Disease Prevention and Public Health Journal
Vol. 19, No. 1, March 2025, pp. 52-58

e-ISSN: 2720-9997

The Relationship between Oral Antidiabetic Treatment and Blood Sugar Level among Type 2 Diabetes Mellitus Patients in Nur Hidayah Hospital Yogyakarta

Mardiana Puji Lestari[1]*, Arina Titami[2], Sugiyono[3]
[1,2,3] Pharmacy Study Program, Faculty of Health, Universitas Jenderal Achmad Yani Yogyakarta, Yogyakarta, Indonesia
*corresponding author: Email: dhiana28lestari@gmail.com

ARTICLE INFO

Article history
Received November 4, 2024
Revised March 15, 2025
Accepted March 17, 2025

Keywords
Blood sugar levels
Diabetes mellitus
Oral antidiabetic
Outcome therapy

ABSTRACT

Background: Diabetes mellitus is a chronic disease that poses a global health threat, with type 2 diabetes mellitus accounts for 90% of all cases. In Indonesia, diabetes mellitus is among the causes of high mortality due to non-communicable diseases. If not treated properly, type 2 diabetes mellitus can lead to various complications, potentially worsening the patient's condition. To address this, blood glucose levels must be controlled through the use of oral antidiabetic medications, either as monotherapy or in combination therapy. This study aims to the accuracy of oral antidiabetic drugs use and its therapy outcomes (blood sugar levels) in type 2 diabetes mellitus patients at Nur Hidayah Hospital Yogyakarta. **Method**: This study is an observational study with retrospective data collection, carried out using the purposive sampling method. A total of 75 samples were obtained from 298 populations that met the specified criteria. Univariate data analysis methods are presented in the form of percentages and tables, including analyses of patient characteristics, treatment characteristics, and therapy outcomes. Subsequently, bivariate analysis was conducted using the chi-square test to determine the relationship between the accuracy of oral antidiabetic drugs use and therapy outcomes, specifically blood sugar levels of patients with type 2 diabetes mellitus. **Results**: The findings of the analysis performed using the chi-square test revealed a correlation between the accuracy of oral antidiabetic medication and blood sugar levels in patients (p-value=0.012). **Conclusion**: proper use of oral antidiabetics shows that the patient's blood sugar levels are controlled.

Introduction

Diabetes mellitus (DM) is a chronic disease that is currently a global health threat. Of all DM cases, 90% or more are type 2 diabetes mellitus [1] a condition marked by deficient insulin secretion by pancreatic islet β-cells, tissue insulin resistance and an inadequate compensatory insulin secretory response [2]. According to the WHO in Indonesia, there will be an increase in the number of patients with type 2 DM from 8.4 million in 2000 to around 21.3 million in 2030 [3]. Based on data from the Basic Health Research (RISKESDAS) survey conducted in 2018, the

Yogyakarta Special Region was found to have the third highest number of diabetes mellitus (DM) patients in Indonesia [4]. Diabetes mellitus (DM) is a non-communicable disease characterized by hyperglycemia with impaired carbohydrate, fat, and protein metabolism due to an absolute or relative decrease in insulin secretion, insulin sensitivity, or both [5]. Hyperglycemia is a medical condition in the form of increased blood glucose levels exceeding normal, which is characteristic of diabetes mellitus in addition to various other conditions [6]. Various epidemiological studies have shown an increasing trend in the incidence and prevalence of type 2 DM in the world [7].

Prevention of these complications requires controlling blood glucose levels with oral antidiabetics (OAD). Metformin, a biguanide, is the first-line oral antidiabetic agent and is the most widely prescribed. Research conducted at two Public Health Centers in Kulon Progo demonstrated that metformin exhibited an 80% effectiveness rate compared to metformin-glimepiride, which showed 66,67% effectiveness [8]. The next oral antidiabetics are the sulfonylurea group (glibenclamide, glimepiride, gliquidone, and gliclazide), which are second-line oral antidiabetics [9]. These oral antidiabetics can be used either as monotherapy or combination therapy, which is effective in controlling blood glucose levels [10]. A Chinese study showed that combination therapy between metformin and glibenclamide was more effective and well tolerated. The combination of metformin and second-generation sulfonylureas such as glibenclamide and third-generation sulfonylureas such as glimepiride is preferred due to its greater effectiveness and better safety [11].

