Relationship between knowledge and adherence of type 2 diabetes mellitus patients in treatment: A cross-sectional study

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Abstract

Background: Type 2 diabetes mellitus is a chronic metabolic disorder that requires long-term pharmacological treatment and sustained adherence to therapy to achieve optimal glycemic control and prevent complications. However, many patients experience difficulties maintaining consistent treatment adherence, which may worsen disease outcomes. Patient knowledge regarding diabetes management is considered an important factor influencing adherence behavior. Understanding the relationship between knowledge and treatment adherence is therefore essential for improving diabetes management strategies in primary healthcare settings.

Objective: This study aimed to analyze the relationship between knowledge and treatment adherence among patients with type 2 diabetes mellitus in a primary healthcare setting.

Methods: This study employed a quantitative descriptive design with a cross-sectional approach. The research was conducted in October 2022 in the working area of UPTD Puskesmas Tanjung Baru. The study population consisted of patients diagnosed with type 2 diabetes mellitus, and a total of 30 respondents were included using a total sampling technique. The independent variable was patient knowledge regarding diabetes mellitus, while the dependent variable was treatment adherence. Data were collected using structured questionnaires and adherence checklists. Descriptive statistics were used to summarize respondent characteristics, and bivariate analysis was performed using the Chi-square test with a significance level of $\alpha = 0.05$. Statistical analysis was conducted using SPSS software.

Results: The results showed that most respondents had a moderate level of knowledge (43.3%), followed by good knowledge (33.3%) and poor knowledge (23.3%). Regarding treatment adherence, the majority of respondents demonstrated moderate adherence (53.3%), while 26.7% were categorized as adherent and 20.0% were non-adherent. The Chi-square test indicated a statistically significant relationship between knowledge and treatment adherence among patients with type 2 diabetes mellitus ($p = 0.011$). Respondents with higher knowledge levels tended to demonstrate better adherence to diabetes treatment.

Conclusion: Knowledge level is significantly associated with treatment adherence among patients with type 2 diabetes mellitus. Improving patient knowledge through targeted education and counseling programs may enhance treatment adherence and support better diabetes management outcomes in primary healthcare settings.

Keyword: Diabetes Mellitus, Type 2; Medication Adherence; Patient Compliance; Patient Education; Primary Health Care

Research Highlights

What is the current knowledge?
- Medication adherence in patients with type 2 diabetes mellitus is influenced by multiple factors, including patient knowledge, health literacy, and self-management capacity.

What is new here?
- Higher levels of diabetes-related knowledge are significantly associated with better treatment adherence among patients with type 2 diabetes mellitus in a primary healthcare setting.

Background

Type 2 diabetes mellitus represents a chronic metabolic disorder that causes disturbances in glucose metabolism due to insulin resistance and pancreatic beta-cell dysfunction in the human body (Sun et al., 2022). This disease increases the risk of various chronic complications such as cardiovascular disease, neuropathy, nephropathy,

and retinopathy among patients with type 2 diabetes mellitus worldwide (Mauricio et al., 2023). Cellular metabolic alterations also trigger tissue damage through chronic inflammatory mechanisms and oxidative stress in individuals with diabetes mellitus (Sherkhane et al., 2021). These complications increase morbidity and mortality burdens among populations living with diabetes globally (Jin & Ma, 2021). Many countries experience a rapid rise in diabetes prevalence due to population aging, unhealthy lifestyles, and increasing metabolic risk factors in the community (Luo et al., 2020). The global diabetes epidemic therefore requires comprehensive management strategies to reduce complications and improve patient outcomes (Sun et al., 2022).

