Self-care education based on local wisdom to improve glycemic control and self-efficacy in type 2 diabetes

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Abstract

Background: Effective management of type 2 diabetes mellitus (T2DM) requires structured self-care education supported by family and cultural context. In Bali, health-related decisions are often influenced by patrilineal households where male family members act as primary decision-makers.
Purpose: This study evaluated a self-care education program based on Balinese local wisdom to improve glycemic control and self-efficacy among T2DM patients.
Methods: A quasi-experimental design with pre- and post-tests and a control group was conducted at Community Health Center in Bali, Indonesia from June to September 2024. .Seventy patients with T2DM living in patrilineal households were purposively recruited and randomly allocated into intervention (n=35) and control (n=35) groups.. The intervention consisted of twelve weekly sessions of culturally tailored self-care education covering diet, physical activity, monitoring, medication, and foot care, with active involvement of male household decision-makers. Outcome measures included self-efficacy (Diabetes Management Self-Efficacy Scale), HbA1C, and systolic/diastolic blood pressure, analyzed using t-tests.
Results: After 12 weeks, the intervention group demonstrated significant improvements compared to controls: self-efficacy (mean difference: 8.37, p<0.001), systolic blood pressure (-4.51 mmHg, p<0.001), diastolic blood pressure (-2.74 mmHg, p<0.001), and HbA1C (-0.61%, p<0.001). Although the HbA1C reduction was modest, it indicates a meaningful step toward better glycemic control.
Conclusion: A 12-week culturally tailored self-care education program involving patrilineal family members improved self-efficacy and glycemic control in T2DM patients. These findings highlight the importance of integrating local wisdom and family involvement into diabetes education to enhance patient empowerment and adherence.

Keywords: decision-making; diabetes mellitus type 2; family support; hemoglobin; glycemic control; self-management

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Introduction

Type 2 diabetes mellitus (T2DM) is a chronic disease caused by impaired insulin production or utilization, leading to long-term health, social, and economic consequences. (IDF, 2021). Globally, over 500 million people are affected, with prevalence projected to increase, especially in low- and middle-income countries. (IDF, 2021). In Indonesia, T2DM affects 13.4% of the population, with Bali showing an average prevalence of 1.7%. Poor glycemic control increases the risk of complications such as neuropathy, cardiovascular disease, and premature mortality, making effective self-management essential(Kaiser, Zhang, 2018) (Kemenkes, 2024).

Self-care education is a cornerstone of diabetes management. It typically emphasizes dietary regulation, physical activity, medication adherence, monitoring, and psychosocial support (ADA, 2017). However, conventional

approaches often overlook cultural and familial dynamics that shape patient behavior (Namusisi H., 2025). Evidence shows that education is more effective when it engages family members and adapts to the local context (Yasa et al., 2023), as families often play a key role in caregiving and decision-making (Suyadnya, 2009; Tiwery et al., 2024).

Educational models and media significantly impact patients' and families' knowledge and understanding of DM care (Beck et al., 2018). Educating families enables them to provide proper care during the management process (Pesantes et al., 2018a). Essential components of family education include understanding DM, adjusting family routines, and addressing emotional challenges associated with the illness (Bennich et al., 2017a). Furthermore, the choice of educational media affects how well information is retained. Studies have shown that audiovisual tools like DVDs are more effective than written materials such as leaflets or booklets for educating patients and their families (Estacio et al., 2015; Pamungkas et al., 2017).

Balinese society is structured around a patrilineal system in which male household members—fathers or eldest sons—act as primary decision-makers, including in health-related matters (Lansing, 2012). Their authority influences dietary practices, healthcare access, and treatment adherence. This cultural feature presents both a barrier and an opportunity: without male involvement, patient adherence may falter, but with it, families can reinforce lifestyle changes and support sustainable self-care practices. Thus, self-care education that actively involves male decision-makers reflects local wisdom and is more likely to succeed.

