

The Effect of a Diabetes Education Module on Knowledge, Attitudes, and Practices Among Filipino Patients with Diabetes: A Pre-Post Without Control Group Single-Institution Cross-Sectional Survey

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Background. Diabetes mellitus is a disease whose prevalence worldwide presents a significant health crisis. Effective education and awareness programs can enhance patient knowledge, attitude, and practices to help in its effective management.

Objectives. Diabetes mellitus is a disease whose prevalence worldwide presents a significant health crisis. Effective education and awareness programs can enhance patient knowledge, attitude, and practices to help in its effective management.

Methodology. This study is a pre-post, without control group, cross-sectional survey conducted at a single institution, Chong Hua Hospital, involving patients with diabetes. Baseline interviews and laboratory tests were carried out prior to the education module, with pre- and post-surveys. Follow-up evaluations occurred three months later to reassess clinical parameters.

Results. A total of 59 individuals participated; the majority were female, over 40 years old, overweight or obese, and had comorbid hypertension. Most used insulin and took oral medications. At baseline, 57 had uncontrolled blood glucose; after three months, this dropped to 28, indicating improved glycemic control. Knowledge and attitude scores also improved significantly after the module, with Cohen's *d* values of 0.89 and 0.70, indicating large and moderate effect sizes. However, these improvements did not significantly correlate with the change in HbA1c levels ($r = 0.136$, $p = 0.306$).

Conclusion. Structured diabetes education equips patients with essential knowledge; however, increasing knowledge and positive attitudes do not consistently improve HbA1c levels. This discrepancy may arise from the complexities inherent in diabetes management and the time required for patients to assimilate new information completely.

Keywords. Diabetes mellitus, knowledge, attitudes, practices, education

Introduction

Diabetes is a major contributor to mortality and disability worldwide and can affect anyone, regardless of location, age, or gender.¹ The rapid rise in its prevalence has become a global health crisis. Preliminary data collected between January and September 2023 indicate that 6.4% of deaths in the Philippines were attributed to diabetes mellitus (DM). The highest number of diabetes-related fatalities was recorded in 2020, with a fatality rate of 6.5%.² The rise in diabetes incidence is associated with insufficient knowledge, attitudes, and practices (KAP) regarding the disease.³

Management of DM relies significantly on the patient's ability to perform self-care in their daily routine and studies have demonstrated that patients with adequate knowledge about DM self-care have better long-term glycemic control.^{7,8} Knowledge about glycemic control could also help individuals understand the risks associated with diabetes, motivating them to seek appropriate treatment and care and keep the disease under control.

People with diabetes must have adequate knowledge, attitudes, and practices to prevent and manage complications linked to their condition, as these elements are essential for reducing the effects of diabetes.^{9,10} Thus, assessing the knowledge, attitudes, and practices of individuals diagnosed is essential for improving their understanding and education.

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Community-specific education and awareness initiatives can improve patient education, attitudes, and dietary practices.¹¹ The findings from this study may influence clinical practices, treatment protocols, and resource allocation in tertiary hospitals, underscoring its significance to the healthcare community in light of the growing diabetes epidemic.

This study was conducted at the Multidisciplinary Center: Diabetes, Endocrine, and Metabolic Health of Chong Hua Hospital, a tertiary referral facility in Cebu City. Established in 2021 under the Section of Endocrinology, the center was designed to address the growing burden of diabetes through integrated, patient-centered care. It offers a range of individualized services, including structured education sessions, lifestyle counseling, and access to advanced diagnostic and treatment modalities. Its multidisciplinary team, composed of endocrinologists, nurses, diabetes educators, and allied health professionals, supports patients in achieving long-term glycemic control and improved self-management. This setting provided an ideal platform for assessing the real-world impact of a focused education module.

While previous studies have examined diabetes knowledge and attitudes, there is still a lack of locally generated evidence on the impact of structured diabetes education modules for Filipino patients. Most existing data come from international studies in different healthcare settings; this study aims to fill that gap. This study aimed to assess the knowledge, attitudes, and practices of patients with diabetes toward glycemic control at baseline and following a single-encounter diabetes education module. Specifically, we characterized the patients based on their clinical and demographic profile, described their KAP score and HbA1c levels pre- and post-module completion (after 3 months for repeat HbA1c), and determined the association between KAP and the magnitude of HbA1c change after three months.

