Effectiveness of Health Promotion Media (Posters) on Reducing Blood Sugar Levels in Diabetes Mellitus Patients

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ABSTRACT

Diabetes Mellitus is a chronic metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Health promotion plays a pivotal role in enhancing patient knowledge and self-management behaviors. Among various educational tools, posters are considered effective media due to their ability to convey complex health messages visually and concisely. This study aimed to evaluate the effectiveness of poster-based health promotion interventions in reducing blood glucose levels among patients with Diabetes Mellitus at the Bandar Khalifah Public Health Center. This research employed a quantitative method utilizing a quasi-experimental design with a one-group pretest-posttest approach. A sample of 52 respondents was selected using a random sampling technique. Data were analyzed using the Paired Sample t-test to determine the statistical significance of the intervention. The statistical analysis revealed a significant difference in blood glucose levels before and after the intervention, with a *p*-value of 0.006 ($p < 0.05$). These findings indicate that the implementation of visual health education significantly contributed to the reduction of blood glucose levels among the respondents. It is concluded that poster-based media is an effective tool for supporting glycemic control in patients with Diabetes Mellitus. Therefore, it is recommended that healthcare providers utilize and develop diverse visual health promotion media regularly to sustain public awareness and foster long-term healthy behaviors.

Keywords: **blood glucose, diabetes mellitus, health promotion, poster media**

INTRODUCTION

Diabetes Mellitus (DM) is a complex, chronic metabolic disorder characterized by persistent hyperglycemia resulting from defects in insulin secretion, insulin action, or a combination of both. According to the American Diabetes Association Professional Practice Committee (2024), the classification of DM includes Type 1 diabetes (immune-mediated beta-cell destruction), Type 2 diabetes (progressive loss of beta-cell insulin secretion frequently on the background of insulin resistance), and gestational diabetes. If left unmanaged, the chronic hyperglycemic state is associated with long-term damage, dysfunction, and failure of various organs, particularly the eyes, kidneys, nerves, heart, and blood vessels (ElSayed et al., 2023).

The global burden of diabetes has reached an alarming scale. The International Diabetes Federation (IDF, 2021) reported that approximately 537 million adults worldwide live with diabetes, a figure projected to reach 783 million by 2045. Indonesia currently ranks among the

top five countries globally for the highest number of adults with diabetes, with an estimated prevalence of 19.5 million cases, which is expected to rise significantly. Domestically, data from the Ministry of Health of the Republic of Indonesia indicates a steady upward trend in prevalence, reaching approximately 11.7% in 2023 (Kementerian Kesehatan RI, 2024). The estimated number of Diabetes Mellitus sufferers in North Sumatra Province in 2024 is 228,679 cases and 192,715 cases (84.27%) will receive health services (Dinas Kesehatan Provinsi Sumatera Utara, 2024).

Health promotion is an essential strategy to mitigate the rising global burden of diabetes, which the IDF (2021) projects will disproportionately affect low-to-middle-income nations. Central to this strategy is patient empowerment through Diabetes Self-Management Education and Support (DSMES), which the American Diabetes Association Professional Practice Committee (2024) and global consensus reports (Powers et al., 2020) identify as a critical pillar for improving glycemic outcomes and preventing complications. However, in developing regions like Indonesia, effective self-management is often obstructed by low medication adherence. A recent systematic review by Pertiwi et al. (2022) confirms that non-adherence remains a prevalent issue among Indonesian diabetic patients, largely driven by a lack of understanding regarding long-term therapy. Consequently, there is an urgent need to translate complex clinical guidelines into simplified, accessible formats that allow patients with varying educational backgrounds to comprehend and comply with medical advice.

In primary healthcare settings such as Health Center, visual educational tools serve as a practical solution to bridge this knowledge gap. Pamungkas and Chamroonsawasdi, (2020), in a study specifically targeting the Indonesian population, demonstrated that structured self-management interventions significantly enhance patients' self-efficacy and metabolic markers. Validated by high-level evidence, printed educational materials (such as posters) function as persistent environmental reminders that facilitate information retention and improve professional practice (Giguère et al., 2020). By simplifying health messages visually, these tools act as cost-effective and scalable interventions to improve adherence and health outcomes in resource-limited community settings.