Bali is an appropriate setting for this research because of its unique sociocultural context, the growing prevalence of T2DM, and the community's reliance on familial and village-level (desa pakraman) support systems. Integrating these cultural structures into diabetes education could enhance patient empowerment and glycemic control while addressing gaps in standard care models.

Therefore, this study aimed to evaluate the effectiveness of a culturally tailored, local wisdom-based self-care education program in improving glycemic control and self-efficacy among patients with T2DM in Bali.

Materials and Methods

Study design

This study employed a quasi-experimental design with pre- and post-tests and a control group (Em, 2024)The design was chosen to assess the impact of a culturally tailored, local wisdom-based self-care education program on glycemic control and self-efficacy in patients with type 2 diabetes mellitus (T2DM).

Participants and eligibility criteria

The study was carried out at Community Health Center in Bali, Indonesia , over a three-month period from June 15 to September 14, 2024. Community Health Center in Bali, Indonesia was chosen as the study site because it represents the core characteristics of Balinese patrilineal culture, where male family members—fathers or eldest sons—act as primary decision-makers in household and health-related matters. This cultural context was essential for evaluating a self-care education model based on local wisdom that actively involved family authority in diabetes management. Mengwi also has a well-established community health infrastructure with a large population of type 2 diabetes patients, making it feasible for structured interventions and follow-ups. Its strong desa pakraman (customary village) system supports family and community participation, aligning perfectly with the study's aim to integrate cultural and familial dynamics into self-care education. Compared to other community health centres in Bali, Mengwi offers a balanced environment that maintains traditional values while providing adequate healthcare facilities and research collaboration, ensuring both cultural relevance and practical feasibility for the intervention.

A total of seventy patients with type 2 diabetes mellitus (T2DM) were recruited. All participants lived in patrilineal households, where male family member —typically fathers or eldest sons—held the primary role in decision-making, including health-related matters.

Eligible participants were men and women between 30 and 60 years of age who were actively receiving treatment at the Community Health Center in Bali, Indonesia . To ensure meaningful engagement in the education program, participants were required to have at least a senior high school (SMA) education and the ability to communicate effectively. Individuals were excluded if they had a diagnosed mental illness that could interfere with participation or if they had stroke-related complications that might limit their ability to engage in the intervention sessions.

Sample size

The average self-efficacy score on The Diabetes Management Self-Efficacy Scale was 26.6, with

$$n = \frac{2\sigma^2}{(\mu 2 - \mu 1)^2} x\, f(\alpha, \beta)$$

n = sample size
σ= standard deviation
f(α,β) = constant based on statistical tables
μ1 = mean empowerment score
μ2 = estimated mean empowerment score

Table 1. Outcome variables before and after intervention (n=70)

Variable	Group			
	Intervention		Control	
	Pre-test	Post-Test	Pre-test	Post-Test
Self-efficacy				
Min-max	13-30	20-40	16-30	16-40
Mean	23.11	31.49	24.03	25.34
SD	4.65	4.90	4.61	5.94
CI (95%)	21.52-24.71	29.80-33.17	22.45-25.61	23.30-27.38
Systolic				
Min-max	133-162	129-158	134-160	130-160
Mean	147.74	143.23	151.11	149.20
SD	8.62	8.48	8.18	7.68
CI (95%)	144.78-150.70	140.32-146.14	140.30-153.92	146.56-151.84
Diastolic				
Min-max	84-100	80-100	83-98	82-95
Mean	89.63	86.89	90.51	89.54
SD	3.61	4.17	3.29	3.15
CI (95%)	88.39-90.87	85.45-88.32	89.38-91.65	88.46-90.62
HbA1C				
Min-max	6.6-11	6.0-10.0	6.8-11	7-10
Mean	8.69	8.09	8.74	8.60
SD	1.09	1.05	1.08	1.00
CI (95%)	8.32-9.07	7.72-8.45	8.37-9.11	8.26-8.94