Methodology

Study Design and Respondent Selection

This study was a pre-post, without control group, cross-sectional survey conducted at a single institution and submitted to the Institutional Review Board of Chong Hua Hospital (CHH-IRB). Individuals aged 18 years and older with a confirmed diagnosis of diabetes mellitus were eligible. The diagnosis of diabetes was established by the attending physician based on American Diabetes Association (ADA) diagnostic criteria, including laboratory parameters such as fasting plasma glucose, HbA1c, or oral glucose tolerance test, with or without supportive clinical symptoms. The projected number of adult participants aimed for inclusion in this survey was 132, based on a 95% confidence interval and a population size of 200. However, only 59 individuals consented to participate. Inclusion required completion of both pre- and post-module assessments and follow-up laboratory testing at 3 months. Exclusion criteria included individuals with cognitive impairment severe enough to

preclude comprehension of the educational intervention, as assessed clinically. Participants who failed to complete the baseline or follow-up HbA1c, weight measurements, or KAP surveys were also excluded.

Overview of Data Collection Procedures

Following approval from the Institutional Review Board of Chong Hua Hospital, the recruitment of study participants commenced. All patients diagnosed with diabetes were invited to participate. The objectives and significance of the study were thoroughly communicated to each individual. Although participants were informed of the study objectives during the consent process, efforts were made to minimize response bias: the scoring method for the questionnaire was not disclosed beforehand, and both the pre- and post-intervention assessments were administered by the same trained diabetes educators using a standardized protocol. Those expressing a willingness to participate were provided with a consent form and requested to sign it. Those who declined to participate typically cited lack of time or disinterest as their primary reasons for non-participation.

Prior to the initiation of the diabetes education module, a baseline-guided interview was conducted to collect the demographic and baseline clinical characteristics of the participants. Baseline laboratory tests were also performed upon their enrollment in the study. Participants were required to complete the validated "Patient's Diabetes Knowledge Questionnaire - DKQ,"¹² including the attitudes and practices survey questions from the research conducted by Asmelash et al. (2019),^{12,13} both before and after the completion of the module. At the conclusion, three months after the module's commencement, follow-up evaluations with the participants took place. Clinical parameters, including weight and serum HbA1c, were reassessed. For this study, glycemic control was defined as an HbA1c level of less than 7%, following the ADA's Standards of Care, while values equal to or above 7% were considered uncontrolled.

An anonymized data sheet was employed for data collection and compilation. Patient identifiers were absent from the research datasheet. The study collected various demographic and clinical variables from the participants, including age, gender, educational attainment, marital status, employment status, year diabetes diagnosed, comorbid conditions, body mass index (BMI), HbA1c levels, insulin use, and KAP before and after intervention. BMI classification followed standard WHO global criteria: Normal (18.5-24.9 kg/m²), Overweight (25.0-29.9 kg/m²), Obese I (30.0-34.9 kg/m²), Obese II (35.0-39.9 kg/m²), and Obese III (≥ 40.0 kg/m²). Prior to analysis, all completed forms were reviewed for missing or incomplete responses. Participants with incomplete data were excluded from the final statistical analysis to ensure consistency and validity across all assessed variables. This study adhered to the principles of the Declaration of Helsinki.

Assessment of Knowledge, Attitudes, and Practices

As mentioned, participant KAPs were assessed using the validated "Patient's Diabetes Knowledge Questionnaire - DKQ" and the attitudes and practices survey questions from the study of Asmelash et al.^{12,13} Both the DKQ and the attitudes and practices survey were previously validated in peer-reviewed studies and have been used in similar populations. Each response received a score of "1" for correct answers and "0" for incorrect ones. The scores of individual participants were calculated and aggregated to produce the total KAP score. Participants who answered more than 50% of the questions correctly were deemed to possess adequate KAP, while those with scores below or equal to 50% were categorized as having inadequate KAP. These thresholds were adapted from the prior research conducted by Asmelash et al. and Mahzari et al.^{3,13} Copies of the questionnaires are available upon request from the corresponding author.

Diabetes Education Module

Participants took part in a one-on-one diabetes education session, conducted by trained nurse educators in a single face-to-face encounter lasting approximately one hour. The module was adapted from educational materials developed by the Multidisciplinary Center: Diabetes, Endocrine, and Metabolic Health of Chong Hua Hospital. The session covered: (1) an overview of diabetes and its complications, (2) proper use of medications including insulin, (3) self-monitoring of blood glucose, (4) nutrition counseling and meal planning, (5) physical activity, and (6) sick day management. Sessions were delivered in English, Filipino, or Cebuano, utilizing culturally appropriate visual aids and engaging in interactive discussions. A summary of the module content is available upon request.

