

The Effect of Education on Compliance, Clinical Outcomes, and Quality of Life of Prolanis Patients with Type 2 DM

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Abstract

Type 2 Diabetes Mellitus (DM) is a disease that requires long-term management, including glycemic control, adherence to antidiabetic medication, and quality of life improvement. This study aims to determine the effect of providing education on the level of adherence, fasting blood sugar (FBP), and quality of life of Prolanis patients with Type 2 DM at the two Pratama Clinics in Semarang City. A quasi-experimental one-group pretest–posttest design was applied to 70 patients selected through total sampling. Inclusion criteria were age ≥ 18 years, receiving antidiabetic therapy, and willingness to participate. Patients with absenteeism or incomplete data were excluded. The intervention consisted of structured education delivered over three months using brochures and booklets. Adherence and quality of life were measured using the MARS-5 and SF-36 questionnaires, while FBG values were obtained from medical records. Adherence and quality of life were assessed using the MARS-5 and SF-36 questionnaires, respectively, while FBG values were obtained from medical records. Data were analyzed using the Wilcoxon and Spearman tests. The results showed significant improvements in adherence ($p < 0.001$), reductions in FBG ($p < 0.001$), and increased quality of life scores ($p < 0.05$). However, no significant correlation was found among changes in these variables ($p > 0.05$). Structured education effectively improved adherence, glycemic control, and quality of life, although the variables were not directly associated.

Keywords: Type 2 Diabetes Mellitus, Education, Compliance, Fasting Blood Sugar, Quality of Life

1. INTRODUCTION

Diabetes mellitus is a chronic metabolic disease characterized by elevated blood glucose levels, which over time causes serious damage to the heart, blood vessels, eyes, kidneys, and nerves (WHO, 2024). In 2017, Indonesia ranked sixth in the world for diabetes, while in 2021, the number of diabetes cases in Indonesia rose to fifth in the world for diabetes (IDF, 2021). Semarang city health profile data for 2023 shows that the number of people suffering from diabetes mellitus is 41.468 people (DKK, 2023). This increase in cases indicates that efforts to prevent and control diabetes mellitus in Indonesia are not yet optimal.

Diabetes mellitus management is essential to optimize treatment, which can reduce the prevalence of degenerative diseases and complications and improve the quality of life of sufferers (Putra, 2023). One of the main challenges in DM management is low patient adherence

to treatment regimens and a lack of understanding of their own health condition, which directly impacts poor glycemic control and a reduced quality of life, especially in the long term (Nascimento et al., 2025).

Previous research has shown that knowledge is one of the factors influencing medication adherence in diabetes mellitus patients. Higher levels of knowledge lead to higher medication adherence, which reduces the risk of disease severity and complications, and helps control blood sugar levels (Pharamita, 2023). Successful diabetes mellitus treatment requires an understanding of the patient's commitment and management of the disease (Rosli et al., 2021).

A study in Nigeria found that educational interventions are effective in improving quality of life in individuals with type 2 diabetes mellitus. Educational interventions are recommended for inclusion in all diabetes mellitus care plans (Okafor et al., 2023). Structured health education can improve glycemic control and patient quality of life (Ye et al., 2024). Pharmacist education has been shown to influence knowledge, adherence, and clinical outcomes in type 2 diabetes mellitus patients (Syafitri et al., 2023). Most of the existing research was conducted in hospitals or community health centers, which have relatively adequate resources. Research specifically examining the implementation of education for diabetes patients within the context of Prolanis in primary care clinics is still very limited. Primary care clinics differ in terms of the number of healthcare workers, available facilities, and patient access to routine and ongoing education services. These challenges often make education programs in clinics less than optimal. The limited literature discussing the implementation of health education in primary care clinics also indicates a critical research gap that needs to be filled, especially given the increasingly strategic role of primary care clinics in Indonesia. Therefore, the results of this study are expected to provide not only empirical evidence of the effectiveness of educational interventions but also practical recommendations for improving education services at the primary care level, which is closer to the community.

