

Treatment Adherence And Its Impact On Glycemic Control In Patients With Diabetes Mellitus Type 2 In Working Area Of Klatak Health Center Banyuwangi 2024

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Abstract. *Background: One of the factors that can affect treatment adherence in patients with type 2 diabetes mellitus is glycemic results, if glycemic control is poor then the implementation of treatment compliance can be a motivation for glycemic control. Purpose: This study aims to determine the relationship between treatment adherence and its impact on glycemic control in patients with type 2 diabetes mellitus in the Klatak Health Center working area in 2024. Methods: This study used a cross sectional design with purposive sampling and a sample size of 35 respondents. Data collection using the MTAQDM questionnaire (modified treatment adherence questionnaire in DM patients) and observation sheets and then analyzed using the spearman rank test. Results: All patients (100%) were in the adherence category following treatment adherence activities and almost all patients (97%) were in the diabetic category. Based on the results of the analysis obtained a P-value of 0.628 ($p > 0.05$) which means that there is no relationship between treatment adherence and the impact of glycemic control, with a correlation of 0.085 which shows a correlation with very weak strength. Conclusion: Respondents who adhere to treatment adherence do not affect their glycemic control and adhere to treatment but HbA1c is not controlled, because many factors can affect it.*

Keywords diabetes mellitus type 2, treatment adherence, glycemic control

1. INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by blood sugar levels that exceed normal limits. The causes of increased blood sugar levels due to insulin deficiency or insulin resistance and metabolic disorders, from the several causes that are the reason for classifying the types of DM into type 1 DM, type 2 DM, and gestational type DM. Type 2 DM with the highest rate ranges from 90% to 95% experiencing the adverse effects of diabetes mellitus. Type 2 DM is currently a global epidemic. The frequency and prevalence rates have been increasing in developed and industrialized countries recently, so the endurance and future of patients with type 2 DM are diminishing (Ayuningrum et al., 2023). Patients with type 2 DM with low adherence have poor glycemic control compared to those with high treatment adherence. Meanwhile, the lack of benefits felt by patients from taking medication, fear of drug side effects, and increasing complexity are factors intended to reduce patient adherence in treatment (Majeed et al., 2021). Treatment adherence to get results and benefits from

therapy has several items such as healthy exercise, health counseling, medical consultation, and physical and laboratory examinations.

In 2021, estimated 537 million people have experience the adverse effects of diabetes, and this number is expected to reach 643 million in 2030, and 783 million in 2045(International Diabetes Federation, 2021). Health services for people with diabetes mellitus in 38 districts/cities throughout East Java have reached 842,004 cases (97.5% of the estimated DM patients) (Dinkes Provinsi Jawa Timur, 2022). Based on the condition of diabetes mellitus sufferers in 2021 in the Banyuwangi area, getting patients with an estimated target of getting more than 25,000 patients and DM sufferers being served is only 20,000 patients (Dinas Kesehatan Kabupaten Banyuwangi, 2022). Based on the data of Klatak Health Center in November 2023, the Type 2 Diabetes Mellitus patients recorded 129 people, with 18 people usually referred to the hospital and 111 people handled by health center staff.

Adherence to treatment is a crucial aspect of managing both pharmacological and non-pharmacological approaches in chronic diseases. While adherence is higher in acute diseases, patients with chronic conditions like Type 2 Diabetes Mellitus (DM) often struggle with adherence, which is essential for controlling complications and improving quality of life (Majeed et al., 2021). Type 2 DM management includes glycemic control through medication, dietary modifications, and physical activity to reduce macrovascular and microvascular complications. Macrovascular complications, such as atherosclerosis and coronary heart disease, can lead to myocardial infarction, strokes, and death. Microvascular complications include diabetic retinopathy, nephropathy, and neuropathy, which can result in blindness, kidney failure requiring dialysis or transplantation, and diabetic foot leading to amputation.

Patient adherence enhances metabolic control and mitigates complications. Interventions like education, follow-ups, and self-management training improve adherence, dietary habits, glycemic control, and knowledge of diabetes management (Fayed et al., 2022).A holistic approach, including the four pillars of diabetes control—education, food planning, physical activity, and pharmacological intervention—is vital. Programs like prolanis, which incorporate healthy exercises, counseling, and monitoring HbA1c levels, are effective in preventing complications (Farhat et al., 2019). Non-adherence can worsen clinical outcomes and undermine therapeutic benefits (Hartiningsih et al., 2023). Consequently, the researcher aims to study "Treatment

Adherence and Its Impact on Glycemic Control in Patients with Diabetes Mellitus Type 2 at Klatak Public Health Center Banyuwangi in 2024."

