

Effectiveness of the putri self-management module in improving knowledge, attitudes, and blood glucose levels among patients with type 2 diabetes mellitus

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ABSTRACT

Poor glycemic control among patients with Type 2 Diabetes Mellitus (T2DM) is often associated with inadequate diabetes knowledge, low self-efficacy, and suboptimal self-management practices. The PUTRI (Pemberdayaan Untuk Tatalaksana dan Regulasi Individu) module was developed as a structured educational tool to support diabetes self-management in primary care settings. This study aimed to evaluate the effectiveness of the PUTRI module on patients' knowledge, attitudes, and random blood glucose (RBG) levels. A quasi-experimental one-group pretest-posttest study was conducted among 50 patients with T2DM enrolled in a chronic disease management program at a primary healthcare center. Participants received a 7-day intervention using the PUTRI module. Knowledge and attitude were assessed using structured questionnaires, while RBG levels were measured using calibrated glucometers. Data were analyzed using the Wilcoxon Signed-Rank Test and Spearman's correlation analysis. Significant improvements were observed in knowledge scores (0.176 ± 0.222 vs. 0.940 ± 0.121 ; $p < 0.001$) and attitude scores (1.95 ± 0.505 vs. 2.91 ± 0.252 ; $p < 0.001$) following the intervention. Mean RBG levels decreased from 267.54 mg/dL at baseline to 185.52 mg/dL on Day 7 ($p < 0.001$). A moderate positive correlation was identified between post-test knowledge and attitude scores ($r_s = 0.566$, $p < 0.001$), while self-efficacy was negatively correlated with Day-7 RBG levels ($r_s = -0.282$, $p = 0.047$). The PUTRI module was associated with improvements in diabetes-related knowledge, attitudes, and short-term glycemic outcomes among patients with T2DM. Further studies using randomized controlled designs and longer follow-up periods are recommended to confirm these findings.

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INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) has emerged as one of the most critical metabolic threats globally, heavily impacting individuals in their later years. Managing this chronic disease requires a lifelong commitment to therapeutic regimens, dietary restrictions, and physical activity. However, in primary care settings, patients frequently experience poor glycemic regulation, which accelerates debilitating microvascular and macrovascular complications. This breakdown in care is rarely due to a lack of medication; rather, it stems from a fundamental breakdown in the patient's behavioral loop: low health literacy, a lack of self-efficacy, and a passive attitude toward daily self-care (ALSharit & Alhalal, 2022; Hurst et al., 2020; Lee, 2020; Ong-artborirak et al., 2023; Saleh et al., 2021).

To bridge this operational gap, non-pharmacological interventions must move beyond standard verbal advice, which suffers from low retention in older populations. The PUTRI (*Pemberdayaan Untuk Tatalaksana dan Regulasi Individu*) module was engineered as an adaptive, structured self-management guide designed to translate complex medical protocols into simple, actionable daily goals. By framing the patient not merely as a passive recipient of care but as an active manager of their metabolic health, the module addresses the cognitive, affective, and physiological domains simultaneously. Although diabetes self-management education (DSME) interventions have been widely implemented in primary care settings, many programs primarily focus on delivering information through counseling sessions and educational leaflets. Such approaches often provide limited support for daily behavioral monitoring and long-term adherence, particularly among older adults with low health literacy and limited self-management skills.

The PUTRI (*Pemberdayaan Untuk Tatalaksana dan Regulasi Individu*) module was developed to address these limitations by integrating diabetes education, self-monitoring activities, dietary recording, physical activity tracking, blood glucose monitoring, and self-reflection exercises into a structured patient-centered workbook. Unlike conventional educational approaches that emphasize knowledge transfer alone, the PUTRI module promotes active participation and continuous self-regulation in daily diabetes care. This integrated approach is expected to strengthen patients' knowledge, attitudes, and self-management behaviors, ultimately contributing to improved glycemic outcomes. (Beck, 2020; Powers, 2020)

Therefore, this study aimed to evaluate the effectiveness of the PUTRI module in improving diabetes-related knowledge, attitudes, and random blood glucose levels among patients with Type 2 Diabetes Mellitus in a primary healthcare setting. (Asmat et al., 2022; Beck, 2020; Chatterjee, 2021; Chowdhury et al., 2024; Powers, 2020).

