

Compliance with Oral Antihyperglycemic Medication and Fasting Blood Sugar Levels in Type 2 Diabetes Mellitus Patients

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ABSTRACT

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Diabetes mellitus is an endocrine disease characterized by hyperglycemia, characterized by elevated blood glucose levels. The cause of elevated blood glucose levels is due to ineffective insulin secretion, insulin action, or both. The purpose of this study was to determine the relationship between adherence to oral antihyperglycemic medication and fasting blood sugar levels in patients with type 2 diabetes mellitus. This study employed a non-experimental, descriptive cross-sectional design. This study was conducted at the Balerejo Community Health Center in Madiun in February 2024 with a total sample of 63 patients. The sampling technique used was the consecutive sampling method. The data analysis used in this study was the Spearman Rank test. The results of the most gender characteristics were female 37 people (58.7%), age 46-55 years 35 people (55.6%), high school education 29 people (46.0%), farmer occupation 11 people (17.5%), normal BMI (18.5-22.9 kg / m²) 25 people (39.7%), metformin monotherapy treatment 11 people (17.5%), metformin + glibenclamide combination 24 people (38.1%). Compliance with taking medication was categorized as compliant in 39 people (61.9%), and non-compliant in 24 people (38.1%). Fasting blood sugar (FBS) targets were achieved by as many as 36 people (57.1%), and not achieved by 27 people (42.9%). The results of the analysis showed significant relationship between compliance with oral antihyperglycemic drugs and fasting blood sugar levels in patients with type 2 diabetes mellitus, with a p-value of 0.000 and a correlation coefficient of 0.510. Conclusion: There is a significant relationship exists between compliance with oral antihyperglycemic drugs and fasting blood sugar levels in type 2 diabetes mellitus patients.

ABSTRAK

Diabetes melitus merupakan penyakit endokrin dengan karakteristik hiperglikemik yang ditandai dengan peningkatan kadar glukosa di dalam darah. Penyebab meningkatnya kadar glukosa darah dikarenakan ketidakefektifan sekresi insulin, kerja insulin atau keduanya. Tujuan dari penelitian ini yaitu untuk mengetahui hubungan kepatuhan minum obat antihiperglikemik oral dengan kadar gula darah puasa pasien diabetes melitus tipe 2. Penelitian ini merupakan penelitian non eksperimental dengan rancangan *cross sectional* yang bersifat deskriptif. Penelitian ini dilakukan di Puskesmas Balerejo Madiun pada bulan Februari 2024 dengan total sampel sebanyak 63 pasien. Tehnik pengambilan sampel menggunakan metode *consecutive sampling*. Analisis data yang digunakan pada penelitian ini adalah *Spearman Rank*. Hasil karakteristik jenis kelamin terbanyak yaitu perempuan 37 orang (58,7%), usia 46-55 tahun 35 orang (55,6%), pendidikan SMA 29 orang (46,0%), pekerjaan petani 11 orang (17,5%), IMT normal (18,5-22,9kg/m²) 25 orang (39,7%), pengobatan monoterapi metformin 11 orang (17,5%), kombinasi metformin + glibenklamid 24 orang (38,1%). Kepatuhan

minum obat dengan kategori patuh sebanyak 39 orang (61,9%), dan tidak patuh 24 orang (38,1%). Gula darah puasa (GDP) target tercapai sebanyak 36 orang (57,1%), dan tidak tercapai 27 orang (42,9%). Hasil analisis menunjukkan ada hubungan kepatuhan minum obat antihiperqlikemik oral dengan kadar gula darah puasa pasien diabetes melitus tipe 2 dengan nilai *p-value* 0,000, *r* 0,510. Kesimpulan: adanya hubungan antara kepatuhan minum obat antihiperqlikemik oral dengan kadar gula darah puasa pasien diabetes melitus tipe 2 secara signifikans.