Table 2. Differences in Self-Efficacy and Glycemic Control Pre- and Post-Test for Both Groups

Variable	Mean difference within group (pre-post)	p-value	Mean difference between group (post-Post)	p-value
Intervention				
Self-efficacy	8.37±4.26	<0.001	7.06	<0.001
Systolic	-4.51±3.29	<0.001	2.60	<0.001
Diastolic	-2.74±2.48	<0.001	1.77	<0.001
HbA1C	-0.61±0.42	<0.001	0.47	<0.001
Control				
Self-efficacy	1.31±2.63	0.01		
Systolic	-1.91±2.90	<0.001		
Diastolic	-0.97±2.54	0.03		
HbA1C	-0.14±0.33	0.02		

a standard deviation of 9.19, in a preliminary study of 30 Type 2 Diabetes Mellitus patients. The intervention is expected to increase the self-efficacy score by 30% to 34.58, with $\alpha = 0.05$ and $\beta = 0.10$. Based on the above formula, a sample size of 34.48 was rounded to 35 for each group, resulting in 70 participants (35 in the control group and 35 in the treatment group). A participant drops out after missing two educational sessions (Arası et al., 2023; Rani et al., 2020).

Intervention

The intervention was developed as a culturally tailored diabetes self-care education program designed specifically for individuals with type 2 diabetes mellitus (T2DM) living within Bali's unique patrilineal family structure. Recognizing that household decision-making in Balinese culture is often dominated by male figures—such as fathers or eldest sons—the research team designed a 12-week program that not only provided patients with

knowledge and skills for diabetes management but also actively engaged male family members as supporters and motivators in the self-care process. This integration of family authority and cultural context formed the foundation of the intervention's structure and delivery.

The intervention was designed as a 12-week program of culturally tailored self-care education, delivered in weekly sessions lasting approximately one hour each. The sessions were facilitated by trained healthcare educators and held at times agreed upon with patients and their families to encourage active participation. A distinctive feature of the program was the involvement of male household decision-makers—fathers or eldest sons—whose authority in Balinese patrilineal families plays a critical role in shaping health behaviors, including dietary choices, access to medical care, and treatment adherence.

The program began with an introductory session that built rapport with participants and provided foundational knowledge about type 2 diabetes mellitus. This included the definition of the disease, its causes, symptoms, possible complications, and general management strategies. Half of the session was dedicated to open discussion, allowing patients and family members to share experiences and ask questions, while the remainder took the form of a structured lecture.

Subsequent sessions addressed specific aspects of diabetes management. Nutrition was a central focus, with discussions on calculating daily caloric needs, the 3J diet method (quantity, type, timing), and the "My Plate" approach. Because male decision-makers often guide food choices, their engagement in these discussions was critical to supporting healthier dietary practices. Practical demonstrations and audiovisual media reinforced the content. Another session emphasized the role of physical activity, introducing safe exercises, strategies for setting target heart rates, and the benefits of regular movement.

Further sessions guided participants in health monitoring, teaching techniques for checking blood glucose levels, blood pressure, and body weight. Foot care was also highlighted, with demonstrations on proper hygiene, nail trimming, and footwear selection, along with simple daily exercises to prevent complications. Medication management formed another important component, where patients and families were introduced to oral therapies and insulin administration. Hands-on demonstrations and video materials ensured that both patients and their supporting family members, especially male household heads, felt confident in managing medications.

Toward the later stages, sessions reinforced previously taught self-care skills and encouraged participants to apply them in daily life. The program culminated in advocacy and evaluation, where patients and their families reviewed their progress, discussed challenges, and built confidence in sustaining long-term diabetes management practices. Throughout these concluding sessions, the participation of male family members was emphasized to strengthen commitment and support for ongoing self-care behaviors.