Evaluation of the accuracy of drug use is a form of quality assurance process that is structured and carried out on an ongoing basis. The purpose of these activities is to ensure that the treatment given to patients is appropriate, safe, and efficient. Rational use of drugs is when the drugs used by patients are in accordance with clinical needs, diseases or complaints, and doses that meet the needs of the body [12]. The goal of DM therapy was reduced and eliminated symptoms (polyuria, polydipsia, polyphagia), reduced the incidence of macrovascular and microvascular complications, reduced mortality and improved quality of life, lower blood glucose levels under normal conditions [13,14]. The increasing number of type 2 DM cases leads to a large number of prescribed drugs, which can lead to several problems such as polypharmacy, inappropriate prescribing, and medication non-adherence that can cause therapeutic failure [15]. Inappropriate prescribing can lead to non-achievement of blood sugar control and causes various macrovascular and microvascular complications. Macrovascular complications generally affect the heart, brain, and blood vessels, while microvascular complications can occur in the eyes, peripheral neuropathy, and kidneys [16,17]

Several studies have reported the effectiveness of oral antidiabetics and their therapy outcomes, including a study conducted at a hospital X that showed a difference in the initial and final blood sugar levels (GDS) after the use of glimepiride and gliquidone, where the p-value was obtained (<0.05). Glimepiride is more effective in reducing blood sugar, with a difference value between the initial and final GDS of 65.46 mg/dl [18]. In another study, patients who exclusively used OAD exhibited consistently lower glycated hemoglobin (HbA1c) levels at 3, 12, 24, and 36 months compared to those who used insulin. At later periods, 77.7% of OAD users achieved glycemic control, versus 64.9% of insulin users, with a marginally significant difference. Subgroup analyses indicated a tendency towards better glycemic control in the OAD group; however, this difference did not reach statistical significance [19].

Given the existence of this phenomenon, it is necessary to study the use of oral antidiabetics in type 2 DM patients, which aims **to** determine the relationship between the accuracy of oral antidiabetic drugs use and its therapy outcomes (blood sugar levels) in type 2 DM patients at Nur Hidayah Hospital, Bantul, Yogyakarta. The high incidence of DM and the importance of proper treatment encourages the need for rational treatment. This study is expected to improve patient compliance in taking oral antidiabetic drugs so that the risk of complications can be prevented.

Materials and Method

This type of research is an observational study with a cross-sectional approach. The data were collected using secondary data from medical records for the period January-December 2023 at Nur Hidayah Bantul Hospital Yogyakarta. The population of this study included all patients with a primary diagnosis of outpatient type 2 DM disease at Nur Hidayah Bantul Yogyakarta Hospital during the period from January to December 2023.The study sample of 75 from 298 patients were selected by purposive sampling method according to the inclusion criteria. The inclusion criteria are as follows: type 2 DM patients with or without comorbidities and complications, aged ≥18 years, diagnosed with type 2 DM for at least 1 year, and had complete medical record data. The exclusion criteria were type 2 DM patients who are pregnant and deceased patients.

The assessment of the appropriateness of drug use was analyzed using the standard reference Drug Information Handbook 2019, Drugs.com, and Perkeni 2021. Univariate data analysis, which describes each variable in the form of a percentage of each variable. The univariate analysis include the respondents' characteristics, namely age, gender, patient blood sugar levels, and comorbidities and/or complications. Moreover, the oral antidiabetic therapy regimen was also examined. Bivariate analysis was conducted to examine the relationship between two variables, employing the chi-square test as a statistical analysis method. The focus of this analysis was the examination of the relationship between the accuracy of oral antidiabetic drugs use and blood sugar levels in patients with type 2 DM. This research has received ethical approval from Universitas Jenderal Achmad Yani Yogyakarta Ethics Committee. Approval number: SKep/157/KEP/V/2024.

Results

This research was conducted to determine the relationship between the accuracy of oral antidiabetic drugs use and blood sugar levels in type 2 DM patients at Nur Hidayah Hospital Bantul Yogyakarta in 2023. The results showed that the characteristics of the majority of type 2 DM patients are as follows: most patients were between the ages of 45 and 65 years old (53.3%), were female (60.0%), had controlled blood sugar levels (62.7%), and had comorbidities or complications (81.3%) (Table 1). The majority of patients received oral antidiabetic combination therapy, 52 patients (69.3%) (Table 2).