The scientific contribution of this study lies in the integrated evaluation of three key indicators: medication adherence, glycemic control, and quality of life as multidimensional outcomes of educational intervention in Type 2 DM management. By simultaneously assessing these variables, this study provides a more comprehensive understanding of how structured education influences patient-centered outcomes. From a practical perspective, the findings highlight the relevance of implementing structured educational programs in primary care settings, particularly within the Prolanis program, to improve clinical and behavioral outcomes among patients with Type 2 DM. This holistic approach is rare in previous studies, which typically focus on only one aspect. Unlike other studies that often rely on pharmacological

approaches, this study provides insight into the importance of non-pharmacological educational interventions, which are relatively simple but have significant potential to improve patients' quality of life. This study not only assesses the impact of education on adherence but also simultaneously evaluates clinical outcomes (FBG) and patient quality of life quantitatively and measurably. FBG was chosen because it is routine data taken every month, making it suitable for this research, which was only conducted in the short term, namely, three months. Using a quasi-experimental one-group pretest-posttest design, this study provides a comprehensive picture of the changes that occurred before and after the educational intervention. The one-group pretest-posttest design was selected due to ethical and practical considerations. As the intervention involved structured health education within the Prolanis program, withholding education from a control group was not ethically feasible. In addition, the study was conducted in a real-world primary care setting where all registered patients routinely receive educational services. Therefore, random allocation or establishment of a control group was not operationally possible. The primary objective of this study was to evaluate changes before and after the intervention rather than to compare different treatment approaches. This design was considered appropriate to assess the effectiveness of the educational program in a routine clinical context.

This study was conducted on Chronic Disease Management Program (PROLANIS) patients with type 2 diabetes mellitus (DM) at two primary clinics. Previous studies on diabetes education have generally focused on single outcomes, such as medication adherence or glycemic control, without simultaneously evaluating clinical, behavioral, and quality-of-life dimensions. Furthermore, available evidence on the effectiveness of structured educational interventions implemented within the Prolanis program in primary healthcare settings, which serve as the spearhead of public health services, particularly at the local level in Semarang City, remains limited. Therefore, a comprehensive evaluation of the impact of education on various patient-centered outcomes in real-world primary healthcare settings is needed. This study addresses this gap by examining the effectiveness of structured education on adherence, fasting blood glucose (FBG), and quality of life among Prolanis patients with type 2 diabetes in primary healthcare settings in Semarang City.

2. METHOD

Research Design

This study employed a quasi-experimental design using a one-group pretest–posttest approach to evaluate the impact of a structured educational intervention on medication

adherence, fasting blood glucose (FBG), and quality of life among patients with Type 2 Diabetes Mellitus.

Scope and Research Object

The study focused on assessing the effectiveness of structured diabetes education implemented within the Chronic Disease Management Program (PROLANIS). The primary outcomes included behavioral (medication adherence), clinical (FBG levels), and patient-reported (quality of life) measures.

Research Setting and Participants

The research was conducted at two primary healthcare clinics delivering the PROLANIS program in Semarang City, Indonesia. Participants were adult patients diagnosed with Type 2 DM who met predefined inclusion criteria and were recruited using a total sampling technique.

Educational Intervention and Instruments

The intervention consisted of structured, group-based diabetes education delivered over a three-month period using validated brochures and booklets in accordance with the 2021 PERKENI national guidelines and the 2020 PNPK guidelines for the Management of Type 2 Diabetes Mellitus in Adults. Medication adherence was measured using the Medication Adherence Report Scale-5 (MARS-5), a five-item Likert-type questionnaire assessing non-adherence behaviors. Quality of life was evaluated using the Short Form-36 (SF-36), comprising 36 items across eight domains summarized into the Physical Component Summary (PCS) and Mental Component Summary (MCS). FBG levels were used as a clinical parameter and were obtained from laboratory records as part of routine clinical assessments.

Data Collection Procedures

Data were collected at baseline (pre-intervention) and after completion of the three-month educational program (post-intervention). Self-reported questionnaires were administered directly to participants, while FBG data were extracted from medical records.