2. LITERATURE REVIEW

Effective management of type 2 diabetes mellitus (T2DM) is heavily reliant on treatment adherence, which significantly influences glycemic control and reduces complications. This literature review critically evaluates recent studies on the relationship between adherence to diabetes treatment and glycemic control, synthesizing their findings, strengths, limitations, and implications for future research and clinical practice.

1. Long-Term Cohort Studies

Based on (Kaaffah et al., 2021) conducted a 4-year follow-up cohort study involving 342 T2DM patients. Their findings underscore the significant impact of treatment adherence, with patients adhering to treatment protocols showing a threefold greater reduction in fasting blood glucose (FBG) and post-prandial blood glucose (PPBG) levels compared to untreated groups. This study highlights the long-term benefits of adherence but also reveals the low compliance rate among patients, suggesting systemic or behavioral barriers to sustained treatment adherence. Critique: While the large sample size strengthens the reliability of the findings, the study primarily focuses on oral medications without delving into other factors like lifestyle interventions. The results are context-specific to Indonesian patients and may not generalize to populations with differing healthcare systems or cultural contexts.

2. Cross-Sectional Analyses

From the research (Sa'dyah et al., 2021) employed cross-sectional designs to examine adherence using structured questionnaires like ARMS and ProMAS. Both studies found significant correlations between higher adherence levels and improved glycemic control. However, Rdeliani et al. noted that despite adherence, 66.7% of patients had uncontrolled blood glucose, indicating that adherence alone may not suffice in managing diabetes. Critique: Cross-sectional designs limit the ability to infer causality. The reliance on self-reported adherence measures may introduce bias, as patients might overestimate their adherence.

3. Quasi-Experimental Approaches

(Mohammed et al., 2020) demonstrated that structured teaching programs significantly improve patient knowledge, treatment adherence, and glycemic control. This quasi-experimental study emphasizes the role of patient education in promoting adherence. Critique: The study's pretest-posttest design supports causal inferences; however, the small sample size (72 respondents) and single-center focus limit the generalizability. Future studies should explore diverse populations and assess the sustainability of educational interventions.

4. Psychological and Behavioral Factors

(Fayed et al., 2022) examined the mediating role of self-reported adherence to treatment (SRAT) in the relationship between diabetes-related distress (DRD) and glycemic control. They reported that higher DRD correlates with poorer adherence and glycemic outcomes, emphasizing the psychological dimension of diabetes management. Critique: This study's novelty lies in linking emotional and behavioral factors with clinical outcomes. However, its cross-sectional nature precludes definitive conclusions about causality. Longitudinal studies are needed to explore these relationships over time.

5. Pharmacological Considerations

(Abdulrahman et al., 2023) evaluated the influence of metformin dosing on glycemic control and cardiovascular risk markers. They concluded that adherence, rather than dose escalation, significantly influences outcomes. This finding aligns with the broader consensus that patient behavior outweighs pharmacological adjustments in T2DM management. Critique: The study's case-series design provides valuable insights into patient-specific outcomes but lacks a control group, which limits the ability to generalize findings to broader populations.

3. METHODS

This research design used a cross-sectional research design, which is a type of research that emphasizes the time of measurement /observation of data on independent and dependent variables only once at a time. In this study, researchers have analyze the relationship between treatment adherence variables and glycemic control variables. The sample in this study, 35 respondents, who participated in the prolanis program at the Klatak Health Center. The sampling technique used is total sampling because the total population is less than 100. This study was conducted on June 2024 at Klatak Public

Health Center. In this research, the inclusion criteria are patients with type 2 diabetes mellitus who participated in the prolanis program and already test HbA1c lab. And the exclusion criteria are patients who are unconscious due to their medical condition and have physically disabled. The statistical test by the researcher will use spearmen rank test using SPSS 26.0 for window.

The instruments used in data collection are observations and questionnaires to measure treatment compliance and glycemic control. The questionnaire used in this study is a modified questionnaire on The Modified Treatment Adherence Questionnaire of Patients with Diabetes Mellitus Type 2 and the Observation made is to obtain hba1c results after lab tests. In this study, there are two instruments used, namely for the independent variable using observation sheets and questionnaires to observe prolanis activities, for the dependent variable using the hba1c laboratory to check whether this patient is indeed in the diabetes category. Different from checking GDA which is measured once a month, to identify and monitor and measure the development of respondents' blood sugar every month on the observation sheet. This instrument has previously been tested for validity and reliability.