Table 1. Characteristics of Type 2 DM Outpatients from January to December 2023 (n=75)

Variables	Total	
	n	%
Age (years)		
18-44	1	1.3
45-65	40	53.3
>65	34	45.3
Gender		
Male	30	40.0
Female	45	60.0
Blood sugar levels		
Controlled (GDS < 200 mg/dl)	47	62.7
Uncontrolled (GDS 200 mg/dl)	28	37.3
Had co-morbidities/complications		
Yes	61	81.3
No	14	18.7

Table 2. Oral Antidiabetic Therapy Regimen (n=75)

The type of the therapy	Total	
	n	%
Antidiabetic Monotherapy	23	30.7
Antidiabetic Combination therapy	52	69.3

Table 3. The Relationship between the Accuracy of Oral Antidiabetic Drugs Use and Blood Sugar Levels

Accuracy of drugs use	Blood Sugar Levels		Total n (%)	p-value
	Controlled n (%)	Uncontrolled n (%)		
Accurate	27 (36.0)	24 (32.0)	51 (68.0)	0.012
Inaccurate	20 (26.7)	4 (5.3)	24 (32.0)	

The evaluation of appropriate drug use is determined by the accuracy of all parameters, which include the appropriateness of the patient, the indication for use, the specific drug, the appropriate dosage, and the appropriate frequency of administration. The results indicated that

the majority of drug prescriptions, a total of 51 cases (68%), were appropriate. Furthermore, there is a relationship between the accuracy of drug use and the outcome of therapy with a p-value=0.012 (Table 3).

Discussion

The research results in Table 1 show that the majority of patients with type 2 DM are in the range of 41–60 years; there were 40 patients (53.3%). This result is in line with research by Ramdini et al. [20] in Pasir Hospital Health Center also believes that the majority of type 2 DM is in the age range of 46-65 years, with as many as 65 patients (5.38%). One's risk of DM experience increases after the age of 45 years because of the increase age causes a decrease in muscle mass, an increase in body fat, hormonal changes, and decreased pancreatic function [21]. Everyone contributes this reduces the effectiveness of insulin, thereby increasing the risk of diabetes mellitus. If insulin secretion decreases and it is not effective, the body will need it there is a lot of insulin to transport glucose, if not controlled, it causes blood glucose levels to increase.

Based on the results of the study in Table 1, the majority of type 2 DM occurred in women, namely 45 patients (60.0%). According to Indonesian Ministry of Health 2018, the prevalence of diabetes mellitus in women is greater than that in men [22]. Women over 40 years old entering premenopause and menopause significantly increase the risk of type 2 DM. A decrease in estrogen levels in women experiencing menopause causes an increase in fat, especially in the abdominal area. This results in increased release of free fatty acids, which is associated with insulin resistance. Hormonal processes in the post-menopausal monthly cycle trigger an increase in body fat accumulation, which causes women to become susceptible to DM [23]. In addition, the hormone progesterone, which is an anti-insulin hormone, disrupts the work of insulin in the body, causing an increase in glucose levels. Progesterone increases insulin secretion in the pancreas by involving the process of gluconeogenesis, which can increase blood glucose when insulin production is limited [24]. After menopause, changes in the body's hormones can trigger fluctuations in blood sugar levels. This makes blood sugar levels more difficult to predict than before menopause. If blood sugar levels are not controlled, there is a higher risk of complications of diabetes [25].

The characteristics of patients' blood sugar levels in this study, presented in Table 1, showed that the majority of patients had controlled blood sugar levels as many as 47 patients (62.7%). In this study, the patient's average blood sugar level data for the last 3 months was used to determine the effectiveness of treatment. Blood glucose monitoring is a critical component of the diagnostic and management process for individuals with impaired glucose metabolism or diabetes. This monitoring facilitates the identification of patterns in blood glucose level fluctuations in response to various factors, including diet, exercise, medications, and pathological processes associated with blood glucose fluctuations [26]. The improvement of glycemic control has been demonstrated to reduce morbidity and increase both life expectancy and quality of life for patients. Furthermore, substantial improvements in long-term clinical outcomes have been observed in patients diagnosed with type 2 diabetes [27].