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A. INTRODUCTION

Diabetes mellitus is a chronic non-communicable disease and a global health priority. This disease is an endocrine disorder characterized by hyperglycemia, or elevated blood glucose levels. This elevated glucose level is caused by ineffective insulin secretion, impaired insulin action, or a combination of both (PERKENI, 2021).

Elevated or imbalanced blood glucose levels in diabetes mellitus can lead to various complications, including macrovascular and microvascular disorders, as well as damage to the nervous system, or neuropathy. These complications can occur in patients with type 2 diabetes mellitus, both long-standing and newly diagnosed. Macrovascular complications typically affect organs such as the heart, brain, and blood vessels, while microvascular complications generally occur in the eyes and kidneys. Furthermore, neuropathic disorders, including motor, sensory, and autonomic neuropathy, are also common in patients with diabetes mellitus (PERKENI, 2021).

Modifiable risk factors are those that can be changed through lifestyle interventions and health education. These factors include a diet rich in saturated fat and simple carbohydrates, impaired glucose tolerance, metabolic syndrome, high blood pressure ($\geq 140/90$ mmHg), elevated plasma triglycerides (≥ 250 mg/dl), and low physical activity. Metabolic syndrome has been linked to type 2 diabetes mellitus due to its high prevalence worldwide, both due to increased obesity and a sedentary lifestyle. Insulin resistance is often the primary metabolic abnormality leading to the development of type 2 diabetes mellitus (Bereda, 2023).

According to 2021 data from the International Diabetes Federation (IDF), an estimated 537 million people aged 20-79 worldwide suffer from diabetes mellitus. Indonesia ranks fifth with 19.47 million sufferers (IDF, 2021). Furthermore, the Basic Health Research (RISKESDAS) report shows a significant increase in the prevalence of diabetes mellitus in Indonesia, from 6.9% in 2013 to 8.5% in 2018, equivalent to approximately 20.4 million people. In East Java, according to the 2022 provincial health profile data, diabetes mellitus cases ranked second after hypertension, with 172,917 cases (Dinkes Jatim, 2022).

Compliance is a behavior change that follows instructions given by a doctor through training, medication, or disease management (Fathurrahman et al., 2023). Medication adherence refers to a patient's compliance with recommendations regarding the use of prescribed medication, including the time, dose, and frequency of use (Bulu et al., 2019). Factors influencing adherence include internal and external factors. Internal factors include

age, gender, background, attitudes and emotions arising from the disease, and the patient's personality. External factors include education, knowledge, environment, the relationship between the patient and healthcare professionals, and family support. Adherence is a crucial factor in determining the success of therapy for patients with diabetes mellitus (Mudawati et al., 2025).

Controlled blood glucose can reduce the risk of various acute complications, improve quality of life, and reduce morbidity and mortality from diabetes mellitus. The success of therapy in patients with diabetes mellitus is also influenced by knowledge, attitudes, and adherence. Poor adherence to treatment can impact the success of therapy in these patients, leading to uncontrolled blood glucose levels and potentially leading to macrovascular and microvascular complications (PERKENI, 2021).

Successful diabetes mellitus therapy is characterized by the maintenance of controlled blood glucose levels. Reasonable blood sugar control can reduce the risk of acute complications, improve quality of life, and decrease morbidity and mortality associated with diabetes (Suciati & Alfian, 2022). Additionally, the success of drug therapy is evident in its effectiveness in reducing fasting blood sugar levels (Siswidiyasari et al., 2025). Success can also be evaluated through laboratory and clinical data. Reference laboratory data include fasting blood sugar in the range of 80-100 mg/dL, 2-hour postprandial blood sugar between 80-144 mg/dL, and hemoglobin A1c (HbA1c) of less than 6.5% (Fathurrahman et al., 2023).

The results of research conducted by (Dhuhania & Karminingtyas (2023), showed a significant relationship between medication adherence in diabetes mellitus patients and fasting blood sugar levels, indicated by a significance value of 0.000 and a correlation coefficient of -0.801. Most diabetes mellitus patients had a moderate level of medication adherence, namely 17 patients (44.74%). Another study also found a relationship between medication adherence and fasting blood sugar levels in patients with type 2 diabetes mellitus at ULIN Banjarmasin Regional Hospital, with a p-value of 0.002. Furthermore, 14 patients (44%) had fasting blood sugar levels within normal limits (Hasanah et al., 2024).