4. RESULTS

Research data can be presented using a table with the results of univariate and bivariate analysis.

Univariate analysis

a. Age

Tabel 1 distribution of respondents by age

Age	Frequency	Percentage
35 – 45 years	6	17%
46 – 55 years	8	23%
56 – 65 years	15	43%
>65 years	6	17%
Total	35	100%

Based on Table 1 The age of respondents with type 2 diabetes mellitus at the Klatak Health Center in 2024, shows that of the 35 respondents studied, the frequency distribution of almost half were aged 56-65 years, which is included in the late elderly period, namely 15 people (43%).

b. Gender

Tabel 2 distribution of respondents based on gender

Gender	Frequency	Percentage
Man	12	34%
Women	23	66%
Total	35	100%

Based on Table 2, the gender of respondents with type 2 diabetes mellitus at the Klatak Health Center in 2024 with the frequency category was mostly female, namely 23 respondents (66%).

c. Education

Tabel 3 distribution of respondents by education

Education	Frequency	Percentage
No school	5	14%
Elementary School	24	69%
Junior High	2	6%
High school	1	3%
D3 & S1	3	9%
Total	35	100%

Based on Table 3 Education of respondents with type 2 diabetes mellitus at Klatak Health Center in 2024, the frequency distribution was mostly elementary school as many as 24 respondents (69%).

d. Occupation

Tabel 4 distribution of respondents by occupation

Profession	Frequency	Percentage
Housewife	21	60%
Others (fishermen, laborers, farmers)	11	31%
Civil servants	3	9%
Total	35	100%

Based on Table 4, the occupation of respondents with type 2 diabetes mellitus at Klatak Health Center in 2024, the frequency distribution was mostly in the housewife category as many as 21 respondents (60%).

e. Length of suffering

Tabel 5 distribution of respondents by length of suffering

Length of suffering	Frequency	Percentage
1 year	4	11%
2-3 year	13	37%
4-5 year	9	26%
>5 year	9	26%
Total	35	100%

Based on Table 5, the length of time the respondents suffered from type 2 diabetes mellitus at the Klatak Health Center in 2024, the frequency distribution was almost half in the 2-3 years category as many as 13 respondents (37%).

f. Income

Tabel 6 distribution of respondents by income

Income	Frequency	Percentage
<500.000	17	48%
600.000-1.000.000	13	37%
1.100.000-2.000.000	2	6%
>2.000.000	3	9%
Total	35	100%

Based on Table 6, the income of respondents with type 2 diabetes mellitus at Klatak Health Center in 2024, the frequency distribution of almost half was in the category of respondents income <500,000 as many as 17 respondents (48%).

Bivariate analysis

a. Treatment adherence

Tabel 7 Distribution of specific characteristics of respondents based on treatment adherence variables

Treatment adherence	Frequency	Percentage
Adherence	35	100%
No adherence	0	0%
Total	35	100%

Based on table 7, it was found that most patients with type 2 diabetes mellitus in the Klatak health center work area had treatment adherence with the frequency distribution of all respondents adherence, as many as 35 respondents (100%).

b. Glycemic control

Tabel 8 Distribution of specific characteristics of respondents based on glycemic control variables

Glycemic control	Frequency	Percentage
Diabetes	34	97%
Pre diabetes	1	3%
Normal	0	0%
Total	35	100%

Based on table 8, it can be seen that patients with type 2 diabetes mellitus at the Klatak Health Center in 2024 frequency distribution almost all fall into the Diabetes category with reference to the HbA1c examination, namely 34 respondents (97%).

DISCUSSION

1. Treatment Adherence

This study analyzed treatment adherence among Prolanis participants at the Klatak Health Center in 2024, focusing on type 2 diabetes mellitus patients. Prolanis activities include healthy exercise, health counseling, medical consultations, and physical and laboratory examinations conducted monthly, with HbA1c measured semi-annually. All 35 respondents (100%) were categorized as adherent to Prolanis activities. However, despite high adherence, HbA1c levels remained uncontrolled for many participants, aligning with prior studies (Ladyani et al., 2020) that reported similar findings due to multifactorial influences.