Table 1 also shows that the majority of type 2 DM patients at Nur Hidayah Bantul Yogyakarta Hospital have comorbidities and/or complications, as many as 61 patients (81.3%). The results of research by Ramdini et al. (2020) showed that the majority of type II DM patients with complications were 41 cases, with a percentage of 51.25%. DM patients are more susceptible to complications because poorly controlled blood sugar levels can cause various complications. The longer the patient has diabetes, the more likely complications will occur [20].

The results of the study in Table 2 show that the majority of therapy regimens are given in the form of a combination of oral antidiabetics, namely 52 patients (69.3%). Research by Ananda et al. (2023) showed the results that the majority of patients with type 2 DM received a combination therapy of 2 drugs, as many as 13 patients (59.1%) [28]. The combination therapy often prescribed was metformin and glimepiride. Metformin-sulfonylurea combination therapy is a first-line treatment regimen that is often chosen for type 2 DM due to considerations of cost, availability, and the synergistic mechanism of action of both drugs. However, there is one that is more

effective than the combination of biguanid and sulfonylurea, namely the combination of biguanid (metformin) with DPP-4 inhibitors, the mechanism of action of the two classes of drugs is complementary, and so as to increase the effectiveness in reducing blood sugar levels [29]. Treatment of type 2 DM starts with lifestyle improvement; if unsuccessful, then a single OAD drug can be used. If a single OAD therapy for 3 months cannot control blood sugar, a combination of OAD with different mechanisms or drug classes can be considered [30].

Based on the research results in Table 3, it shows that the majority of drug use was correct for as many as 51 patients (68%). Evaluation of the accuracy of drug use is seen based on the accuracy of all parameters, including the right patient, the right indication, the right drug, the right dose, and the right frequency. The use of drugs is considered appropriate if it meets all the appropriate criteria. The same results were shown by the research of Ananda et al. (2023) that the accuracy of the use of antidiabetic oral drugs in patients with type 2 DM was dominated by the use of appropriate drugs, namely 13 patients (59.09%) [28].

The results in Table 3 show that there is a relationship between the accuracy of the use of oral antidiabetic drugs and the patient's blood sugar level with a significance value of (p-value=0.012). These results are in line with the research of Rizky et al. [31], there is a relationship between the accuracy of the use of oral antidiabetic drugs and the target therapy (p-value=0.014). The control of blood glucose levels can be influenced by the level of patient compliance in taking medication, appropriate food intake, and physical activities such as regular exercise.

Conclusion

Type 2 diabetes mellitus patients at Nur Hidayah Bantul Yogyakarta Hospital are mostly female, aged 45-65 years, with controlled blood sugar levels, and have comorbidities and complications. The profile of oral antidiabetic treatment in patients with type 2 DM is dominated by a combination of two drug therapies, namely metformin and glimepiride, which meet the criteria for appropriate drug use. The results of chi square analysis showed a relationship between the accuracy of drug use with blood sugar levels.

Declaration

Acknowledgments: The authors would like to thank the Nur Hidayah Hospital where the research was conducted and Institute for Research and Community Service Universitas Jenderal Achmad Yani Yogyakarta.

Conflicts of Interest: This study has no conflict of interest.