Effective management of type 2 diabetes mellitus requires long-term pharmacological therapy and consistent adherence to prescribed treatment regimens among patients with diabetes (Rodriguez-Gutierrez et al., 2019). Medication adherence plays a crucial role in maintaining optimal glycemic control and preventing both microvascular and macrovascular complications in patients with diabetes mellitus (Yaguchi et al., 2022). Patients who maintain adequate adherence to antidiabetic medications demonstrate better metabolic outcomes and reduced disease progression over time (Chepulis et al., 2020). However, many individuals with diabetes fail to adhere to prescribed treatment due to complex therapeutic regimens, lifestyle challenges, and limited understanding of disease management (Unni et al., 2022). Poor medication adherence consequently contributes to uncontrolled blood glucose levels and increases the risk of hospitalization and disease complications (Balkhi et al., 2019). Healthcare systems therefore emphasize improving adherence behavior as an essential component of diabetes care (Alsaidann et al., 2023).

Patient knowledge about diabetes and its treatment plays an important role in influencing medication adherence and self-management behaviors among individuals with chronic illness (Mikhael et al., 2019). Adequate knowledge enables patients to understand the importance of medication therapy, lifestyle modification, and regular monitoring of blood glucose levels in daily life (Muhammad Haskani et al., 2022). Patients who possess better knowledge about diabetes management tend to demonstrate stronger motivation to follow therapeutic recommendations and adhere to prescribed medications (AlShayban et al., 2020). Conversely, limited health literacy and poor understanding of treatment benefits often lead to inadequate adherence behaviors among individuals with type 2 diabetes mellitus (Ajuwon & Insel, 2022). Studies in different countries indicate that insufficient patient knowledge remains one of the major determinants of non-adherence in chronic disease management (Xu et al., 2020). Improving patient knowledge therefore becomes an important strategy to enhance adherence and optimize clinical outcomes in diabetes care (Afaya et al., 2020).

Medication adherence among patients with type 2 diabetes mellitus is also influenced by multiple socioeconomic, behavioral, and psychological factors that shape patient health behaviors (Baghikar et al., 2019). Economic limitations, cultural beliefs, and health system barriers often reduce patients' ability to maintain consistent medication adherence in long-term therapy (Shahin et al., 2019). Several studies report that inadequate access to healthcare resources and medication availability may further worsen adherence among patients with chronic diseases (Al Saffer et al., 2021). Psychological factors such as illness perception and self-efficacy also influence how patients interpret their disease and respond to treatment recommendations (Bilondi et al., 2021). Patients who perceive diabetes as a manageable condition tend to demonstrate better adherence to treatment regimens (Wu et al., 2023). These findings highlight the importance of understanding behavioral and knowledge-related determinants that affect adherence in patients with diabetes mellitus (Mannan et al., 2021).

Previous studies conducted in various countries demonstrate that medication non-adherence among patients with type 2 diabetes remains a significant public health problem (Mitiku et al.,

2022). Research conducted in several healthcare settings shows that a considerable proportion of patients fail to follow prescribed treatment plans despite the availability of effective medications (Murwanashyaka et al., 2022). Similar findings indicate that barriers such as limited knowledge, complex medication regimens, and inadequate patient education contribute to poor adherence in diabetes management (Rezaei et al., 2019). Evidence also shows that insufficient adherence increases the risk of disease progression and worsens metabolic outcomes in patients with diabetes mellitus (Sahoo et al., 2022). Understanding the relationship between patient knowledge and treatment adherence is therefore essential for improving diabetes care programs (Zairina et al., 2022). Healthcare professionals must identify behavioral factors that influence adherence to develop effective educational interventions for diabetes management (Panduwiguna et al., 2022).

Despite increasing research on diabetes management, limited studies specifically examine the relationship between patient knowledge and adherence to treatment in individuals with type 2 diabetes mellitus in various healthcare contexts (Muhammad Haskani et al., 2022). Identifying this relationship is important because patient knowledge may influence how individuals interpret treatment instructions and implement medication therapy in daily life (Araya et al., 2020). Evidence indicates that improved patient knowledge may strengthen self-management capacity and promote better treatment adherence among individuals with chronic diseases (Krzemińska et al., 2021). Health literacy also supports patients in understanding medication instructions, monitoring disease progression, and preventing complications associated with diabetes mellitus (Liu et al., 2020). Investigating this relationship can provide valuable evidence for developing targeted educational interventions and improving patient outcomes (Ayele et al., 2022). Therefore, this study aims to analyze the relationship between knowledge and treatment adherence among patients with type 2 diabetes mellitus using a cross-sectional approach.