Statistical Analysis

Statistical analyses were conducted using Jamovi version 2.4.7, an open-source, standalone statistical computing software. Distributions of categorical variables are presented as frequencies (%), while continuous variables are expressed as mean $\pm$ standard deviation or median with interquartile range, as appropriate.

Pearson's chi-squared test was applied to assess associations between categorical variables, including the distribution of HbA1c categories before and after the intervention. To evaluate the effect of the intervention on HbA1c as a continuous variable, both a paired t-test and a Wilcoxon signed-rank test were performed to compare pre- and post-intervention values. The paired t-test was also used to analyze pre- and post-intervention KAP scores. The Pearson correlation coefficient was used to examine associations between post-intervention KAP scores and HbA1c levels at follow-up. Missing values were appropriately encoded to minimize their impact on the results. A two-sided p-value of less than 0.05 was considered statistically significant for all analyses.

Results

A total of 59 participants were included in the study (Table 1). Majority of the participants were aged 40 and older (74.6%), women (67.8%), married (72.9%), college educated (72.9%), and had hypertension as well (71.2%). More than half were classified as overweight and obese (67.8%), used insulin (66.1%), and followed oral medication regimens (78.0%) for diabetes management. At baseline, only 2 (3.4%) individuals had controlled glycemia, which improved to 31 individuals (52.5%) three months post-education module. Improvement in glycemic control was observed across all sociodemographic and clinical subgroups.

Knowledge on diabetes and glycemic control improved following the education module (Table 2). Substantial gains were observed in understanding the pathophysiology and complications of diabetes, as well as understanding of key symptoms, management, and complications. However, some misconceptions remain, particularly regarding the common symptoms of hyperglycemia and hypoglycemia (statements 20 and 21), the equal importance of various aspects of diabetes management (statement 12), and the testing methods related to diabetes (statement 8).

Following the education module, participants showed improvement in attitudes supportive of evidence-based diabetes management (Table 3). Positive shifts were observed in nearly all attitude-related statements, reflecting increased awareness of the importance of glycemic control and associated lifestyle practices. The percentage of individuals who trust alternative medicine appears to be decreasing (statement 6), alongside a reduction in those who believe that the medication metformin has harmful effects on body organs (statement 11). However, many respondents believe dietary management alone is more effective for glycemic control than combined medication and diet (statement 8). Additionally, they view conventional treatments as more beneficial than modern medications for diabetes mellitus (statement 12), contrasting with the smaller group that does not support alternative medicine.

The education module resulted in overall improvement in participants' self-reported practices related to glycemic control (Table 4). Positive health behaviors increased across most domains, while harmful habits declined or remained unchanged. There has been an increase in the percentage of participants who consume vegetables daily, engage in physical activities, adhere to prescribed medications, effectively manage their weight, consult their doctors regularly, maintain punctual eating habits, and ensure proper eye and foot care. Moreover, a decrease is observed in the percentage of individuals who smoke, increase the amount of sugar and salt in their diets, and consume alcoholic beverages.

There was a statistically significant improvement in overall KAP scores following the education module (Table 5). After the education module, the proportion of participants scoring above 50% increased to 76.3% from 54.2% ($p = 0.03$).

Although the change in categorical HbA1c distribution in our study did not reach statistical significance, the analysis of HbA1c as a continuous variable revealed a statistically significant reduction in glycemic levels after the education module. This result suggests that the intervention had a broad glycemic impact across participants, regardless of their initial HbA1c category.

Notably, this improvement was not significantly correlated with post-intervention KAP scores, suggesting that the HbA1c reduction may have resulted from general exposure to the module rather than individual-level changes in knowledge, attitudes, or practices. It can also be due to the small sample size. This dissociation between self-reported KAP outcomes and objective glycemic outcomes highlights the need for further investigation into mediating factors such as medication adherence, psychosocial support, or health system engagement.