References

1. American Diabetes Association Professional Practice Committee. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes—2022. *Diabetes Care*. 2021; 45:S17–38. https://doi.org/10.2337/dc22-S002.
2. Galicia-Garcia U, Benito-Vicente A, Jebari S, Larrea-Sebal A, Siddiqi H, Uribe KB, et al. Pathophysiology of Type 2 Diabetes Mellitus. *Int J Mol Sci*. 2020; 21(17):6275. https://doi.org/10.3390/ijms21176275.
3. WHO. *Guidelines for the prevention, management and care of diabetes mellitus*. Cairo: 2006.
4. Indonesian Ministry of Health. *Laporan Nasional Riskesdas 2018*. Jakarta: 2019.
5. Kazi A, Blonde L. Classification of diabetes mellitus. *Clin Lab Med*. 2001; 21(1):1–13.
6. Begic E, Arnautovic A, Masic I. Assessment of Risk Factors for Diabetes Mellitus Type 2. *Mater Sociomed*. 2016; 28(3):187–90. https://doi.org/10.5455/MSM.2016.28.187-190.
7. Lestari MP, Faridah IN, Maliza R, Dania H, Widianingrum M, Perwitasari DA. Identification of SNP rs1799854 ABCC8 gene and blood glucose levels in patients with type 2 diabetes mellitus at Moewardi hospital Surakarta Solo. *Pharmaciana*. 2021; 11(3):338–46. https://doi.org/10.12928/PHARMACIANA.V11I3.19100.
8. Sulastri, Perwitasar DA, Supadmi W. Analisis Efektivitas Biaya Penggunaan Metformin dan Metformin-Glimepirid pada Pasien Diabetes Melitus Tipe 2 di Dua Puskesmas Kulon Progo Yogyakarta: Mellitus Patients at the Two Public Health Centers Kulon Progo Yogyakarta.

Indones J Pharm Nat Prod. 2023; 6(02):143–53. https://doi.org/10.35473/IJPNP.V6I02.2306.
9. Linden S, Erwina W. Terapi Penggunaan Obat Antidiabetik Oral pada Pasien Diabetes Melitus Tipe 2 Rawat Jalan di Rumah Sakit Swasta Samarinda. *J Pharm Sci*. 2022; 5(2):214–26. https://doi.org/10.36490/JOURNAL-JPS.COM.V5I2.127.
10. Sylvia Puspita, Kuncara Nata Waskita, Vivi Rosalina. Efektivitas Antidiabetik Oral Baik Kombinasi Maupun Tunggal Pada Pasien Diabetes Mellitus Tipe Ii Di Rsud Caruban. *J Sains Dan Kesehat*. 2023; 5(2):57–66. https://doi.org/10.57214/jusika.v5i2.293.
11. Chien HH, Chang CT, Chu NF, Hsieh SH, Huang YY, Lee I Te, et al. Effect of glyburide-metformin combination tablet in patients with type 2 diabetes. *J Chin Med Assoc*. 2007; 70(11):473–80. https://doi.org/10.1016/S1726-4901(08)70044-3.
12. Pebriarti IW, Anggitasari W, Mayasari S, Darrojah UN, Pramesti LA. Ketepatan Penggunaan Obat Oral Antidiabetik pada Pasien Diabetes Melitus Tipe 2 di Instalasi Rawat Inap. *Media Pharm Indones*. 2024; 6(1):83–91. https://doi.org/10.24123/MPI.V6I1.6386.
13. Mayasari S, Anggitasari W, Pebriarti IW. Drug rationality profile in diabetes mellitus patients. *J Eduhealth*. 2023; 14(01):175–81.
14. Jha PK, Shukla H, Makwana A, Kakkad A. *Pharmacotherapy of Type 2 Diabetes Mellitus*. In: Chlup R, editor. Type 2 Diabetes 2024 - From Early Suspicion to Effective Management, IntechOpen; 2023. https://doi.org/10.5772/INTECHOPEN.1002309.
15. Apristina A, Nurinda E, Kusumawardani N, Yugistyowati A, Dwinta E. Analisis Hubungan Tingkat Kepatuhan Penggunaan Obat terhadap Luaran Klinis Pasien PROLANIS Program Rujuk Balik Diabetes dengan Hipertensi di Puskesmas Minggir pada Masa Pandemi COVID-19. *Pharm J Indones*. 2023; 8(2):149–56. https://doi.org/10.21776/UB.PJI.2023.008.02.6.
16. Bidulka P, Lugo-Palacios DG, Carroll O, O'Neill S, Adler AI, Basu A, et al. Comparative effectiveness of second line oral antidiabetic treatments among people with type 2 diabetes mellitus: emulation of a target trial using routinely collected health data. *BMJ*. 2024; 385:e077097. https://doi.org/10.1136/BMJ-2023-077097.