RESEARCH METHOD

This study employed a quasi-experimental, pre-test and post-test design to observe changes across behavioral and metabolic metrics. The study population comprised 50 respondents diagnosed with Type 2 Diabetes Mellitus under the active care of a primary health center's chronic disease management program (Prolanis). Participants were selected using purposive sampling based on predetermined eligibility criteria. Inclusion criteria consisted of patients diagnosed with Type 2 Diabetes Mellitus, aged ≥ 40 years, able to communicate effectively, willing to participate, and enrolled in the Prolanis program. Patients with severe complications, cognitive impairment, or conditions preventing active participation in self-management activities were excluded from the study.

Baseline measurements (*pre-test*) for knowledge, attitude, and clinical markers were established on Day 1. The clinical marker evaluated was Random Blood Glucose (RBG/GDS), measured using standard, calibrated glucometers. Knowledge and attitude were assessed using structured questionnaires developed from diabetes self-management education indicators. Self-

efficacy was measured using the Diabetes Management Self-Efficacy Scale (DMSES), which evaluates patients' confidence in performing diabetes self-management behaviors. Prior to implementation, all instruments were reviewed for content validity by experts in diabetes care. Internal consistency testing demonstrated acceptable reliability, with Cronbach's alpha coefficients of 0.80 for the knowledge questionnaire, 0.76 for the attitude questionnaire, and 0.83 for the DMSES.

The intervention spanned 7 days, during which patients integrated the PUTRI module into their daily routines—tracking dietary intake, recording physical activity, and logging daily blood glucose readings. Clinical monitoring was conducted daily to track glycemic trends. The PUTRI (Pemberdayaan Untuk Tatalaksana dan Regulasi Individu) module was designed as a structured self-management workbook consisting of five main components: (1) basic diabetes education, (2) dietary management guidance, (3) physical activity monitoring, (4) daily blood glucose recording, and (5) self-reflection activities aimed at strengthening self-efficacy. Participants were instructed to complete the module independently each day and were monitored by healthcare personnel throughout the intervention period. On Day 7, a final evaluation (*post-test*) was administered using identical psychometric tools alongside a concluding blood glucose test. Data analysis was executed using non-parametric inferential statistics, applying the *Wilcoxon Signed Ranks Test* to assess pre-to-post variations, and Spearman's rho correlation analysis and multiple linear regression analysis were performed to examine relationships among study variables to isolate the structural interactions between variables post-intervention.

The conceptual framework of the PUTRI module was developed based on principles of diabetes self-management education and support (DSMES), health literacy enhancement, and self-efficacy theory, which have consistently demonstrated effectiveness in improving self-care behavior and glycemic outcomes among adults with T2DM. Because this study employed a one-group pretest-posttest design without a comparison group, the findings should be interpreted with caution. The study design allows assessment of changes following the intervention but does not fully eliminate the influence of external factors that may affect glycemic outcomes. (Beck, 2020; Lee, 2020; Powers, 2020; Yu et al., 2022).

RESULTS AND DISCUSSIONS

Demographic and Baseline Profile of Respondents

Analysis of the demographic profile within the research database reveals a highly distinct layout among the 50 respondents: Gender distribution is predominantly female, accounting for 70% (35 patients) of the total sample, while male patients represent 30% (15 patients). The majority of the patients completed secondary education, with 58% (29 patients) holding a high school diploma (SMA) and 20% (10 patients) reaching a middle school level (SMP). The mean age of the participants stands at 57.08 years (9.51), placing most respondents within the pre-elderly and elderly brackets. Furthermore, they present a mean diabetes duration of 3.66 years (2.11) (Ong-artborirak et al., 2023). Similar demographic characteristics have been reported in previous studies involving middle-aged and older adults with T2DM, where age, educational attainment, and duration of diabetes significantly influenced self-management performance and glycemic outcomes (Hurst et al., 2020; Panagiotidis et al., 2024).

