforcement of key messages, family involvement	30 T2DM patients, educators	Improved motivation and adherence-supportive behaviors
5	Evaluation and Reflection	To assess program effectiveness and participant satisfaction	Post-test assessment, descriptive analysis, feedback discussion, reflection session	30 T2DM patients, program team	Measured improvement, recommendations for sustainability

RESULT AND DISCUSSION

RESULT

This community service program demonstrated positive outcomes in improving treatment adherence among patients with Type 2 Diabetes Mellitus in Makassar. Following the implementation of the five-stage integrated education intervention, participants showed clear improvements in knowledge, attitudes, and adherence-related behaviors. The educational sessions increased participants' understanding of diabetes management and the importance of consistent treatment, while mentoring and reinforcement activities contributed to more positive attitudes

toward long-term therapy. Overall, the results indicate that integrated education is an effective approach for strengthening patient adherence and supporting better self-management of Type 2 Diabetes Mellitus at the community level.

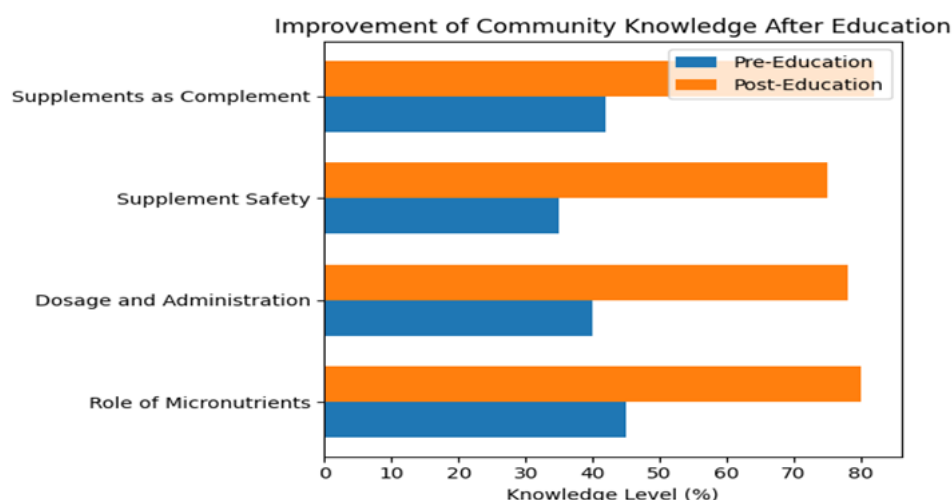


Figure 1. Improvement of Community Knowledge After Education

The results illustrated in the figure indicate a clear improvement in participants' knowledge following the integrated education intervention. Across all assessed domains, post-education knowledge levels were substantially higher than pre-education levels, demonstrating the effectiveness of the educational activities.

Before the intervention, participants' knowledge was generally moderate. The highest pre-education score was observed in the role of micronutrients (approximately 45%), followed by supplements as a complement and dosage and administration (around 40–42%). The lowest baseline knowledge was found in supplement safety (about 35%), indicating limited understanding of safe use, potential side effects, and correct practices prior to education. After the intervention, knowledge levels increased markedly in all domains. Dosage and administration and role of micronutrients showed the most pronounced improvements, reaching approximately 80–82%. Knowledge regarding supplement safety also increased substantially to around 75%, reflecting improved awareness of appropriate and safe use. Similarly, understanding of supplements as a complement rose to about 70%, indicating better comprehension that supplements should support, rather than replace, standard treatment.

Overall, the consistent increase across all indicators suggests that the integrated education approach was effective in strengthening participants' knowledge related to treatment support and safe practices. These findings are highly relevant to the program's objective of improving treatment adherence, as enhanced knowledge is a critical foundation for positive attitudes and sustained adherence behaviors among patients with chronic conditions such as Type 2 Diabetes Mellitus.

DISCUSSION

The findings of this community service program demonstrate that integrated education significantly improved participants' knowledge related to treatment support for

Type 2 Diabetes Mellitus (T2DM). The observed increase across all assessed domains supplements as a complement, supplement safety, dosage and administration, and the role of micronutrients highlights the effectiveness of a structured and comprehensive educational approach in addressing knowledge gaps that often contribute to poor treatment adherence. These results are consistent with existing evidence indicating that well-designed educational interventions are critical in enhancing diabetes self-management and long-term adherence behaviors (Kumari et al., 2025).

At baseline, participants showed moderate to low levels of knowledge, particularly regarding supplement safety. This finding reflects a common issue in chronic disease management, where patients may consume supplements without adequate understanding of appropriate use, potential interactions, or risks (Li et al., 2025). Limited knowledge in this domain can negatively affect adherence to prescribed therapy, as patients may substitute or incorrectly combine supplements with antidiabetic medications (Mukonka et al., 2026). The substantial post-education improvement in supplement safety knowledge suggests that integrated education successfully clarified misconceptions and promoted safer, more informed health behaviors. This is especially relevant in the Indonesian context, where the use of dietary supplements and traditional remedies is widespread (Paudel et al., 2025).