By combining structured education with active family involvement, the program sought not only to increase knowledge and skills but also to embed diabetes self-management within the cultural framework of Balinese households. The program culminates with advocacy and evaluation during the eleventh and twelfth sessions. The sessions emphasize progress review, challenge identification, and fostering patient and family confidence in self-care maintenance. Given the influential role of male family members in decision-making, their involvement in these concluding sessions helps reinforce long-term commitment to diabetes management. Facilitators deliver feedback, assess outcomes, and provide guidance for ongoing health management.

Instruments

The Diabetes Management Self-Efficacy Scale was used to measure self-efficacy. A previous study found that a CVI of 1.00 was produced by the content validity evaluation, correlation scores exceeded the critical r table value of 0.388 (r = 0.550-0.867), and Cronbach's alpha of 0.934, indicating that all items exhibited valid and reliable (Hertuida Clara et al., 2025).

Data analysis

Data were analyzed using computer statistical software. Descriptive statistics (mean, SD, frequency, proportion) summarized participant characteristics. Data were normally distributed ($p>0.05$). Paired t-tests assessed within-group differences, and independent t-test assessed between-group differences. Statistical significance was set at $p<0.05$.

Ethical considerations

This study received ethical approval from the Ethics Committee of Poltekkes Kemenkes Denpasar with approval number No: Ref. LB.02.03/EA/KEPK/0367/2023. All participants were provided with comprehensive information about the study's purpose, procedures, benefits, and potential risks, and written informed consent was obtained before participation. Participant confidentiality and data privacy were strictly maintained, and participants had the right to withdraw from the study at any time without negative consequences. The study was designed to minimize risk, with all findings transparently reported and used to enhance knowledge about self-management diabetes mellitus.

Results

Characteristics of Respondents

There were 70 respondents divided into two groups: the control group and the intervention group. The respondents' characteristics, based on gender, age, and duration of illness. The majority of females were found on the intervention (51.40%) and control 20 (57.40%). The ages of respondents in the intervention and control groups were not significantly different. The average age of respondents in the intervention group was 53.51±5.00, and in the control group, it was 52.97±. The average duration of T2DM in both groups is similar, ranging from 6 to 12 years, with an average of 9,23±1.56 and 8,77±1.35, respectively, intervention and control.

Before the intervention, there was little difference in respondents' self-efficacy between the intervention and control groups. The minimum self-efficacy score in the intervention group was lower than in the control group, at 13 and 16, respectively, with a maximum score of 30 for both groups in the pre-test. After the intervention, there were differences between the groups in minimum score, mean, and standard deviation. The post-test variation in self-efficacy scores was smaller in the intervention group than in the control group, as shown by a min-max range of 20-40 and mean 31.49±4.90 in the intervention group, compared to a min-max of 16-40 and mean of 25.34±5.94 in the control group (Table 1).

In the pre-test, respondents' systolic blood pressure levels showed similar minimum and maximum values, with a range of 133-162 mmHg in the intervention group and 134-160 mmHg in the control group. The control group had a higher mean systolic blood pressure than the intervention group, with 151.11 mmHg compared to 147.74 mmHg. The standard deviation of systolic blood pressure in both groups was similar, at 8.62 mmHg and 8.18 mmHg, respectively. Following the intervention, changes in systolic blood pressure occurred in both groups, with both experiencing a general decrease. The intervention group's mean systolic blood pressure decreased from 147.74 to 143.23 mmHg, while the control group's decreased from 151.11 to 149.20 mmHg. Respondents' pre-test diastolic blood pressure was nearly identical between groups, with a mean of 89.63±3.29 in the intervention group and 90.51±3.29 in the control group. After the intervention, the difference widened, with the intervention group mean decreasing to 86.89 and the control group to 89.54.

Pre-test HbA1C levels in both groups were similar, with a range of 6.6-11 in the intervention group and 6.8-11 in the control group. The mean HbA1C was also comparable between groups, at 8.69 and 8.74, respectively. After the intervention, the intervention group showed a reduction in HbA1C to 8.09, while the control group saw a slight increase to 8.60.