Operational Definitions

The independent variable was structured diabetes education delivered through scheduled group sessions supported by printed educational materials. The dependent variables were defined as follows:

1. Medication adherence: total MARS-5 score, with higher scores indicating better adherence.
2. Clinical outcome (FBG): fasting blood glucose value (mg/dL) recorded from laboratory examinations.
3. Quality of life: total and component scores of the SF-36, including PCS and MCS.

Statistical Analysis

Pre and post intervention differences were analyzed using the Wilcoxon signed-rank test. Associations among adherence, FBG levels, and quality of life were examined using Spearman's rank correlation test. Statistical significance was set at $p < 0.05$.

3. RESULTS AND DISCUSSION

In the main study, a sample of 70 respondents participated until the end of the study. All respondents completed an informed consent form indicating their willingness to participate. Furthermore, respondents received monthly education for three consecutive months during routine Prolanis activities. The characteristics of the respondents participating in the activities are presented in Table 1.

Table 1. Characteristics of Respondents Who Received Educational Intervention

Characteristics	Categorical	Amount*	Percentage (%)
Gender	Man	22	31.43
	Woman	48	68.57
Age	40-49	8	11.43
	50-59	23	32.86
	60-69	27	38.57
	>70	12	17.14
Education	No school	2	2.86
	Elementary School	16	22.86
	Junior High School	15	21.43
	Senior High School	29	41.43
	Bachelor	8	11.43
Employment Status	Work	8	11.43
	Doesn't work	62	88.57
Duration of Disease	1-5 Years	13	18.57
	> 5 Years	57	81.43
Antidiabetic Drugs	OHO	65	92.86
	Insulin	5	7.14

*= 70

Table 1 shows that the majority of respondents were women (68.57%), dominated by those aged 60–69 years (38.57%), which is considered elderly. This finding reflects the general characteristics of type 2 diabetes mellitus patients, where increasing age is associated with decreased insulin sensitivity, metabolic changes, and decreased pancreatic β -cell function, thus increasing the risk of chronic hyperglycemia (Rif'at et al., 2023; IDF, 2023). Furthermore, hormonal factors, including postmenopausal changes, contribute to an increased risk of metabolic disorders in women (Kautzky-Willer et al., 2023). This advanced age also has the potential to affect cognitive abilities and understanding of health information, which can ultimately impact glucose conservation and control.

Respondents' education levels varied, but the majority had a high school education (41.43%). Formal education is an important determinant of health literacy and an individual's ability to understand therapy instructions and manage chronic diseases (Nugent et al., 2023). Limited health literacy can influence perceptions of the importance of medication adherence, increasing the risk of complications and reducing patients' quality of life. Therefore, the use of simple and easy-to-understand educational media is a relevant strategy for this population.

The majority of respondents were unemployed (88.57%), which may reflect limited productivity due to health conditions or socioeconomic factors. Employment status is often associated with access to health resources, economic stability, and overall quality of life. Furthermore, most patients had diabetes for more than five years (81.43%), with therapy patterns dominated by the use of oral hypoglycemic medications (92.86%). Long disease duration has the potential to lead to treatment fatigue or therapy burnout, which various studies have linked to decreased long-term adherence and impaired glycemic control (Polonsky & Henry, 2016).

Overall, the characteristics of the respondents in this study provide important context for understanding the dynamics of adherence, glycemic control, and quality of life in patients with type 2 diabetes and emphasize the need for educational interventions tailored to patients' demographic and social circumstances. The level of medication adherence of respondents in the study was measured using the MARS-5 (Medication Adherence Report Scale - 5 items) questionnaire before and after receiving educational interventions regarding diabetes mellitus. questionnaire before and after receiving educational interventions about diabetes mellitus.

Table 2. Distribution of Medication Compliance Before and After Educational Intervention

Compliance	Before		After	
	N*	%	N*	%
Low (0-5)	0	0	0	0
Medium (6-24)	61	87,14	19	27,14
Height (25)	9	12,86	51	72,86

*Number of respondents = 70

The distribution presented in Table 2 demonstrates a substantial shift in medication adherence levels following the educational intervention. Prior to the intervention, the majority of participants were categorized as having moderate adherence (87.14%), with only 12.86% classified as highly adherent. After three months of structured education, the proportion of patients in the high adherence category increased markedly to 72.86%, while the moderate adherence group decreased to 27.14%. Notably, no participants were classified as having low adherence in either assessment period. This shift indicates not merely a numerical increase but a meaningful behavioral transition from moderate to high adherence levels. Such improvement suggests that the structured educational program effectively strengthened patients' understanding of medication use and reinforced consistent treatment behavior.