This study has several limitations. The relatively small sample size may limit the generalizability of the findings to broader populations with T2DM. Although statistically significant improvements were observed in knowledge and attitude scores, the reduced final sample size ($n = 59$), compared to the original target ($n = 132$), may have limited the study's power to detect more subtle associations, particularly those involving glycemic control outcomes. The study lacked a control group, making it difficult to rule out the influence of external factors on the observed improvements in KAP scores and glycemic control. Also, the reliance on self-reported data for practices introduces the potential for social desirability and recall bias.

Despite these limitations, this study provides valuable insights. Based on review of literature, patient education consistently translated to improved knowledge and behaviours, but the magnitude and sustainability of clinical outcomes appeared to depend on follow-up duration and education intensity.^{5-7, 14-17} Healthcare providers can adapt similar interventions to bolster diabetes self-management and consider influences on patient actions. Policymakers are urged to integrate these modules into community diabetes initiatives to improve accessibility and health outcomes. Future research should prioritize randomized controlled trials to validate the effectiveness of these interventions and address existing limitations. Longitudinal studies are essential for assessing long-term effects on clinical outcomes, such as HbA1c levels and complication rates. Modifying and testing the module across diverse settings may yield insights into its broader applicability. Furthermore, investigating family support and external influences on patient behaviors could further refine the design of the intervention.

Conclusion

This study demonstrated that a single-session diabetes education module significantly improved KAP among patients with T2DM. Although no significant correlation

was found between post-intervention KAP scores and HbA1c at three months, this does not diminish the module's observed impact. The lack of direct correlation may reflect the complex and multifaceted nature of diabetes management, wherein clinical improvements may be influenced by a range of behavioral, psychosocial, and systemic factors beyond knowledge and attitude alone. These findings reinforce the value of structured diabetes education as a critical component of patient-centered care. Integrating such modules into routine care may serve as a practical strategy to improve patient outcomes and reduce the burden of uncontrolled diabetes.

Conflicts of Interest

The authors declare no conflicts of interest related to this study.

References

1. Ong, K. L., Stafford, L. K., McLaughlin, S. A., et al. (2023). Global, regional, and national burden of diabetes from 1990 to 2021, with projections of prevalence to 2050: A systematic analysis for the Global Burden of Disease Study 2021. *The Lancet*, 402(10397), 203-234. [https://doi.org/10.1016/S0140-6736\(23\)01301-6](https://doi.org/10.1016/S0140-6736(23)01301-6)
2. Statista. Share of deaths caused by diabetes mellitus diseases in the Philippines from 2017 to 2023. Accessed April 2, 2024 from <https://www.statista.com/statistics/1367306/philippines-deaths-from-diabetes/>
3. Mahzari, M. A., Oraibi, O. H., Shami, A. M., et al. (2022). Knowledge, attitude, and practice regarding diabetes mellitus among type 2 diabetic patients attending primary health care centers in the Jazan region of Saudi Arabia. *Cureus*, 14(1), e28704. <https://doi.org/10.7759/cureus.28704>
4. Feldman, H., ElSayed, N. A., McCoy, R. G., et al. (2023). Standards of care in diabetes—2023 abridged for primary care providers. *Clinical Diabetes*, 41(1), 4-31. <https://doi.org/10.2337/cd23-as01>
5. Świątoniowska, N., Sarzyńska, K., Szymańska-Chabowska, A., & Jankowska-Polańska, B. (2019). The role of education in type 2 diabetes treatment. *Diabetes Research and Clinical Practice*, 151, 237-246. <https://doi.org/10.1016/j.diabres.2019.04.004>
6. Lian, J. X., McGhee, S. M., Chau, J., Wong, C. K. H., Lam, C. L. K., & Wong, W. C. W. (2017). Systematic review on the cost-effectiveness of self-management education programme for type 2 diabetes mellitus. *Diabetes Research and Clinical Practice*, 127, 21-34. <https://doi.org/10.1016/j.diabres.2017.02.021>
7. Jiang, X. J., Jiang, H., Lu, Y. H., et al. (2019). The effectiveness of a self-efficacy-focused structured education programme on adults with