However, a substantial research gap remains regarding the physiological impact of such interventions. While numerous studies have demonstrated the effectiveness of health promotion on cognitive outcomes (knowledge) and behavioral outcomes (attitude), there is a scarcity of evidence evaluating clinical outcomes, specifically blood glucose reduction, within the Indonesian primary care context. Reliance on self-reported data often introduces bias;

therefore, measuring objective biological markers is essential to validate the true efficacy of educational interventions (Powers et al., 2020). Furthermore, specific data on the clinical impact of visual media at the Bandar Khalifah Public Health Center has not yet been established.

The novelty of this study lies in its focus on the biological efficacy of health promotion. Unlike previous research that primarily assessed knowledge retention, this study integrates educational theory with clinical metrics to determine if poster-based interventions can lead to tangible improvements in glycemic control. Therefore, the objective of this study is to determine the effectiveness of poster-based health promotion in reducing blood glucose levels among patients with diabetes mellitus. The findings are expected to provide robust, empirical evidence to support the integration of visual media into standard diabetes care protocols at the primary level.

METHODS

Study Design

This study employed a quantitative quasi-experimental design aimed at testing the effectiveness of the intervention variable. The study was conducted using a one-group pretest–posttest design, in which repeated observations and measurements were performed before and after the health promotion intervention using posters. This design allows for the evaluation of changes in the dependent variable (blood glucose level) following exposure to the intervention.

Study Setting and Period

The study was conducted at Bandar Khalifah Public Health Center, located in Serdang Bedagai Regency, North Sumatra, Indonesia. Data collection took place over a six-month period, from December 2023 to June 2024.

Population and Sample

The population of this study consisted of all patients diagnosed with diabetes mellitus registered at Bandar Khalifah Public Health Center, totaling 315 individuals. The sample size was determined using the Lemeshow formula, resulting in 52 respondents who were selected through a random sampling technique. Inclusion criteria included patients diagnosed with type 2 diabetes mellitus, aged ≥18 years, and willing to participate in the study. Patients with severe complications or cognitive impairment were excluded.

Variables and Intervention Media

The study defined the poster-based health promotion intervention as the independent variable, aimed at influencing the dependent variable, specifically the blood glucose levels of patients with Type 2 Diabetes Mellitus. The educational media employed was a standardized poster designed in accordance with established health communication principles to ensure construct validity. This visual aid utilized high-contrast imagery and concise text to elucidate four critical pillars of diabetes self-management: medication adherence, physical activity, foot care, and dietary regulation based on the principles Schedule, Type, and Amount. This nutritional guideline is consistent with the standard management protocols for diabetes in Indonesia regarding medical nutrition therapy (PERKENI, 2021).

Intervention Procedure

To ensure procedural fidelity, the intervention was delivered by the research team through a single 20–30 minutes face-to-face session, adhering to established diabetes self-management standards (Powers et al., 2020). Furthermore, participants received a leaflet replica of the poster as a home-based visual reinforcement tool to sustain behavioral changes during the follow-up period (Giguère et al., 2020).

Data Collection Procedure

Data collection was conducted in three stages: pretest, intervention, and posttest. Baseline blood glucose levels were measured during the pretest to establish initial physiological conditions. The intervention consisted of poster-based health education focused on improving diabetes self-management, including diet regulation, physical activity, medication compliance, and lifestyle modification. Two weeks after the intervention, blood glucose levels were reassessed during the posttest to determine the effectiveness of the educational intervention in lowering glycemic levels among participants.

Data Analysis

Data analysis employed univariate and bivariate statistical methods. Univariate analysis summarized respondents' characteristics and key study variables using frequencies and percentages. Bivariate analysis was performed to assess differences between the independent and dependent variables. Data normality was tested using the Shapiro–Wilk test due to the sample size being fewer than 50 participants. For normally distributed data, a paired sample t-test was used to compare pretest and posttest mean values, whereas the Wilcoxon signed-rank test was applied for non-normally distributed data. Statistical significance was determined at a

p-value of ≤ 0.05, indicating a significant effect of poster-based health education on blood glucose reduction in patients with diabetes.

RESULTS

Univariate Analysis

Table 1. Respondent Characteristics

Characteristics	Frequency (f)	Percentage (%)
Gender		
Man	20	38.5
Woman	32	61.5
Age (Years)		
25-34	9	17.3
35-44	11	21.2
45-54	18	34.6
55-64	14	26.9

Table 1 above shows that the number of respondents by gender was 20 men (38%) and 32 women (61.5%). The highest age range for respondents was 45-54 years (38%), and the lowest was 25-34 years.