Cognitive Transformation and Affective Internalization

The study observed significant changes in patients' knowledge and attitudes following the PUTRI module intervention. To assess the significance of changes in cognitive (Knowledge) and affective (Attitude) behavior before and after the PUTRI module intervention, the results of the Wilcoxon Signed-Rank Test are presented in Table 1 below.

Table 1. Wilcoxon signed ranks test: behavioral shift pre and post-intervention (n=50)

Behavioral Metric	Phase	Mean Score	Std. Deviation	Z-Value	Asymp. Sig (2-tailed)
Knowledge Score	Pre-Test	0.176	0.222		
	Post-Test	0.940	0.121	-6.182	0.000
Attitude Score	Pre-Test	1.950	0.505		
	Post-Test	2.910	0.252	-5.944	0.000

The baseline knowledge score indicates limited understanding of diabetes management among participants before the intervention. Following the deployment of the PUTRI module, this score experienced a substantial increase to 0.940 ($p=0.000$). These findings suggest that the module may facilitate improved understanding of diabetes self-management concepts. This improvement in diabetes-related knowledge was accompanied by a positive change in patients' attitudes toward diabetes self-management.

These findings align with evidence demonstrating that structured educational interventions improve diabetes knowledge, health literacy, and patient attitudes toward disease management, ultimately strengthening self-care behaviors (Butayeva et al., 2023; Chatterjee, 2021; Ernawati et al., 2021; Whitehead et al., 2022).

Gradual Daily Regulation of Random Blood Glucose (RBG/GDS)

Changes in blood glucose levels were examined to assess the potential clinical outcomes associated with the intervention. A gradual reduction in random blood glucose levels was observed throughout the 7-day intervention period.

Table 2. Daily profile and paired comparison of random blood glucose (RBG) progression

Timeline Intervensi	Mean RBG/GDS (mg/dL)	Std. Deviation	Mean Drop (Δ)	Asymp. Sig (2-tailed)*
Day 1 (Pre-Test)	267.54	69.36	<i>Baseline</i>	-
Day 2	256.04	65.51	-11.50	0.000
Day 3	242.88	58.74	-13.16	0.000
Day 4	226.78	53.68	-16.10	0.000
Day 5	213.12	48.06	-13.66	0.000
Day 6	199.38	44.59	-13.74	0.000
Day 7 (Post-Test)	185.52	39.81	-13.86	0.000
Total Akumulasi	Day 1 vs Day 7	-	-82.02	0.000

*The significance test is based on the Wilcoxon Signed Ranks Test, with all parameters compared against the Day 1 random blood glucose (RBG) baseline values (Pre-Test).

At Day 1, the respondents were within a zone of poor glycemic control, presenting a mean baseline random blood glucose (RBG) level of 267.54 mg/dL. However, following the integration of the behavioral module, the RBG levels contracted consistently and systematically every 24 hours – with an average daily decline ranging between 11 and 16 mg/dL – ultimately reaching a lower blood glucose level of 185.52 mg/dL by Day 7 ($p=0.000$). This represents a total absolute reduction of 82.02 mg/dL. The observed reduction in random blood glucose levels may be associated with improved adherence to dietary recommendations, physical activity, and self-monitoring practices encouraged through the PUTRI module. However, the physiological mechanisms underlying these changes were not directly assessed in the present study (Chowdhury et al., 2024; Chrvala, 2020; Powers, 2020).

Comparable reductions in glycemic parameters have been observed following DSME-based interventions, particularly when educational programs are combined with self-monitoring, dietary regulation, and structured physical activity components (Chrvala, 2020; Cunningham, 2021; Rasoul, 2021).

Bivariate and Multivariate Synergy: Mapping the Behavioral-Metabolic Loop

To establish the structural relationships among variables following the implementation of the PUTRI module, Spearman's Rho correlation analysis and multiple linear regression testing were conducted. These results clearly map out how psychological transformations (Knowledge

and Attitude) correlate directly with objective clinical improvements (Random Blood Glucose and Self-Efficacy) (ALSharit & Alhalal, 2022; Ong-artborirak et al., 2023).

The observed relationship between knowledge and attitude supports Social Cognitive Theory, which posits that increased understanding of disease mechanisms can facilitate positive behavioral adaptation and long-term self-management engagement (Lee, 2020; Whitehead et al., 2022).