This study aims to determine the compliance of patients with type 2 diabetes mellitus in taking oral antihyperglycemic drugs and their fasting blood sugar levels patients at Balerejo Madiun Health Center.

B. METHODS

This study employs an analytical observational (non-experimental) design with a descriptive cross-sectional approach. This study was conducted at the Balerejo Madiun Community Health Center. Data were obtained from medical records and direct measurements related to medication adherence in patients with type 2 diabetes mellitus. Data collection was conducted in February 2024 resulting in a total sample of 63 patients. The total number of patient samples as the target population of this study was 65 patients and 2 subjects did not meet the inclusion requirements. The sampling technique used was the consecutive sampling method. The inclusion criteria were patients with type 2 diabetes mellitus, aged 18 years or older, who were willing to participate in the study by signing an informed consent form and were able to read and write. Exclusion criteria included patients with illegible medical records, those referred to other facilities, and individuals who did not wish to participate as respondents in this study. Medication adherence was assessed using the Morisky Medication Adherence

Scale-8 (MMAS-8) questionnaire. The MMAS-8 questionnaire scores range from 0 to 8, with compliance levels categorized as follows: high compliance (score of 8), moderate compliance (score of 6-7), and low compliance (score of less than 6). According to PERKENI (2021), fasting blood sugar levels are considered to be <126 mg/dL. The data analysis used in this study used the Spearman Rank test.

C. RESULT AND DISCUSSION

1. Result

a. Characteristics of Diabetes Mellitus Patients

Table 1. Characteristics of Type 2 Diabetes Mellitus Patients

Characteristics	f	%
Gender		
Man	26	41.3
Woman	37	58.7
Age		
26-35 year	6	9.5
36-45 year	22	34.9
46-55 year	35	55.6
Education		
SD	3	4.8
SMP	9	14.3
SMA	29	46.0
PT	22	34.9
Work		
Doesn't work	20	31.7
Farmer	11	17.5
Trader	10	15.9
Self-employed	7	11.1
Private Employees	10	15.9
PNS	5	7.9
BMI		
Not enough (18.5 kg/m ²)	11	17.5
Normal (18.5-22.9 kg/m ²)	25	39.7
Excessive (23-29.9 kg/m ²)	24	38.1
Obesity (>30 kg/m ²)	3	4.8

Based on table 1, the results of the characteristics of type 2 diabetes mellitus patients, the most common gender was female 37 people (58.7%), aged 46-55 years 35 people (55.6%), high school education 29 people (46.0%), occupation farmers 11 people (17.5%) and normal BMI (18.5-22.9 kg/m²) 25 people (39.7%).

b. Diabetes Mellitus Patient Treatment Profile

Table 2. Diabetes Mellitus Patient Treatment Data

Drug	f	%
Monotherapy		
Methformin	11	17.5%
Glimepiride	6	9.5%
Acarbose	2	3.2%
Combination		
Methformin + Glibenclamide	24	38.1%
Methformin + Glimepiride	17	27.0%
Glimepiride + Acarbose	3	4.8%
Total	63	100%

Based on table 2, the research results obtained, the most common type of medication given to patients with type 2 diabetes mellitus was metformin monotherapy in 11 people (17.5%), glimepiride in 6 people (9.5%), combination treatment of metformin + glibenclamide in 24 people (38.1%), and metformin + glimepiride in 17 people (27.0%).

c. Medication Compliance

Table 3. Medication Compliance Data

Medication Compliance	f	%
Obedient	39	61.9
Not Obey	24	38.1
Total	63	100

Based on table 3, the results of the questionnaire on adherence to oral antihyperglycemic drugs in patients with type 2 diabetes mellitus showed that 39 patients (61.9%) were compliant, and 24 patients (38.1%) were non-compliant.