Normality testing using the Kolmogorov–Smirnov test revealed that adherence data were not normally distributed ($p < 0.05$), necessitating the use of a non-parametric approach. The type of data collected is paired data, so the non-parametric paired difference test, the Wilcoxon signed ranks test, was chosen to see statistical differences. The data from the Wilcoxon adherence test analysis are shown in Table 3.

Table 3. The Influence of Education on Compliance Levels

Medication Compliance (N=70)	Median	<i>p-value</i>
	Min - Max	
Before	23 (15-25)	0,000
After	25 (22-25)	

*Number of respondents = 70

The analysis presented in Table 3 indicates a meaningful improvement in medication adherence following the educational intervention. The median adherence score increased from 23 (range 15–25) before education to 25 (range 22–25) after the intervention. The increase in median value, accompanied by a narrower post-intervention range, suggests not only an overall improvement but also a more consistent adherence pattern among participants. In other words, fewer patients remained in the lower adherence spectrum after receiving structured education. This improvement may be explained by enhanced patient understanding of medication benefits,

better awareness of long-term complications, and strengthened motivation to follow therapeutic recommendations. Structured education provides not only information but also reinforcement and clarification of misconceptions, which are common barriers to adherence in chronic disease management.

Statistical testing using the Wilcoxon signed-rank test confirmed that the observed difference was significant ($p < 0.001$), indicating that the change in adherence scores was unlikely due to random variation. These findings suggest that the educational intervention contributed to measurable behavioral changes in medication-taking practices. Previous studies have similarly reported that continuous and pharmacist-led education can improve medication adherence by promoting patient engagement and self-management behaviors (Naafi et al., 2016; Atolagbe et al., 2023). However, the present findings highlight the importance of structured and repeated education within primary care settings, particularly for patients enrolled in chronic disease management programs.

FBG measurements were conducted by staff at the clinic where the study was conducted, during the routine monthly implementation of the Prolanis program. The FBP data collected by the researchers were pre-intervention data in the first month and post-intervention data in the fourth month. The distribution of respondents' FBP measurement results is presented in Table 4.

Table 4. Distribution of FBP Measurement Results

FBP	Before		After	
	n*	%	n*	%
Uncontrollable	41	58.57	29	44.29
Controlled	29	41.43	39	55.71

*Number of respondents = 70

Fasting blood glucose (FBG) data were obtained from patients' medical records as part of routine laboratory examinations conducted within the PROLANIS program. Baseline FBG values were collected prior to the educational intervention, while follow-up values were retrieved three months after completion of the structured education. No additional laboratory procedures were performed specifically for research purposes. In this study, glycemic outcomes were categorized as "controlled" or "uncontrolled" based on the therapeutic targets recommended by the Indonesian Guidelines for the Management and Prevention of Type 2 Diabetes Mellitus (PERKENI, 2021). FBG levels between 80–130 mg/dL were classified as controlled, whereas levels above 130 mg/dL were considered uncontrolled.

As shown in Table 4, before the intervention, 29 participants (41.43%) achieved controlled FBG levels, while 41 participants (58.57%) were categorized as uncontrolled. After three months of education, the proportion of controlled cases increased to 39 participants (55.71%), and the proportion of uncontrolled cases decreased to 31 participants (44.29%). This shift indicates a positive trend in glycemic control following the educational intervention. Furthermore, a Wilcoxon test was performed on the respondents' FBP levels before and after the intervention, and the results are presented in Table 5.