Methods

Study Design

This study employed a quantitative descriptive research design with a cross-sectional approach to examine the relationship between knowledge and treatment adherence among patients with type 2 diabetes mellitus. A cross-sectional design was selected because it allows researchers to measure exposure variables and outcome variables simultaneously within a defined population at a single point in time, enabling the identification of associations between variables efficiently and within a limited timeframe. This approach is widely used in epidemiological and public health research to explore relationships between behavioral factors and health outcomes in clinical populations. The research was conducted in October 2022 in the working area of UPTD Puskesmas Tanjung Baru, which serves as a primary healthcare facility providing chronic disease management services, including diabetes mellitus care. The selection of this setting was justified because primary healthcare centers play a central role in monitoring long-term disease management and treatment adherence among patients with chronic conditions such as type 2 diabetes mellitus. The reporting of this study followed the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guideline from the EQUATOR Network, which provides standardized recommendations for the transparent and comprehensive reporting of observational studies, including cross-sectional research designs.

Sampling

The study population consisted of patients diagnosed with type 2 diabetes mellitus who were registered and receiving treatment at the UPTD Puskesmas Tanjung Baru during the year 2022. Eligibility criteria included patients who had been clinically diagnosed with type 2 diabetes mellitus by healthcare professionals, were receiving routine treatment or follow-up care at the health center, were able to communicate effectively, and were willing to participate in the study. Patients who experienced severe complications or were unable to complete the questionnaire independently were

excluded to ensure the reliability of responses. The sample size for this study consisted of 30 respondents with type 2 diabetes mellitus, representing the accessible population of diabetes patients attending the health center during the study period. The study applied a total sampling technique, in which all eligible patients meeting the inclusion criteria were included in the study sample. This approach was selected to maximize representativeness and minimize sampling bias, particularly because the number of patients available during the study period was relatively limited. Total sampling is commonly recommended in small population studies within primary healthcare settings because it allows the researcher to capture the entire target population and improve the external validity of the findings within the study context.

Instruments

Data in this study were collected using structured research instruments consisting of a knowledge questionnaire and a treatment adherence checklist designed to measure the main study variables. The independent variable in this study was patient knowledge regarding type 2 diabetes mellitus, while the dependent variable was treatment adherence among patients with type 2 diabetes mellitus. The knowledge questionnaire contained several items assessing patients' understanding of diabetes mellitus, including knowledge of disease causes, treatment objectives, medication use, potential complications, and lifestyle management. Responses were categorized and scored to classify participants into knowledge levels such as good knowledge and poor knowledge based on predetermined scoring criteria. The adherence checklist was used to evaluate patient behavior in following prescribed treatment regimens, including medication consumption, compliance with treatment schedules, and adherence to recommended diabetes management practices. The instruments were structured in a closed-ended format to ensure consistency in responses and facilitate quantitative analysis. Prior to data collection, the instruments were reviewed to ensure clarity, relevance, and appropriateness for use among patients in a primary healthcare setting.

Data Collection

Data collection was conducted during October 2022 at the UPTD Puskesmas Tanjung Baru. Researchers coordinated with healthcare staff to identify patients who met the inclusion criteria and invited them to participate in the study. Eligible participants were provided with a brief explanation regarding the objectives of the study, the procedures involved, and their rights as research participants before completing the questionnaire. After obtaining informed consent, respondents were asked to complete the structured questionnaire under the supervision of the researcher to ensure accuracy and completeness of responses. For participants who required assistance due to reading difficulties or health limitations, the researcher provided guidance while maintaining neutrality and avoiding influence on participant responses. The questionnaires were completed in a designated area within the healthcare facility to ensure privacy and minimize potential distractions during the data collection process. All completed questionnaires were reviewed immediately after submission to ensure that no items were left unanswered or incorrectly recorded.