d. Fasting Blood Sugar Levels

Table 4. Data on Fasting Blood Sugar Level Values

GDP	f	%
Achieved	36	57.1
Not Achieved	27	42.9
Total	63	100

Based on table 4, the fasting blood sugar levels of patients with type 2 diabetes mellitus in this study, 36 patients (57.1%) achieved their target, while 27 patients (42.9%) did not.

e. Medication Compliance with Fasting Blood Sugar Levels

Table 5. Analysis of Medication Compliance with Fasting Blood Sugar Levels

Medication Compliance	GDP		Total	Pvalue	R
	Achieved	Not Achieved			
Obedient	30	9	39	0.000	0.510
	47.6%	14.3%	61.9%		
Not Obey	6	18	24		
	9.5%	28.6%	38.1%		
Total	36	27	63		

57.1% 42.9% 100.0%

Based on table 5, the results of the analysis showed significant relationship between adherence to oral antihyperglycemic drugs and fasting blood sugar levels in patients with type 2 diabetes mellitus, with a p-value of 0.000 and a correlation coefficient of 0.510.

2. Discussion

a. Diabetes mellitus patient profile and treatment

Diabetes mellitus can be defined as a metabolic disorder in the body caused by the inability of the insulin hormone to regulate blood glucose balance, resulting in increased glucose levels in the blood, commonly referred to as hyperglycemia. Pharmacological therapy can be administered in conjunction with diet and a healthy lifestyle. Pharmacological therapy consists of oral medications and injectable forms of insulin. In certain circumstances, if blood glucose levels are not achieved with a combination of two medications, a combination of two antihyperglycemic drugs and insulin may be given (PERKENI, 2021).

Metformin is the first-line treatment for most cases of diabetes mellitus. Its primary effect is to reduce hepatic glucose production (gluconeogenesis). The metformin dose is reduced in patients with impaired renal function. Metformin should not be given to patients with severe liver impairment or those prone to hypoxemia. Possible side effects include gastrointestinal disturbances such as dyspepsia, diarrhea, and others. Sulfonylurea drugs (Glimepiride and Glibenclamide) primarily increase insulin secretion by pancreatic beta cells. Side effects of this class of drugs include hypoglycemia and weight gain. This class of alpha-glucosidase drugs (Acarbose) works by inhibiting the alpha-glucosidase enzyme in the digestive tract, thereby inhibiting glucose absorption in the small intestine. Possible side effects of this class of drugs include bloating (gas buildup in the intestines), which can lead to flatus (PERKENI, 2021).

Indicators of successful treatment in diabetes mellitus patients include controlled blood glucose levels. Normal values for GDP are 70-99 mg/dL, GD2PP 70-139 mg/dL, and Hemoglobin A1c (HbA1c) <5.7%. Controlled blood glucose can reduce the risk of various acute complications, improve quality of life, and decrease diabetes mellitus morbidity and mortality (PERKENI, 2021). Patient non-compliance in self-management can cause the condition of diabetes mellitus to worsen, the risk of serious complications will increase, the quality of life will decrease, and the cost of treatment will increase (Fadhila & Kartinah, 2025).

According to the results of research conducted by Duhania & Karminingtyas (2023), It shows that the characteristics of patients based on age are mostly 56-65 years, 22 (57.89%), female gender, 28 (73.68%), junior high school education level, 14 (36.84%), private employee occupation, 12 (31.58%), and no comorbidities, 27 (71.05%). The results of other studies, show that the demographic characteristics based on gender are mostly female 29 (61.7%), age 46-60 years 33 (70.2%), elementary school education level 17 (36.2%), self-employed occupation 22 (46.8%), duration of suffering <1 year 27 (57.4%), and no family history 17 (36.2%) (Amalia et al., 2024).