The self-care education model was implemented over 12 weeks, and this intervention resulted in significant differences in all four dependent variables. The mean difference in self-efficacy was 8.37 (p-value: <0.001). For systolic blood pressure, the mean difference was -4.51 mmHg (p-value: <0.001), and for diastolic blood pressure, it was -2.74 mmHg (p-value: <0.001). The HbA1C difference was -0.61 (p-value: <0.001). Negative values indicate reductions in average scores from pre- to post-intervention. All p-values indicate significant differences in self-efficacy scores, systolic and diastolic blood pressure, and HbA1C before and after the intervention in the treatment group.

In the control group, the mean differences for self-efficacy, systolic blood pressure, diastolic blood pressure, and HbA1C were smaller than those in the treatment group, with varying p-values. The mean difference for self-efficacy was 1.31 (p-value: 0.01). For systolic blood pressure, it was -1.91 mmHg (p-value: <0.001), and for diastolic blood pressure, it was -0.97 mmHg (p-value: 0.03). The HbA1C difference was 0.14 (p-value: 0.02). These p-values indicate significant differences in self-efficacy, systolic and diastolic blood pressure, and HbA1C over three months of observation in the control group.

The mean differences In self-efficacy, systolic blood pressure, diastolic blood pressure, and HbA1C between the treatment and control groups varied. Self-efficacy showed a mean difference of 7.06 (p-value: <0.001). The mean difference in systolic blood pressure was 2.60 mmHg (p-value: <0.001), for diastolic blood pressure, it was 1.77 mmHg (p-value: <0.001), and for HbA1C, it was 0.47 (p-value: <0.001). The p-values indicate significant differences in self-efficacy, systolic blood pressure, diastolic blood pressure, and HbA1C between the treatment and control groups. Based on Table 2, the mean differences for all four dependent variables were greater in the treatment group compared to the control group. These data suggest that the self-care education model had an impact on self-efficacy and glycemic control (systolic and diastolic blood pressure and HbA1C) in patients with type 2 diabetes.

Discussion

This study demonstrated that a 12-week self-care education program grounded in Balinese local wisdom significantly improved self-efficacy, reduced blood pressure, and modestly lowered HbA1C levels among patients with type 2 diabetes mellitus. These findings indicate that involving patrilineal family structures, particularly male decision-makers, can strengthen adherence to self-care behaviors and contribute to better diabetes outcomes.

The most notable improvement was seen in self-efficacy. Patients in the intervention group reported greater confidence in managing diet, physical activity, medication, and health monitoring. This suggests that education tailored to cultural norms

does more than transfer knowledge—it fosters empowerment through social reinforcement. In Balinese households, male family members often determine food purchasing and preparation decisions (Dongoran, 2024). By engaging them directly in the educational process, the intervention ensured that patients' self-care efforts were supported rather than hindered by household dynamics. This mechanism explains why self-efficacy increased significantly in the intervention group compared with controls. A good understanding of T2DM and its management positively impacts patients' self-efficacy (Sheila D'souza et al., 2017).

Blood pressure reductions, while statistically significant, remained within the hypertensive range. This finding underscores both the potential and the limitations of short-term educational interventions. Improved dietary regulation and increased physical activity, reinforced by family support, likely contributed to the modest reductions observed. However, the persistence of elevated blood pressure suggests that longer interventions or integration with pharmacological adjustments may be necessary to achieve clinically optimal outcomes (Reis et al., 2018).

HbA1C reduction in the intervention group (−0.61%) was statistically significant but clinically modest, as most participants remained above the target threshold of 7%. This reflects a common challenge in diabetes research, where short-term behavioral interventions improve glycemic trends but may not achieve full clinical targets without extended follow-up or more intensive support. Importantly, the results highlight that even small reductions in HbA1C are meaningful, as they contribute to lowering the risk of long-term complications (Wang et al., 2022).