Data Analysis

The collected data were entered into a statistical database and analyzed using Statistical Package for the Social Sciences (SPSS) software. Descriptive statistical analysis was first conducted to summarize the characteristics of the respondents, including demographic characteristics, levels of knowledge, and levels of treatment adherence among patients with type 2 diabetes mellitus. Descriptive results were presented in the form of frequency distributions and percentages to provide a clear overview of the study variables. Subsequently, bivariate analysis was conducted to examine the relationship between knowledge and treatment adherence among patients with type 2 diabetes mellitus. The Chi-square (χ^2) statistical test was used to determine whether a statistically significant association existed between the independent variable (knowledge) and the dependent variable (treatment adherence). The level of statistical significance was set at $\alpha = 0.05$,

meaning that a p-value less than 0.05 indicated a statistically significant relationship between the variables. The results of the analysis were presented in tabular form to facilitate interpretation and comparison of findings.

Ethical Consideration

This study was conducted in accordance with ethical principles for research involving human participants. Prior to data collection, participants were provided with clear information regarding the purpose of the study, the procedures involved, the voluntary nature of participation, and the confidentiality of the information collected. Each participant provided informed consent before participating in the study. Participants were informed that they had the right to refuse participation or withdraw from the study at any stage without any negative consequences for their healthcare services. To maintain confidentiality, all collected data were anonymized and used exclusively for research purposes. Personal identifiers were not included in the data analysis or reporting of results to protect participant privacy. The study procedures were designed to ensure respect for participant dignity, confidentiality, and autonomy throughout the research process.

Results

This section presents the distribution of respondent characteristics based on knowledge level and treatment adherence among patients with type 2 diabetes mellitus in the working area of UPTD Puskesmas Tanjung Baru. Descriptive analysis was conducted to summarize the distribution of the main study variables before performing inferential analysis. The results of the descriptive analysis are presented in Table 1, which shows the frequency and percentage distribution of respondents according to their knowledge level and adherence to diabetes treatment.

Table 1. Distribution of Respondent Characteristics Based on Knowledge Level and Treatment Adherence

Variables	Frequency (n)	Percentage (%)
Knowledge		
Good	10	33.3
Moderate	13	43.3
Poor	7	23.3
Treatment Adherence		
Adherent	8	26.7
Moderately Adherent	16	53.3
Non-Adharent	6	20

As shown in Table 1, the distribution of knowledge among respondents indicates that most participants had a moderate level of knowledge, accounting for 13 respondents (43.3%). Table 1 also shows that 10 respondents (33.3%) had good knowledge regarding type 2 diabetes mellitus and its treatment. Meanwhile, Table 1 indicates that 7 respondents (23.3%) had poor knowledge about diabetes management.

Regarding treatment adherence, Table 1 demonstrates that the largest proportion of respondents exhibited moderate adherence, with 16 respondents (53.3%). Table 1 further shows that 8 respondents (26.7%) were classified as adherent to treatment recommendations. In contrast, Table 1 indicates that 6 respondents (20.0%) were categorized as non-adherent to diabetes treatment. Overall, Table 1 provides an overview of the variability in knowledge levels and adherence behaviors among patients with type 2 diabetes mellitus in the study setting.