The improvement observed in the domain of dosage and administration is particularly important from a clinical perspective. Incorrect dosage, irregular timing, or inappropriate administration of medication are among the most frequent causes of suboptimal glycemic control (Peinado Ruíz et al., 2025). After the educational intervention, participants demonstrated markedly higher knowledge in this area, indicating better understanding of how and when medications should be taken. This finding supports the notion that practical, skills-oriented education such as demonstrations and interactive discussions can effectively translate abstract information into actionable behaviors. Improved knowledge in dosage and administration is likely to contribute directly to better treatment adherence and, ultimately, improved clinical outcomes (Qiu et al., 2025).

Similarly, increased knowledge regarding the role of micronutrients reflects participants' improved understanding of the supportive role of nutrition in diabetes management. Micronutrients are often misunderstood by patients, who may overestimate their ability to replace pharmacological treatment (Sharma et al., 2025). The high post-education score in this domain suggests that participants gained a more balanced perspective, recognizing micronutrients as complementary rather than curative. This aligns with the program's objective of promoting rational and evidence-based self-care practices. Enhanced understanding of nutritional support can reinforce adherence by helping patients integrate dietary management into their daily routines in a more informed and sustainable manner (Skaria et al., 2024).

The improvement in knowledge related to supplements as a complement further reinforces the value of integrated education. Prior to the intervention, many participants appeared to view supplements as alternative treatments (Zulfiah et al., 2025). Following

education, participants demonstrated better understanding that supplements should support, not replace, standard medical therapy (Syaharuddin et al., 2025). This shift in knowledge is crucial for preventing treatment discontinuation and reinforcing adherence to prescribed medications. It also underscores the importance of addressing culturally embedded beliefs through respectful and context-sensitive educational strategies (Tinmaz & Altundağ, 2025).

The integrated nature of the educational intervention likely played a central role in achieving these outcomes (Yuceer & Cinar, 2025). Unlike fragmented health education, which often focuses solely on medication instructions, the integrated approach combined medical information, nutritional guidance, behavioral reinforcement, and interactive engagement (Wibowo et al., 2025). This comprehensive strategy allowed participants to connect different aspects of diabetes management into a coherent understanding. By addressing both cognitive and practical dimensions, the program facilitated deeper learning and greater retention of information (Wijayanti et al., 2025).

Moreover, the mentoring and reinforcement component of the program may have enhanced the sustainability of knowledge gains. Individual and small-group counseling provided opportunities for participants to clarify doubts, share experiences, and receive personalized feedback (Yao et al., 2025). Such interactions can strengthen self-efficacy and motivation, which are essential for translating knowledge into consistent adherence behaviors. Although this program primarily measured knowledge outcomes, the observed improvements suggest a strong potential for positive changes in attitudes and long-term treatment adherence (Yeh et al., 2025).

Despite these encouraging findings, several considerations should be noted. The program involved a relatively small number of participants and was conducted within a limited timeframe. Therefore, the results may not be fully generalizable to all patients with T2DM in Makassar or other settings. In addition, the assessment focused on knowledge improvement and did not include objective clinical indicators such as glycemic control. Future programs and studies should incorporate longer follow-up periods and clinical outcome measures to better evaluate the impact of integrated education on overall diabetes management.

In conclusion, the discussion of these results indicates that integrated education is an effective strategy for improving knowledge related to treatment support among patients with T2DM. Enhanced understanding of supplement use, medication administration, and nutritional support provides a strong foundation for improving treatment adherence. These findings support the continued development and implementation of integrated, community-based educational programs as part of comprehensive diabetes management strategies.

CONCLUSION

The integrated education program successfully enhanced participants' knowledge related to treatment support for Type 2 Diabetes Mellitus. Improvements were observed across all assessed domains, indicating that a comprehensive and structured educational approach is effective in addressing knowledge gaps that commonly influence treatment

adherence. Strengthening patient understanding of medication use, nutritional support, and safe complementary practices provides a critical foundation for fostering positive attitudes and supporting consistent adherence to long-term diabetes management.

Based on these findings, integrated education is recommended as a routine component of community and primary health care services for patients with Type 2 Diabetes Mellitus. Educational interventions should be delivered in a holistic manner, combining medical, nutritional, and behavioral elements, and reinforced through ongoing mentoring and follow-up. Expanding program coverage and incorporating clinical outcome indicators in future initiatives will further support the sustainability and effectiveness of diabetes management at the community level..

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Conflict of Interests

All authors declare no conflict of interest in this community service program.

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