Table 5. The Influence of Education on FBP Levels

	Median		<i>p-value</i>
	Minimum	Maximum	
FBS Before Education (N=70)	139.50	(73-391) mg/dL	0,000
FBS After Education (N=70)	129	(63-350) mg/dL	

*N= Number of respondents

The reduction in fasting blood glucose (FBG) levels observed after the educational intervention suggests a meaningful improvement in glycemic control among participants. The shift in median values reflects a general downward trend in glucose levels across the study population, indicating that more patients moved toward achieving recommended therapeutic targets. This improvement may be attributed to enhanced self-management behaviors following structured education, including better medication adherence, dietary awareness, and lifestyle regulation. Education plays a critical role in increasing patients' understanding of the relationship between daily habits and blood glucose fluctuations. By reinforcing knowledge regarding therapeutic goals and potential complications, patients may become more consistent in implementing recommended treatment strategies. Such behavioral adjustments can contribute to improved metabolic stability over time.

The statistically significant result obtained from the Wilcoxon analysis ($p < 0.05$) supports that the observed reduction was unlikely due to random variation. Similar findings have been reported in previous studies demonstrating that structured diabetes education can improve glycemic outcomes through strengthened patient engagement and self-care practices (Chawla et al., 2019). However, it should be acknowledged that glycemic control is influenced by multiple factors, including disease duration, pharmacotherapy adjustments, and individual metabolic responses. Therefore, while education appears to have contributed positively, it likely functions as part of a broader multifactorial management process.

The respondents' quality of life in the study was measured using the Short Form-36 (SF-36) questionnaire before and after receiving the educational intervention on diabetes mellitus.

In this study, the classification criteria used were a score <50 categorized as poor quality of life and a score ≥ 50 categorized as good quality of life (Modersitzki et al., 2014). The distribution of respondents' quality of life before and after is presented in Table 6.

Table 6. Distribution of Respondents' Quality of Life Before and After Educational

Quality of Life	Intervention			
	Before		After	
	N*	%	N*	%
Good	66	94.29	100	100
Bad	4	5.71	0	0

*Number of respondents = 70

Quality of life in this study was measured using the SF-36 questionnaire and interpreted according to standard scoring procedures, in which domain scores are transformed into a 0–100 scale, with higher scores indicating better perceived health status (RAND Health Care, 2016; Laucis et al., 2015). In this study, respondents with overall scores above the predefined threshold (≥ 50) were categorized as having a good quality of life, while those scoring below this value were classified as poor. This categorization was applied consistently at baseline and post-intervention. As shown in Table 6, prior to the educational intervention, 66 respondents (94.29%) were classified as having a good quality of life, while 4 respondents (5.71%) fell into the poor category. Following three months of structured education, all participants (100%) met the criteria for good quality of life. Although the baseline proportion of good quality of life was already high, the elimination of the poor category after the intervention suggests an overall improvement in perceived physical and mental well-being.

The observed improvement may be explained by enhanced disease-related knowledge and self-management capacity following structured education. Previous studies have shown that patient education improves coping ability, treatment confidence, and perceived health status, which are central components of quality of life in chronic disease populations (Carrera et al., 2024; Chawla et al., 2019). Education not only increases clinical awareness but also reduces anxiety related to disease complications and strengthens patients' sense of control over their condition and factors consistently associated with better patient-reported outcomes (WHO, 2024).

Nevertheless, it is important to recognize that quality of life is a multidimensional construct influenced by physical, psychological, and social determinants. Therefore, while the educational intervention appears to have contributed positively, improvements in quality of life likely reflect the interaction between behavioral changes, clinical stabilization, and

psychosocial adaptation. Table 7 shows the results of the Wilcoxon statistical analysis of the data measuring respondents' quality of life before and after the intervention.