- type 2 diabetes: A multicentre randomised controlled trial. *Journal of Clinical Nursing*, 28(17-18), 3299-3309. <https://doi.org/10.1111/jocn.14908>
8. Steinsbekk, A., Rygg, L., Lisulo, M., Rise, M. B., & Fretheim, A. (2012). Group-based diabetes self-management education compared to routine treatment for people with type 2 diabetes mellitus: A systematic review with meta-analysis. *BMC Health Services Research*, 12, Article 213. <https://doi.org/10.1186/1472-6963-12-213>
 9. Stratton, I. M., Adler, A. I., Neil, H. A. W., et al. (2000). Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): Prospective observational study. *BMJ*, 321(7258), 405-412. <https://doi.org/10.1136/bmj.321.7258.405>
 10. The Diabetes Control and Complications Trial Research Group. (1993). The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *The New England Journal of Medicine*, 329(14), 977-986. <https://doi.org/10.1056/nejm199309303291401>
 11. Babikr, W. G., Aedh, A. I., Ahmed, A. M., et al. (2017). Assessment of knowledge, attitude and practice of diabetic people in Najran, Kingdom of Saudi Arabia. *International Journal of Research in Medical Sciences*, 5(5), 2150-2155. <https://doi.org/10.18203/2320-6012.ijrms20171860>
 12. University of Michigan. (n.d.). *Patients' Diabetes Knowledge Questionnaire (DKQ)*. [Instrument]. Retrieved from <https://www.med.umich.edu/>
 13. Asmelash, D., Abdu, N., Tefera, S., Baynes, H. W., & Derbew, C. (2019). Knowledge and practice towards glycemic control and its associated factors among diabetes mellitus patients. *Journal of Diabetes Research*, 2019, Article 2593684. <https://doi.org/10.1155/2019/2593684>
 14. Mansy, W., Wajid, S., Alwhaibi, A., Alghadeer, S. M., Alhossan, A., Babelghaith, S., Alrabiah, Z., & Al Arifi, M. N. (2022). Assessing outpatients' knowledge, attitude, and practice toward managing diabetes in Saudi Arabia. *Inquiry: The Journal of Health Care Organization, Provision, and Financing*, 59, 00469580221082781. <https://doi.org/10.1177/00469580221082781>
 15. Mohamed, H., Al-Lenjawi, B., Amuna, P., Zotor, F., & Elmahdi, H. (2013). Culturally sensitive patient-centred educational programme for self-management of type 2 diabetes: A randomized controlled trial. *Primary Care Diabetes*, 7(3), 199-206. <https://doi.org/10.1016/j.pcd.2013.05.002>
 16. Trani, M. R., Bilocura, I., Bersabal, S., Panilagao, R. K., Toledo, B. R., Garrido, E., Aultman, C., Oh, P., & Ghisi, G. L. M. (2024). Effects of a comprehensive structured patient education intervention on disease-related knowledge and behaviour change among people living with type 2 diabetes in the Philippines. *Frontiers in Rehabilitation Sciences*, 5, 1374850. <https://doi.org/10.3389/fresc.2024.1374850>
 17. Chawla, S. P. S., Kaur, S., Bharti, A., Garg, R., Kaur, M., Soin, D., Ghosh, A., & Pal, R. (2019). Impact of health education on knowledge, attitude, practices and glycemic control in type 2 diabetes mellitus. *Journal of Family Medicine and Primary Care*, 8(1), 261-268. <https://doi.org/10.4103/jfmpc.jfmpc.228.18>

Table 1. Glycemic control before and 3 months after the module

Characteristic	Total Participants N=59	Before		3 months after	
		Controlled n = 2	Uncontrolled n= 57	Controlled n = 31	Uncontrolled n = 28
Age range					
Younger than 40	15 (25.4)	1 (50.0)	14 (25.0)	5 (16.0)	10 (36.0)
40 and older	44 (74.6)	1 (50.0)	43 (75.0)	26 (84.0)	18 (64.0)
Gender					
Male	19 (32.2)	1 (50.0)	18 (32.0)	8 (26.0)	11 (39.0)
Female	40 (67.8)	1 (50.0)	39 (68.0)	23 (74.0)	17 (61.0)
Marital Status					
Never married	16 (27.1)	2 (100.0)	14 (25.0)	10 (32.0)	6 (21.0)
Married	43 (72.9)	-	43 (75.0)	21 (68.0)	22 (79.0)
Education					
Elementary	3 (5.1)	-	3 (5.3.0)	2 (6.5)	1 (3.6)
HS	13 (22.0)	-	13 (23.0)	6 (19.0)	7 (25.0)
College	43 (72.9)	2 (100.0)	41 (72.0)	23 (74.0)	20 (71.0)
Occupation					
None	29 (49.2)	1 (50.0)	28 (49.0)	17 (55.0)	12 (43.0)
Private	22 (37.3)	-	22 (39.0)	9 (29.0)	13 (46.0)
Government	8 (13.5)	1 (50.0)	7 (12.0)	5 (16.0)	3 (11.0)
Hypertension	42 (71.2)	1 (50.0)	41 (72.0)	23 (74.0)	19 (68.0)
Kidney Disease	4 (6.8)	-	4 (7.0)	3 (9.7)	1 (3.6)
BMI Class					
Overweight	20 (33.9)	1 (50)	19 (33.0)	12 (39.0)	8 (29.0)
Obese 1	9 (15.3)	-	9 (16.0)	5 (16.0)	4 (14.0)
Obese 2	10 (16.9)	-	10 (18.0)	5 916.0)	5 (18.0)
Obese 3	1 (1.7)	1 (50.0)	-	-	1 (3.6)
On insulin	39 (66.1)		39 (68.0)	21 (68.0)	18 (64.0)
On oral meds	46 (78.0)	2 (100.0)	44 (77.0)	25 (81.0)	21 (75.0)