Table 2. Association Between Knowledge Level and Treatment Adherence Among Patients with Type 2 Diabetes Mellitus

Knowledge Level	Adherent (n,%)	Moderately adherent (n,%)	Non-adherent (n,%)	p-value
Good	5 (62.5)	5 (31.3)	0 (0)	0.011
Moderate	3 (37.5)	8 (50)	2 (33.3)	
Poor	0 (0)	3 (18.8)	4 (66.7)	

As presented in Table 2, respondents with good knowledge demonstrated the highest proportion of treatment adherence, with 5 respondents (62.5%) classified as adherent. Table 2 also shows that 5 respondents (31.3%) with good knowledge were moderately adherent to treatment. Additionally, Table 2 indicates that none of the respondents with good knowledge were categorized as non-adherent.

Among respondents with moderate knowledge, Table 2 shows that 3 respondents (37.5%) were adherent to treatment. Table 2 further indicates that 8 respondents (50.0%) with moderate knowledge demonstrated moderate adherence to treatment recommendations. Meanwhile, Table 2 shows that 2 respondents (33.3%) with moderate knowledge were classified as non-adherent.

In the group of respondents with poor knowledge, Table 2 demonstrates that none of the respondents were adherent to treatment. Table 2 also indicates that 3 respondents (18.8%) with poor knowledge had moderate adherence. Furthermore, Table 2 shows that 4 respondents (66.7%) with poor knowledge were categorized as non-adherent to treatment.

The Chi-square statistical analysis presented in Table 2 shows a p-value of 0.011, which is lower than the significance level of $\alpha = 0.05$. Based on the results displayed in Table 2, this finding indicates that there is a statistically significant relationship between knowledge level and treatment adherence among patients with type 2 diabetes mellitus in the working area of UPTD Puskesmas Tanjung Baru in 2022. These results suggest that patients with higher levels of knowledge tend to demonstrate better adherence to diabetes treatment compared with those who have lower levels of knowledge.

Discussion

This study identified several important findings regarding knowledge level and treatment adherence among patients with type 2 diabetes mellitus. The results showed that most respondents had a moderate level of knowledge about diabetes management. The study also found that the majority of respondents demonstrated moderate adherence to their diabetes treatment. The findings further indicated that patients with good knowledge tended to show better adherence behavior compared with patients who had lower knowledge levels. Statistical analysis demonstrated a significant relationship between knowledge and treatment adherence among patients with type 2 diabetes mellitus. These results suggest that improving patient knowledge may play an important role in strengthening treatment adherence in diabetes management.

Type 2 diabetes mellitus represents a chronic metabolic disease that requires long-term treatment adherence to achieve optimal glycemic control and prevent complications (Sun et al., 2022). Chronic hyperglycemia causes metabolic disturbances that increase the risk of microvascular and macrovascular complications among individuals with diabetes mellitus (Mauricio et al., 2023). Persistent metabolic dysregulation also contributes to oxidative stress and inflammatory responses that damage multiple organs in patients with diabetes (Sherkhane et al., 2021). These biological mechanisms increase morbidity and mortality rates among populations affected by diabetes worldwide (Jin & Ma, 2021). Global epidemiological trends indicate that the prevalence of diabetes continues to rise due to demographic transitions and lifestyle changes (Luo et al., 2020). Effective long-term disease management therefore becomes essential to

reduce the burden of diabetes complications in healthcare systems (Sun et al., 2022).

Effective management of type 2 diabetes mellitus requires consistent adherence to pharmacological therapy and lifestyle modification among patients with diabetes (Rodriguez-Gutierrez et al., 2019). Medication adherence helps maintain optimal blood glucose control and reduces the risk of long-term diabetes complications (Yaguchi et al., 2022). Patients who consistently follow prescribed medication regimens demonstrate better glycemic outcomes and improved disease prognosis (Chepulis et al., 2020). However, many individuals with diabetes experience difficulties maintaining long-term adherence due to complex treatment regimens and behavioral challenges (Unni et al., 2022). Poor medication adherence often leads to uncontrolled diabetes and increases the risk of hospitalization and disease progression (Balkhi et al., 2019). Healthcare systems therefore emphasize improving adherence behavior as a critical component of diabetes management (Alsaidann et al., 2023).