Table 7.The Influence of Education on Quality of Life

Domain	Median (Min-Max)		<i>p-value</i>
	Before	After	
Physical Components (PCS)			
Physical Function	70.00 (0-100)	85.00 (0-100)	0,000
Physical Role	50.00 (0-100)	75.00 (0-100)	0.003
Pain	72.50 (22.5-100)	80.00 (45-100)	0,000
General Health	62.50 (25-100)	70.83 (29.17-100)	0,000
Total	66.34 (36.04-96.88)	74.37 (47.92-95.63)	0,000
Mental Components (MCS)			
Vitality	70.00 (40-100)	80.00 (45-100)	0,000
Social Function	75.00 (25-100)	87.50 (50-100)	0.030
The Role of Emotions	66.67 (0-100)	100.00 (33.33-100)	0,000
Mental Health	78.00 (36-100)	88.00 (44-100)	0,000
Total	72.22(50.46-99)	81.93(64.08-100)	0,000

The results of the study, as shown in Table 7, indicate that providing education had a significant positive impact on all domains of quality of life in patients with type 2 diabetes mellitus. There was an increase in scores across all physical (PCS) and mental (MCS) components after the educational intervention, with a *p*-value of 0.000 ($p < 0.05$). This consistent increase indicates that the educational intervention improved patients' perceptions of their physical abilities, reduced physical limitations, and increased understanding of their general health condition. Various studies conducted to date have demonstrated positive results from health education in slowing disease progression and preventing complications (Chawla et al., 2019). Thus, education has proven effective in improving patients' quality of life, both physically and mentally, and can therefore be considered an important non-pharmacological strategy in the management of type 2 diabetes mellitus.

Next, statistical tests were conducted to determine the relationship between adherence levels, clinical outcomes, and respondents' quality of life after the educational intervention. The Spearman correlation test was chosen because the data were not normally distributed. The results of the test on the relationship between adherence, clinical outcomes, and quality of life are presented in Table 8.

Table 8. The Relationship between Compliance Level and Clinical Outcomes (FBP) and Quality of Life After Educational Intervention

Variables	r	p-value	Information
Compliance – GDP	–0,068	0,575	Not significant
Compliance – General quality of life	0,190	0,115	Not significant
Compliance – Physical component	0,153	0,207	Not significant
Compliance – Mental component	0,233	0,053	Not significant
GDP – General quality of life	0,076	0,533	Not significant
GDP – Physical component	–0,115	0,341	Not significant
GDP – Mental component	0,170	0,158	Strongly significant
General quality of life – Physical component	0,816	<0,001	Strongly significant
General quality of life – Mental component	0,773	<0,001	Not significant

The Spearman's rho correlation test results in Table 8 using post-intervention data indicate that patient adherence levels were not significantly associated with clinical outcomes in the form of fasting blood sugar levels or with patient quality of life, either in general or based on physical and mental components, as indicated by a significance value above the statistical significance limit ($p > 0.05$). This finding indicates that after the educational intervention, increased medication adherence was not directly related to changes in clinical conditions or to patient perceptions of their quality of life. Research in Malaysia showed no significant association between medication adherence and quality of life ($p = 0.833$) (Azmi et al., 2021). Research conducted by Nascimento et al. also showed that adherence values were not significantly associated with blood glucose control ($p = 0.330$) (Nascimento et al., 2025).

4. CONCLUSION

Based on the research results, structured education provided for three months to Prolanis patients with type 2 diabetes mellitus at the Pratama Clinic in Semarang City has been proven to have a significant effect on increasing medication adherence, reducing fasting blood sugar levels, and improving patients' quality of life, both physically and mentally ($p > 0,05$). Education not only functions as a transfer of information, but also strengthens patients' awareness, motivation, and active involvement in self-care, thereby resulting in behavioral changes that impact clinical conditions and quality of life. However, the research findings showed that there was no statistically significant relationship between adherence, fasting blood sugar levels, and quality of life after the intervention ($p > 0,05$). This confirms that diabetes mellitus management is complex and multidimensional, where clinical outcomes and quality of life are not only determined by adherence, but are also influenced by various other factors, such as clinical conditions, complications, social support, and the patient's psychological status.

Further research should focus on exploring intermediary factors that may bridge the influence of education on clinical outcomes, such as family support, economic status, self-efficacy, and comorbidities. Research in larger locations with diverse populations and longer-term educational interventions is also needed to provide a more representative and comprehensive picture. Furthermore, future research should involve support staff in the data collection process, particularly during questionnaire completion, to ensure data quality, particularly for the Prolanis population, which requires intensive support.

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