17. Sangruangake M, Srisuwan P, Ruangsuksud P, Solikhah S, Sungworawongpana T. The Factor of Association of Diabetes Knowledge in Diabetes Mellitus type 2 patients. *Dis Prev Public Heal J*. 2022; 16(1):70–8. https://doi.org/10.12928/DPPHJ.V16I1.5293.
18. Fitriani F, Barus T. Perbandingan Efektifitas antara Glimepirid dan Glikuidon untuk Menurunkan Glukosa Darah pada Pasien Diabets Melitus Tipe 2 di Rumah Sakit "X" Tahun 2018. *Soc Clin Pharm Indones J*. 2019; 4(2):24–9.
19. Lee YM, Lin PR, Sia HK. Oral antidiabetic therapy versus early insulinization on glycemic control in newly diagnosed type 2 diabetes patients: a retrospective matched cohort study. *Sci Rep*. 2024; 14(1). https://doi.org/10.1038/S41598-024-66468-1.
20. Ramdini DA, Wahidah LK, Atika D. Evaluasi Rasionalitas Penggunaan Obat Diabetes Melitus Tipe II pada Pasien Rawat Jalan di Puskesmas Pasir Sakti Tahun 2019. *J Farm Lampung*. 2020; 9(1):67–76. https://doi.org/10.37090/JFL.V9I1.334.
21. Yazdkhasti M, Jafarabady K, Shafiee A, Omran SP, Mahmoodi Z, Esmaeilzadeh S, et al. The association between age of menopause and type 2 diabetes: a systematic review and meta-analysis. *Nutr Metab (Lond)*. 2024; 21:87. https://doi.org/10.1186/S12986-024-00858-0.
22. Indonesian Ministry of Health. Hari Diabetes Sedunia Tahun 2018 - Penyakit Tidak Menular Indonesia 2018. https://p2ptm.kemkes.go.id/tag/hari-diabetes-sedunia-tahun-2018.
23. Xing Z, Kirby RS, Alman AC. Association of age at menopause with type 2 diabetes mellitus in postmenopausal women in the United States: National Health and Nutrition Examination Survey 2011-2018. *Prz Menopauzalny = Menopause Rev*. 2022; 21(4):229–35. https://doi.org/10.5114/PM.2022.123514.
24. Lee SR, Choi WY, Heo JH, Huh J, Kim G, Lee KP, et al. Progesterone increases blood glucose via hepatic progesterone receptor membrane component 1 under limited or impaired action of insulin. *Sci Rep*. 2020; 10(1):16316. https://doi.org/10.1038/S41598-020-73330-7.
25. Karyati S, Astuti P. Usia Menopause dan Kejadian Diabetes Mellitus. *J Ilmu Keperawatan Dan Kebidanan*. 2016; 7(2):27–31.
26. Mathew TK, Zubair M, Tadi P. Blood Glucose Monitoring. *Med Devices Syst*. 2023. 66–10. https://doi.org/10.5005/jp/books/12651_10.
27. Valentine WJ, Palmer AJ, Nicklasson L, Cobden D, Roze S. Improving life expectancy and decreasing the incidence of complications associated with type 2 diabetes: A modelling study of HbA1c targets. *Int J Clin Pract*. 2006; 60(9):1138–45. https://doi.org/10.1111/j.1742-1241.2006.01102.x.

28. Ananda MS, Kurniawati D, Yuandari E. Evaluasi Penggunaan Obat Antidiabetes pada Pasien Diabetes Mellitus Tipe II di Salah Satu Rumah Sakit Swasta di Banjarmasin. *Innov J Soc Sci Res*. 2023; 3(5):4240–8.
29. Fasha AA, Kusuma IY, Samodra G. Uji Efek Penurunan Glukosa Darah Dapagliflozin Monoterapi dan Kombinasi dengan Glucose Lowering Agent Lainnya. *Pharmacon J Farm Indones*. 2021; 2021(0):97–103. https://doi.org/10.23917/pharmacon.v0i0.15839.
30. PERKENI. *Pedoman Pengelolaan dan Pencegahan Diabetes Melitus Tipe 2 Dewasa di Indonesia 2021*. PB PERKENI; 2021.
31. Rizky WA, Annisaa E, Dini IRE. Relationship of OHA'S Treatment Rationality with Therapy Targets Achievement in Type II Diabetes Mellitus Patients. *Med Sains J Ilm Kefarmasian*. 2024; 9(3):765–70. https://doi.org/10.37874/ms.v9i3.1188.