BMI classification based on WHO global cut-offs.

Table 2. Knowledge about Glycemic Control (Pre-post Module)

Statements	Number of participants responding with 'Yes'			
	Pre-module		Post-module	
	n	%	n	%
1. Eating too much sugar and other sweet foods is a cause of diabetes.	5	8.5	1	1.7
2. The usual cause of diabetes is lack of effective insulin in the body.	36	61.0	57	96.6
3. Diabetes is caused by failure of the kidneys to keep sugar out of the urine.	19	32.2	27	45.8
4. Kidneys produce insulin.	25	42.4	17	28.8
5. In untreated diabetes, the amount of sugar in the blood usually increases.	49	83.1	57	96.6
6. Diabetes can be cured.	15	25.4	34	57.6
7. A fasting blood sugar level of 210 is too high.	49	83.1	57	96.6
8. The best way to check my diabetes is by testing my urine.	31	52.5	38	64.4
9. Regular exercise will increase the need for insulin or other diabetic medication.	21	35.6	36	61.0
10. There are two main types of diabetes: Type 1 (insulin dependent) and Type 2 (noninsulin dependent).	37	62.7	48	81.4
11. Hypoglycemia is caused by too much food.	30	50.8	48	81.4
12. Medication is more important than diet and exercise to control my diabetes.	36	61.0	38	64.4
13. Diabetes often causes poor circulation.	37	62.7	54	91.5
14. Cuts and abrasions on diabetes heal more slowly.	47	79.7	54	91.5
15. Diabetics should take extra care when cutting their toenails.	42	71.2	57	96.6
16. A person with diabetes should cleanse a cut with iodine and alcohol.	5	8.5	3	5.1
17. The way I prepare my food is as important as the food I eat.	57	96.6	58	98.3
18. Diabetes can damage my kidneys.	50	84.7	56	94.9
19. Diabetes can cause loss of feeling in my hands, fingers and feet.	47	79.7	56	94.9
20. Shaking and sweating are signs of high blood sugar.	7	11.9	24	40.7
21. Frequent urination and thirst are signs of low blood sugar.	23	39.0	32	54.2
22. Tight elastic hose or socks are not bad for diabetics.	14	23.7	22	37.3
23. A diabetic diet consists mostly of special foods.	19	32.2	9	15.3

Table 3. Attitudes about Glycemic Control (Pre-post Module)

Statements	Number of participants responding with 'Yes'			
	Pre-module		Post-module	
	n	%	n	%
1. Do you think glycemic control is necessary for DM?	36	61.0	54	91.5
2. Do you think regular exercise can help to control DM?	54	91.5	57	96.6
3. Do you think smoking causes poor glycemic control?	39	66.1	54	91.5
4. Do you think blood pressure control is necessary for glycemic control?	41	69.5	56	94.9
5. Do you think glycemic control prolonged life expectancy?	40	67.8	55	93.2
6. Do you think that alternative treatments are good?	26	44.1	23	39.0
7. Do you believe good blood sugar control is important for DM?	53	89.8	55	93.2
8. Do you think changes in diet alone is better than medication and changes in diet as to achieving glycemic control?	18	30.5	30	50.8
9. Do you believe fruits and vegetables are good for glycemic control?	37	62.7	53	89.8
10. Do you think alcohol can increase the complication of DM?	49	83.1	53	89.8
11. Do you think metformin has harmful effects to the organs of the body?	17	28.8	13	22.0
12. Do you think traditional treatments are better than modern medicines for DM?	33	55.9	34	57.6