Bivariate Analysis

Table 2. Frequency Distribution of Blood Sugar Levels in Diabetes Mellitus Patients

KGD Scale	Mean	Standard Deviation	Min	Max
Before giving health promotion (poster)	195.37	27,214	145	250
After being given health promotion (poster)	194.13	27,252	143	247

Based on Table 2 above, it shows that the minimum blood sugar level of respondents before health promotion using posters was 145 and the maximum was 250 with an average value of 195.37 with a standard deviation of 27.214. And after health promotion, the minimum blood sugar level of respondents was 143 and the maximum was 247 with an average value of 194.13 with a standard deviation of 27.252.

Table 3. Frequency Distribution of Blood Sugar Levels Before and After Health Promotion (Poster) on Reducing Blood Sugar Levels in Diabetes Mellitus Patients

	Mean	Standard Deviation	Std.Error Mean	p-value
Health Promotion Pretest-Poster	1,231	3,097	0.430	0.006

Table 3 above, it is stated that the difference in the average value of blood sugar levels between blood sugar level measurements before and after is 1.231 with a standard deviation of 3.097. The results of statistical tests using paired sample t-test obtained a p-value = 0.006 where the p-value is smaller than the value of α = 0.05, so it can be concluded that the hypothesis is accepted, which means there is an effectiveness of health promotion media (posters) on blood sugar levels in diabetes mellitus patients at the Bandar Khalifah Community Health Center, Serdang Bedagai Regency.

DISCUSSION

Respondent Characteristics

The demographic analysis reveals that the highest prevalence of Type 2 Diabetes Mellitus (T2DM) in this study occurred within the 45–54 age group (34.6%), followed by the 55–64 age group (26.9%). This finding corroborates global epidemiological data from the IDF Diabetes Atlas 10th Edition, which identifies the 40–59 age bracket as a critical period for diabetes onset in low-to-middle-income countries (Sun et al., 2022). The dominance of middle-aged respondents aligns with the natural history of the disease, where the risk of T2DM escalates significantly after the age of 45. Aging is physiologically linked to a progressive decline in pancreatic beta-cell function and a concurrent increase in insulin resistance, a condition often exacerbated by age-related sarcopenia and reduced metabolic flexibility (ElSayed et al., 2023). Consequently, this age group represents a pivotal window for secondary prevention efforts in primary care settings to delay the progression of complications.

Regarding gender distribution, this study found a higher proportion of female respondents (61.5%) compared to males (38%). While global statistics often show a slightly higher prevalence in men, this finding is consistent with regional trends in Southeast Asia and specific risk factors associated with women. Recent literature highlights that sex differences in diabetes are driven by complex biological and psychosocial factors. Kautzky-willer et al. (2023) explain that women, particularly during the post-menopausal transition, experience drastic hormonal changes specifically a reduction in estrogen which shifts fat storage towards visceral adiposity. This accumulation of visceral fat is a potent driver of insulin resistance and systemic inflammation. Furthermore, sociocultural factors in Indonesia, such as lower physical activity levels among housewives compared to the male working population, may further contribute to the higher incidence of T2DM among women in this study setting.

Blood Sugar Levels Before and After Health Promotion (Poster)

The principal finding of this study demonstrates a measurable and significant improvement in blood glucose levels among patients with Type 2 Diabetes Mellitus (T2DM) following the poster-based health promotion intervention. These results provide empirical evidence that visual health education acts as more than a mere information delivery system; it serves as a catalyst for physiological change. The observed reduction in blood glucose levels suggests that the intervention successfully bridged the gap between cognitive understanding and behavioral application. This aligns with the American Diabetes Association (2024) standards, which emphasize that Diabetes Self-Management Education and Support (DSMES) is a critical pillar of care, capable of significantly lowering HbA1c and improving glycemic outcomes when delivered effectively (ElSayed et al., 2023).

The effectiveness of the poster intervention can be largely attributed to its ability to simplify complex medical information into actionable steps, thereby reducing the cognitive load on patients. Diabetes management involves intricate rules regarding dietary restrictions (e.g., the "3J" rule), medication schedules, and lifestyle modifications. Giguère et al. (2020), in a comprehensive Cochrane Systematic Review, confirmed that printed educational materials significantly improve professional practice and patient process outcomes by making guidelines accessible and easy to recall. By utilizing high-contrast visuals and concise text, the posters in this study likely improved the patients' health literacy, enabling them to make better daily decisions regarding carbohydrate intake and medication adherence without feeling overwhelmed by technical medical jargon.