Table 3. Bivariate non-parametric correlation matrix (spearman's rho)

Variables Compared	Correlation Coefficient (r)	p-value (2-tailed)	Clinical / Behavioral Interpretation
Knowledge Post Attitude Post	0.566	0.000	Strong Positive Correlation; Knowledge was positively associated with attitudes toward diabetes self-management.
DMSES Post GDS Day 7	-0.282	0.047	Significant Negative Correlation; Higher self-efficacy was associated with lower blood glucose levels.

The correlation analysis presented in Table 3 confirms a strong and positive relationship between Post-Test Knowledge and Post-Test Attitude ($r_s=0.566$, $p=0.0001$). This indicates that the clear cognitive comprehension facilitated by the PUTRI module serves as a primary foundation for shaping adaptive attitudes among elderly patients (Butayeva et al., 2023). Conversely, a statistically significant negative correlation was observed between the Diabetes Management Self-Efficacy Scale (Post-Test DMSES) and random blood glucose (RBG) levels on Day 7 ($r_s=0.282$, $p=0.047$). This finding suggests that patients with higher self-efficacy tended to have lower blood glucose levels on Day 7. Furthermore, to isolate which behavioral variable exerts the most dominant contribution toward the reduction of blood glucose levels on Day 7, a multiple linear regression analysis was performed, as summarized in Table 4.

The association between self-efficacy and blood glucose control found in this study is consistent with previous evidence indicating that self-efficacy is among the strongest predictors of successful diabetes self-management and HbA1c reduction (Hurst et al., 2020; Panagiotidis et al., 2024; Saleh et al., 2021).

Table 4. Multivariate linear regression model for glycemic determinants (RBG day 7)

Predictor Variables	Unstandardized Coefficients (B)	Standardized Coefficients (β)	t-statistic	p-value	Status
(Constant)	224.156	-	5.214	0.000	-
Knowledge Post-Test	-12.450	-0.038	-0.198	0.844	Non-Significant
Attitude Post-Test	-3.120	-0.020	-0.106	0.916	Non-Significant
DMSES Post-Test (Self-Efficacy)	-0.428	-0.324	-2.102	0.041	Significant

Predictor Variables	Unstandardized Coefficients (B)	Standardized Coefficients (β)	t-statistic	p-value	Status
(Constant)	224.156	-	5.214	0.000	-

*Dependent Variable: Random Blood Glucose (GDS) Day 7 ($R=0.335$, $R^2=0.12$).

Based on the multivariate modeling presented in Table 4, when Knowledge, Attitude, and Self-Efficacy (DMSES) were examined simultaneously, DMSES (Self-Efficacy) emerged as the sole significant independent predictor of the reduction in random blood glucose levels on Day 7, yielding a p -value of 0.041 and a standardized coefficient (β) of -0.324. The constant value of 224.156 establishes the baseline clinical prediction when behavioral factors are excluded; however, each unit increase in a patient's self-efficacy score significantly decreases the random

blood glucose (RBG) level by 0.428 mg/dL. This statistically substantiates the behavioral theory that while the cognitive (knowledge) and affective (attitude) dimensions enhanced by the PUTRI module function as critical enablers, These findings suggest that self-efficacy may play an important role in supporting diabetes self-management behaviors associated with glycemic improvement (Hurst et al., 2020; Mikhael et al., 2020).

The dominance of self-efficacy as a predictor of glycemic improvement suggests that educational interventions should not only focus on knowledge transfer but also on strengthening patients' confidence in their ability to perform daily self-care activities. Similar findings have been reported in nurse-led DSME programs and community-based diabetes management interventions (Adu, 2020; Sun et al., 2025; Yu et al., 2022).

CONCLUSION

The findings of this study indicate that the PUTRI self-management module was associated with significant improvements in diabetes-related knowledge, attitudes, and short-term random blood glucose levels among patients with Type 2 Diabetes Mellitus. The intervention may serve as a practical educational tool to support self-management practices in primary healthcare settings. However, given the absence of a control group and the short intervention period, further randomized controlled studies with larger samples and longer follow-up durations are needed to confirm the effectiveness and sustainability of these outcomes.

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