Table 4. Practices towards Glycemic Control (Pre-post Module)

Statements	Number of participants responding with 'Yes'			
	Pre-module		Post-module	
	n	%	n	%
1. Eat vegetables daily	52	88.1	55	93.2
2. Daily physical exercise	48	81.4	55	93.2
3. Medication treatment adherence	57	96.6	58	98.3
4. Control/maintain body weight	52	88.1	55	93.2
5. Regular blood check-up	52	88.1	56	94.9
6. Cigarette smoking	11	18.6	7	11.9
7. Extra sugar and salt on a regular diet	18	30.5	11	18.6
8. Alcohol intake	10	16.9	10	16.9
9. Eating on time	48	81.4	58	98.3
10. Eye and foot care	55	93.2	59	100.0

Table 5. KAP score distribution before and after module

KAP score	Before	After	p-value
≤50%	27 (45.8%)	14 (23.7%)	0.03
>50%	32 (54.2%)	45 (76.3%)	

Table 6. Level of Knowledge and Attitudes of T2DM Patients Towards Glycemic Control (Before and after module)

Variables	Before	After	p-value	Effect size Cohen's d	95% CI [lower, upper]
Knowledge	11.88 ± 4.20	15.47 ± 3.83	<0.001	0.89	[0.59, 1.19]
Attitudes	7.51 ± 2.50	9.10 ± 2.01	<0.001	0.70	[0.42, 0.99]

Figure 1. Distribution of HbA1c levels before and after the diabetes education module

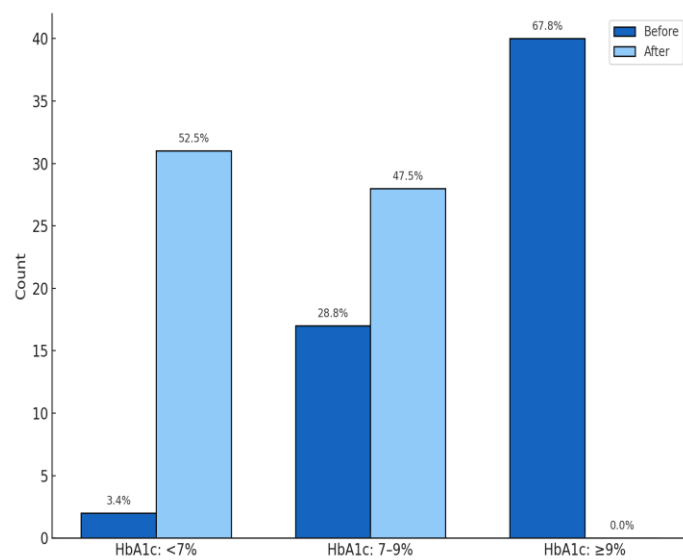


Figure 2. Boxplot showing distribution of HbA1c levels before and after the diabetes education module

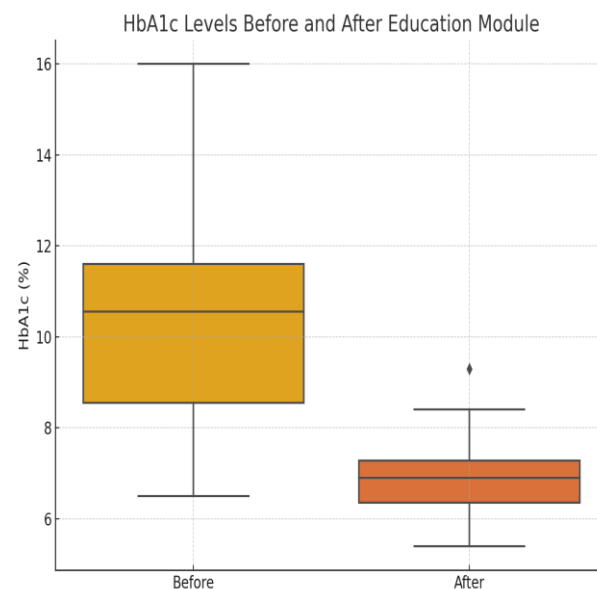


Figure 3. Correlation of KAP and HbA1c 3 months after