Patient knowledge represents one of the most important determinants influencing adherence to treatment among individuals with chronic diseases (Mikhael et al., 2019). Adequate knowledge enables patients to understand disease mechanisms, treatment objectives, and the importance of long-term medication use (Muhammad Haskani et al., 2022). Patients who possess higher levels of knowledge tend to demonstrate stronger motivation to follow therapeutic recommendations and maintain adherence to prescribed treatment (AlShayban et al., 2020). Limited health literacy often reduces patients' ability to understand medical instructions and manage their disease effectively (Ajuwon & Insel, 2022). Several studies indicate that inadequate patient knowledge remains a major contributor to medication non-adherence in chronic disease management (Xu et al., 2020). Educational interventions therefore play a critical role in improving treatment adherence among patients with diabetes mellitus (Afaya et al., 2020).

Various socioeconomic and behavioral factors also influence adherence behavior among patients with type 2 diabetes mellitus (Baghikar et al., 2019). Cultural beliefs and economic barriers often affect patients' perceptions of treatment importance and their willingness to follow prescribed therapy (Shahin et al., 2019). Limited access to healthcare services and medication availability may further reduce adherence among individuals with chronic illnesses (Al Saffer et al., 2021). Psychological factors such as illness perception and self-efficacy also shape how patients respond to treatment recommendations (Bilondi et al., 2021). Patients who perceive diabetes as a controllable condition are more likely to maintain adherence to medication therapy (Wu et al., 2023). Understanding these behavioral determinants is therefore essential for designing effective diabetes management programs (Mannan et al., 2021).

Previous studies conducted in different healthcare settings demonstrate that medication non-adherence among patients with type 2 diabetes remains a major public health concern (Mitiku et al., 2022). Evidence indicates that a substantial proportion of patients fail to follow prescribed treatment regimens despite the availability of effective antidiabetic medications (Murwanashyaka et al., 2022). Research findings also show that inadequate knowledge and poor disease awareness contribute significantly to treatment non-adherence (Rezaei et al., 2019). Poor adherence behaviors often worsen glycemic control and increase the risk of diabetes-related complications (Sahoo et al., 2022). Identifying factors associated with adherence behavior therefore becomes essential for improving diabetes care strategies (Zairina et al., 2022). Healthcare professionals must design targeted education programs to improve patient knowledge and treatment adherence (Panduwiguna et al., 2022).

Improving patient knowledge can significantly enhance self-management behaviors and treatment adherence among individuals with type 2 diabetes mellitus (Krzemińska et al., 2021). Health literacy helps patients understand medication instructions, recognize symptoms, and monitor disease progression effectively (Liu et al., 2020). Educational interventions also empower patients

to participate actively in disease management and decision-making processes (Ayele et al., 2022). Strong knowledge levels enable patients to implement lifestyle changes and maintain long-term treatment compliance (Araya et al., 2020). Health education programs therefore represent an important strategy for strengthening patient adherence in diabetes care (Muhammad Haskani et al., 2022). Continuous patient education and counseling are necessary to improve treatment outcomes and reduce the burden of diabetes complications globally (Sun et al., 2022).

Conclusion and Recommendation

This study concluded that knowledge level has a significant relationship with treatment adherence among patients with type 2 diabetes mellitus. Patients who possess better knowledge about diabetes and its treatment tend to demonstrate higher adherence to medication therapy and disease management. These findings indicate that improving patient knowledge represents an important strategy for enhancing treatment adherence and preventing diabetes complications. Healthcare providers should strengthen patient education programs in primary healthcare settings to improve understanding of diabetes management. Educational interventions should focus on increasing patient awareness about medication use, disease control, and long-term complications. Future research should explore additional behavioral, psychological, and social factors that influence treatment adherence among patients with type 2 diabetes mellitus.

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