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Analysis of Drug Use and Potential Interactions in Type 2 Diabetes Inpatients at a Type C Hospital, Kediri (2024)

Anis Akhwan Dhafin[1], Elsa Mahardika Putri[2], Herman[3], Pulung Prabowo[4], Prayoga Feri Yuniarto[5], Winartiana[6], Luh santhi Utami Wiryani[7*]

[1,2,3,4,5,6)] Bachelor of Pharmacy, Universitas Kadiri, Indonesia
[7)]Bachelor of Pharmacy, Universitas Mahasaraswati Denpasar, Indonesia

Email :
anisdhafin13@unik-kediri.ac.id

ABSTRACT

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder with a high prevalence and frequent comorbidities, particularly hypertension, which often require multidrug therapy and increase the risk of drug interactions. This study aimed to analyze the pattern of antidiabetic drug use and the potential for drug interactions in hospitalized patients with T2DM at a type C hospital in Kediri City during June–December 2024. The research employed a retrospective descriptive design using medical record data of 44 patients who met the inclusion criteria. Data were analyzed descriptively and presented in frequency distribution tables. Results showed that the most commonly prescribed drug class was biguanides (26.25%), followed by sulfonylureas (21%), insulin (21%), and α-glucosidase inhibitors (12.5%). Combination therapy was widely used, particularly the combination of two oral antidiabetic agents. Potential drug interactions were identified in 72.73% of patients, with moderate interactions being the most frequent (78.13%), followed by minor (12.5%) and major (9.38%) interactions. The most common interactions included metformin with amlodipine or ramipril (moderate severity), captopril with hydrochlorothiazide (minor severity), and simvastatin with amlodipine (major severity). However, in this study polypharmacy was defined as the concomitant use of ≥5 medications. These findings indicate that such polypharmacy in T2DM patients with hypertension substantially increases the likelihood of drug interactions, underscoring the importance of careful monitoring and rational prescribing to improve patient safety.

Keywords: Type 2 Diabetes Mellitus, Hypertension, Drug Use, Drug Interactions

Introduction

According to the International Diabetes Federation Diabetes Atlas 11th Edition, (2025), approximately 589 million adults aged 20-79 years are living with diabetes worldwide, representing 11.1% of this age group. This number is projected

to rise to 853 million by 2050, marking an increase of about 45%. Over 90% of individuals with diabetes have type 2 diabetes mellitus, and more than 250 million cases around 42% remain undiagnosed.

In Indonesia itself, based on a report from the Kediri City Health Office, the prevalence of DM sufferers was 2599 cases and at the Sukorame Health Center there were 190 cases in 2024. Type 2 DM sufferers recorded in the Sukorame Health Center work area were 315 people (Ramayanti et al., 2025). The number of Type 2 DM sufferers is spread across seven sub-districts in the Sukorame Health Center work area, but the largest distribution of Type 2 DM sufferers is in Bujel Village, around 46 people. Diabetes mellitus is a chronic metabolic disorder that occurs due to an imbalance in the body's production or response to insulin, a hormone that plays a role in regulating blood glucose levels. When the body lacks insulin or cannot utilize it optimally, blood sugar levels increase, known as hyperglycemia (American Diabetes Association (ADA), 2017).

The most common type of diabetes is type 2 diabetes mellitus, which generally occurs due to insulin resistance or insufficient insulin production. Genetic and lifestyle factors play a major role in its development. Although it more often attacks individuals over the age of 40, cases in younger age groups are also starting to increase. Treatment of this condition can be done through lifestyle changes and insulin therapy if needed (PERKENI, 2021). Patients with type II diabetes mellitus who experience complications require multiple medications for their treatment, which can increase the risk of side effects and unwanted drug interactions (Maimanah *et al*., 2020). Drug interactions are the modification of the effect of one drug due to another drug administered initially or concurrently, altering its effectiveness (Iskandar *et al*, 2021). These interactions can lead to uncontrolled blood glucose levels, affecting patient mortality, morbidity, and quality of life.

Almost 90% of all diabetes cases in the world are type 2. Globally, diabetes is among the top ten leading causes of death and triggers various serious complications such as blindness, heart disease, and kidney failure (Kemenkes, 2020a).

Considering the large burden of this disease and its potential complications, health care facilities, especially hospitals, play an important role in efforts to control and manage type 2 diabetes mellitus. Therefore, this study focuses on assessing management strategies and drug interactions of type 2 DM in patients treated at one of the type C hospitals in Kediri City.

Methodology

This is a retrospective, descriptive study aimed to analyze drug use patterns and interactions in hospitalized patients with type 2 diabetes mellitus. A descriptive approach was chosen to capture the true situation based on medical record data without direct intervention.

Data collection was conducted retrospectively from July to December 2024 at a type C hospital in Kediri City. The study population included all inpatients diagnosed with type 2 diabetes who underwent therapy during that period.