Observations revealed that while Prolanis activities were well-attended, the program's quality was suboptimal. Participants often lacked discipline, particularly during educational sessions, and there were no group discussions for exchanging experiences. As a result, the program's objective of improving participants' quality of life was not fully achieved, with 97% of participants still classified in the diabetic category based on HbA1c levels.

From this research data based on gender, according to (Muhammad, 2022) if female respondents are more compliant with participating in activities than men, the results of the proportion of poor glycemic control are found in men than women. From the research that has been done, it has also been found that women are more adherent and related to the data that has been processed. Research data based on occupation also found that most are housewives who can manage part of the time to participate in the treatment adherence activities of this prolanis activity.

2. Glycemic Control

This study examined glycemic control among type 2 diabetes mellitus (DM) patients at the Klatak Health Center in 2024. Of 35 respondents, 97% were in the diabetic category, and 3% were in the pre-diabetic category. HbA1c levels showed poor glycemic control (HbA1c > 8%) in 20 respondents, moderate control (HbA1c 6.5–8%) in 14 respondents, and good control (HbA1c < 6.5%) in 1 respondent.

The findings align with prior research (Helny Zuraini Tarigan & Riduan Benny, 2024) that highlight several factors influencing HbA1c levels, including physical activity, energy and fiber intake, and adherence to Prolanis activities. Despite adherence, many participants still had uncontrolled HbA1c levels, emphasizing the multifactorial nature of glycemic control. Factors such as irregular

diets, high-glycemic index foods, lack of physical activity, medication noncompliance, stress, and illness can all contribute to poor outcomes (Muhammad, 2022).

The study underscores the importance of regular physical activity tailored to individual conditions, adequate fiber intake, and reduced consumption of high-energy foods to improve glycemic control and lower complication risks. Notably, a respondent in the pre-diabetic category demonstrated better glycemic control, potentially due to shorter disease duration, younger age (<40 years), and adherence to health recommendations. Regular follow-up for Prolanis participants is recommended to achieve long-term glycemic control.

3. The relationship between treatment adherence and glycemic control for sufferers of type 2 diabetes mellitus in the klatak public health center in 2024

The Spearman rank test analysis using SPSS version 26 (significance level of 0.05) showed no significant relationship between treatment adherence and glycemic control among type 2 diabetes mellitus (DM) patients at the Klatak Health Center in 2024, with a p-value of 0.628 and a correlation coefficient of 0.085. This indicates no correlation between the two variables. Several factors influence the effectiveness of Prolanis programs, including the quality of human resources, availability of facilities, infrastructure, and funding, particularly for reminder activities like SMS (Imade Rosdiana et al., 2017). Group discussions using IEC and BCC methods can also improve awareness and behavior change. Other studies (Idris et al., 2014) highlight the impact of diet, glycemic load, and adherence to antidiabetic medications on blood sugar control.

At the Klatak Health Center, Prolanis activities included physical exercises, health counseling, medical consultations, and laboratory tests. Although participants attended these activities, many did not fully engage during educational sessions, limiting their effectiveness. The absence of group discussions hindered communication and knowledge exchange among participants, further affecting program quality. Despite adherence to Prolanis activities, 97% of participants had HbA1c levels in the diabetes category, suggesting poor glycemic control. Multiple factors such as medication adherence, diet, carbohydrate intake, physical activity, stress, illness, and lifestyle habits (e.g., alcohol consumption) likely contribute to uncontrolled HbA1c levels. To improve outcomes, Prolanis organizers and participants should address these factors consistently, focusing on more than just

attendance. Enhanced program quality and regular evaluations can help achieve the program's disease management goals more effectively.

5. CONCLUSION

In the Klatak Health Center working area in 2024, 35 respondents (100%) adhered to Prolanis activities, which include healthy exercise, health counseling, medical consultations, and physical and laboratory examinations. Glycemic control data revealed that 97% of respondents (34 out of 35) had HbA1c levels exceeding 6.5%, placing them in the diabetes mellitus category. The Spearman rank test analysis showed a p-value of 0.6 ($p > 0.05$) and a correlation coefficient of $r = 0.085$, indicating no significant relationship between treatment adherence and glycemic control in patients with type 2 diabetes mellitus.

LIMITATION

The study was limited to 35 respondents from the Klatak Health Center working area. While this sample size provided some insight into treatment adherence and glycemic control, it may not be representative of the broader population of individuals with type 2 diabetes mellitus, potentially limiting the generalizability of the findings.

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