These findings are consistent with prior studies showing that culturally tailored interventions are more effective than generic education (Abu & Llahana, 2025). Research in South Asian, Middle Eastern, and Latin American populations has similarly demonstrated that involving family members in diabetes education improves dietary adherence, medication use, and glycemic outcomes (Bennich et al., 2017b; Pamungkas & Chamroonsawasdi, 2020; Pesantes et al., 2018b; M. Sohal et al., 2022). However, this study adds novelty by addressing a patrilineal cultural context, where male authority is particularly influential in household health behaviors. Unlike individual-centered approaches, this model situates self-care within family decision-making structures, demonstrating how cultural adaptation can improve adherence.

Despite these strengths, several limitations must be acknowledged. First, the sample size was relatively small and drawn from a single health center, which may limit generalizability. Second, while the intervention achieved significant improvements, clinical outcomes such as HbA1C and blood pressure remained above recommended targets, underscoring the need for longer interventions and integration with medical management. Finally, the study relied on self-reported adherence and may be influenced by reporting bias.

Overall, the study suggests that self-care education grounded in local wisdom and reinforced through family engagement is a promising approach to diabetes management. Future research should explore long-term follow-up, larger and more diverse samples, and comparisons with similar culturally tailored models in other regions to strengthen the evidence base and refine intervention strategies.(T. Sohal et al., 2015)[NO_PRINTED_FORM]

Implications for Practice

This study emphasizes the need for culturally tailored type 2 diabetes self-care education models. In cultures with strong family-based decision-making, like Bali's patrilineal system, involving family members in education can improve self-care and patient outcomes. Healthcare providers treating type 2 diabetes patients may include family support systems to reinforce self-management. Culturally sensitive education models that fit patients' social structures improve engagement and may lead to lasting lifestyle changes.

The study emphasizes the importance of structured educational interventions for diabetes care, improving self-efficacy and glycemic control. This implies that healthcare institutions should routinely develop and implement similar educational programs for diabetes management. Regular follow-up and reinforcement sessions may improve long-term outcomes, as this study's duration suggests ongoing support. Finally, applying these models to other cultures can broaden diabetes education by allowing healthcare providers to tailor interventions to cultural dynamics and family involvement, improving patient empowerment and health outcomes across diverse populations.

Conclusion

This study showed that a 12-week self-care education program based on Balinese local wisdom significantly improved self-efficacy, reduced blood pressure, and modestly lowered HbA1C levels in patients with type 2 diabetes mellitus. By actively involving male household decision-makers in the educational process, the program aligned diabetes management strategies with cultural norms and family structures, thereby enhancing patient empowerment and adherence to self-care practices.

While the improvements in glycemic control and blood pressure were statistically significant, they did not fully achieve clinical targets. The HbA1C reduction of 0.61% represents progress toward better glycemic control but remains above the recommended threshold of <7%, and blood pressure values continued to fall within the hypertensive range. These outcomes highlight both the promise and the limitations of short-term, culturally tailored educational interventions.

The findings suggest that embedding self-care

education within the cultural framework of patrilineal households can strengthen diabetes management in settings where family decision-making plays a central role. At the same time, the modest clinical improvements underscore the need for longer-term interventions, integration with medical therapy, and larger-scale studies to confirm and extend these results.

In conclusion, self-care education that respects and leverages local wisdom is a valuable strategy for improving diabetes management. It should be considered as a complementary approach to standard clinical care, particularly in culturally distinct communities where family involvement strongly influences health behaviors.

Declaration of Interest

We declare that there is no conflict of interest

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Author contribution

The author confirm contribution to the paper as follows: study conception and design, Author, data collection, analysis and interpretation of results, draft manuscript preparation, reviewed the results of the manuscript

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