Furthermore, the specific format of the intervention utilizing visual cues played a distinct role in sustaining behavioral change. Unlike auditory information delivered during verbal counseling, which relies heavily on patient memory and may be easily forgotten, the poster and leaflet provided a permanent reference point for the participants. Consequently, the take-home materials functioned as persistent environmental reminders in the patients' homes, encouraging consistent adherence to the prescribed diet and physical activity regimens, which directly supported the stabilization of blood glucose levels over the follow-up period.

These findings are consistent with the evolving global consensus on diabetes management strategies. While Powers et al. (2020) previously established the foundational role of self-management, the ADA and EASD Consensus Report (2022) updated by Davies et al. (2022) further asserts that education must be accessible, person-centered, and responsive to the social

determinants of health to effectively reduce clinical inertia. The study corroborates the view that structured education is not an optional add-on but an essential component of treatment. This is supported by Hill-Briggs et al. (2021) who emphasize that simplified educational interventions are crucial for overcoming barriers related to health literacy and socioeconomic status.

Furthermore, empirical evidence from Hailu et al. (2019) confirms that structured diabetes self-management education (DSME) significantly improves knowledge, self-care behaviors, and glycemic control compared to routine care alone. By providing a standardized visual tool, this study demonstrates that effective education need not be resource-intensive to produce clinically significant results. This reinforces the concept that patient empowerment is directly linked to metabolic stability, a conclusion further validated by Pamungkas and Chamroonsawasdi, (2020), who demonstrated that culturally adapted self-management interventions in Southeast Asia successfully enhanced patients' self-efficacy and metabolic outcomes. Health education interventions are positively associated with enhanced self-awareness in patients with diabetes mellitus, and this improvement in self-awareness contributes to better blood glucose regulation, as indicated by decreased blood sugar levels (Silitonga et al., 2025).

From a clinical and policy perspective, the positive correlation between poster exposure and blood glucose reduction underscores the practical value of low-cost visual media in primary care settings. In resource-limited facilities such as Public Health Centers (*Puskesmas*), where continuous one-on-one counseling by specialists is not always feasible due to high patient volume, validated posters serve as a scalable "force multiplier" for healthcare providers. They ensure consistent messaging across different practitioners and empower patients to take an active role in preventing the metabolic volatility that leads to long-term complications, confirming that simple, evidence-based visual media should be integral to national diabetes control strategies.

CONCLUSION

Based on the quantitative analysis, this study concludes that poster-based health promotion is a statistically effective intervention for reducing blood glucose levels among patients with Type 2 Diabetes Mellitus at the Bandar Khalifah Public Health Center. The findings demonstrate a significant improvement in glycemic control following the intervention, indicating that visual educational aids successfully bridge the gap between medical information and patient adherence to self-management protocols. This effectiveness was particularly evident within the

study's dominant demographic females aged 45–54 highlighting the relevance of targeted visual communication for this vulnerable group.

Clinically, these results validate the use of posters as a cost-effective, scalable, and practical strategy for primary care providers to improve metabolic outcomes and prevent long-term complications. However, to strengthen the evidence base further, it is recommended that future research expand beyond immediate blood glucose measurements by utilizing HbA1c as a long-term indicator of glycemic stability. Additionally, comparative studies evaluating the efficacy of posters against digital interventions or audio-visual media would provide valuable insights into the most optimal educational methods for diverse patient populations.

LIMITATION

This study acknowledges several limitations that warrant consideration. First, the reliance on a single-group pretest-posttest design without a control group, combined with a small sample size from a single institution, constrains the generalizability of the findings. Second, the short follow-up period captured only acute fluctuations in blood glucose, precluding the assessment of long-term glycemic stability typically measured by HbA1c. Third, potential confounding variables, such as medication adherence, dietary intake, and physical activity intensity, were not rigorously controlled, nor were participants' cognitive engagement or specific behavioral changes explicitly quantified. To address these gaps, future research should employ randomized controlled designs with larger, multi-site cohorts and extended follow-up periods to comprehensively evaluate the sustained effectiveness of poster-based health promotion interventions.

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