The results of this study are in line with research conducted by Amalia et al., (2024), which showed that the most common diabetes mellitus drugs used were glimepiride and metformin, at 31 (66.0%); and glibenclamide and metformin, at 16 (34.0%) (Amalia et al., 2024). The results of other studies showed that the types of metformin monotherapy were 4 (10.53%), gliclazide at 1 (2.63%), glimepiride at 1 (2.63%), acarbose at 1 (2.63%); combination of acarbose + glimepirid 11 (28.95%), metformin + glimepirid 8 (21.05%), metformin + gliquidone 4 (10.53%), acarbose + gliclazide 3 (7.89%), acarbose + gliquidone 3 (7.89%), metformin + gliclazide 1 (2.63%), metformin + acarbose + gliquidone 1 (2.63%) (Dhuhania & Karminingtyas, 2023).

b. The Relationship Between Medication Compliance and Fasting Blood Sugar Levels

Compliance is a patient's attitude toward taking prescribed medication and adopting a lifestyle consistent with the healthcare provider's recommendations. Treatment compliance refers to a patient's adherence to the recommendations for prescribed medication, including the timing, dosage, and frequency. Diabetes mellitus treatment adherence aims to maintain blood glucose levels within the normal range. Poor adherence can lead to increased complications, higher treatment costs, and longer hospitalizations.

An indicator of successful diabetes mellitus therapy includes controlled blood glucose levels. Well-maintained blood sugar levels can reduce the risk of various acute complications, improve quality of life, and reduce morbidity and mortality in diabetes mellitus patients (Suciati & Alfian, 2022). Furthermore, treatment success in diabetes mellitus patients is also influenced by the patient's level of knowledge, attitude, and compliance (Lestarina, 2017).

According to the results of research conducted by Dhuhania & Karminingtyas (2023), it shows a high level of compliance for monotherapy of 2 (5.26%), combination of 8 (21.05%); a moderate level of compliance for monotherapy of 3 (9.89%), combination of 14 (36.84%); and a low level of compliance for monotherapy of 2 (5.26%), combination of 9 (23.68%). There were 38 patients in the category of fasting blood sugar levels, with the target achieved by 13 patients (34.21%) and not achieved by 25 patients (65.79%). Other research shows the level of compliance with the category of compliance as many as 18 (56%) and non-compliance as many as 14 (44%); the target was achieved by 14 patients (44%) and the target was not achieved by 18 patients (56%) (Hasanah et al., 2024).

The results of a study conducted by Dhuhania & Karminingtyas (2023), showed a significant relationship between medication adherence in diabetes mellitus patients and fasting blood sugar levels, with a significance value of 0.000 and a correlation coefficient of -0.801. Most diabetes mellitus patients were at a moderate level of adherence, namely 17 patients (44.74%). Another study also found a significant relationship between the level of medication adherence and fasting blood sugar levels in patients with type 2 diabetes mellitus at ULIN Banjarmasin Regional Hospital, with a p-value of 0.002. In addition, 14 patients (44%) had fasting blood sugar levels within normal limits (Hasanah et al., 2024).

Patients with low adherence tend to experience therapy failure, resulting in uncontrolled blood glucose levels and potentially causing macrovascular and

microvascular complications (Triastuti et al., 2020). Research results indicate that drug therapy is effective in reducing fasting blood glucose levels (FBS), specifically metformin with a p-value of $0.000 < 0.05$ and glimepiride with a p-value of $0.000 < 0.05$ (Siswidiyasari et al, 2025). The normal value of blood sugar levels (FBS) according to the 2021 Indonesian Endocrinology Association (PERKENI) guidelines is said to be achieved if <126 mg/dL (PERKENI, 2021).

D. CONCLUSION AND SUGGESTIONS

Based on the research results, it can be concluded that there is a relationship between compliance with oral antihyperglycemic drugs and fasting blood sugar levels in patients with type 2 diabetes mellitus, with a significance value of $p = 0.000$ and a correlation coefficient (r) of 0.510. Further research is expected to look at HbA1c values to provide an overview of average blood glucose levels over the past 2-3 months.

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