The study sample was determined using a purposive sampling technique, which is a selection based on specific criteria determined by the researcher. Data analysis of potential drug interactions was performed using the Drug Interaction Checker (Medscape and Lexicomp). The severity of interactions was classified into three categories based on Lexicomp and Medscape standards:

- **Minor:** The interaction may cause limited clinical effects, such as manifestations that include an increase in the frequency or severity of side effects but generally would not require a major adjustment of therapy. Monitoring is usually sufficient, and the effect is often inconvenient but not medically detrimental.
- **Moderate:** The interaction may worsen the patient's clinical condition or require an alteration of therapy, such as dose adjustment or closer monitoring. Evidence suggests a clinically significant interaction where the patient's condition may deteriorate, necessitating additional care to avoid negative outcomes.
- **Major:** The interaction may be life-threatening, cause permanent damage, or require immediate medical intervention to prevent serious outcomes, such as discontinuation of drugs, hospitalization, or specific treatment. It is often contraindicated, with risks outweighing benefits).

Based on these criteria, 44 patients met the sample requirements. Data analysis of potential drug interactions was performed using the Drug Interaction Checker (Medscape, Lexicomp). The severity was categorized as: Minor: Small clinical effect. Moderate: May worsen the condition or require adjustment of therapy. Major: Potentially life-threatening or require immediate medical intervention. The data obtained were analyzed descriptively and presented in a frequency table depicting the number and percentage of use of each type of medication and the potential for antidiabetic drug interactions. These results provide an overview of therapy patterns and potential drug interactions for type 2 diabetes in hospitalized patients.

Result and Discussion

A. Characteristics of Type 2 DM Patients Hospitalized at a Type C Hospital in Kediri City

Based on research related to the pattern of antidiabetic drug use in hospitalized patients with type 2 DM in one of the type C hospitals in Kediri City for the period July-December 2024, data was obtained from 44 patients who met the criteria. This data was collected through a review of medical records during July to December 2024. The results obtained are as follows:

Table 1. Characteristics Patient

Characteristics	Amount	Percentage (%)
Gender		
Woman	26	59.1
Man	18	40.9
Age (WHO, 2022)		
≤60 (Adult)	12	22.7
60-74 (Elderly)	24	54.5
≥75 years (Very Elderly/High-Risk Elderly)	8	18.2
Accompanying Diseases		
DM without any accompaniment	10	22.7
DM with Companion	34	77.3
Total	44	100

Table 1 shows the characteristics of patients where female patients numbered 26 patients (59.1%) and male patients numbered 18 patients (40.9%). For the gender of inpatients with type 2 DM, the age group 46-80 years (elderly) numbered 36 patients (81.8%) and the age group ≥35-45 years numbered 8 patients (18.2%). For type 2 DM patients without comorbidities, there were 10 patients (22.7%) and type 2 DM patients with comorbidities numbered 34 patients (77.3%).

Table 1 shows that the majority of patients diagnosed with type 2 DM were over 46 years of age, as many as 36 patients (81.8%) and ≥ 35-45 years of age, as many as 8 people (18.2%). According to Pangestika *et al*., (2022), people over 45 years of age have a greater risk of experiencing glucose intolerance due to degenerative factors, namely the weakening of the body's glucose metabolism. The American Diabetes Association, (2017) states that age 45 years and over is a risk factor for diabetes. In the elderly, physiological body function will decrease due to aging so that it can experience apoptosis (death) of pancreatic β cells, insulin and glucose production in the liver (hepatic glucose production) increases, insulin resistance and insulin secretion are disrupted. Patients with a normal body index, more disorders in insulin resistance in peripheral tissues such as muscle cells, liver cells, and fat cells (adipocytes)

This study indicates that the presence of comorbidities is a primary driver for medication prescription among most Type 2 DM patients. Data from Table 1 corroborates this, detailing that 77.3% (n=34) of patients presented with comorbidities notably hypertension and hyperlipidemia whereas 22.7% (n=10) had none. This high prevalence of comorbidities aligns with existing evidence that an increase in age correlates with a higher burden of chronic disease (Thorell et al., 2020). The elderly population is particularly susceptible to multipathology (suffering from more than one illness) as a consequence of physiological decline associated with the aging process (Kemenkes, 2019). This phenomenon is mirrored in a World Health Organization (WHO, 2002), report, which identified that conditions such as cardiovascular disease, hypertension, diabetes mellitus, stroke, chronic obstructive pulmonary disease (COPD), and musculoskeletal disorders (e.g., arthritis and osteoporosis) are the most common ailments affecting the elderly worldwide (Kemenkes, 2019).

B. Overview of Drug Use

Table 2. Overview of Drug Use

Group	Type 2 DM medication	Amount of Drugs	Percentage (%)
Biguanid	Metformin 500mg	28	35
Sulfonylureas	Glimepiride 2mg	19	23.75
	Glibenclamide 5mg	2	2.5
a-glucoside inhibitor	Acarbose 100mg	10	12.5
Insulin	Lever	11	13.75
	Lantus	4	5
	Glargine	2	2.5
	Apidra fast	2	2.5
	Novorapid cpt	2	2.5
Total		**80**	**100**

Table 2 shows the results of the administration of type 2 DM drugs to hospitalized patients in one of the hospitals in Kediri City, the results obtained were the administration of biguanide drugs, namely metformin 500mg as many as 28 prescriptions (35%), sulfonylurea group, namely glimepiride 2mg as many as 19 prescriptions (23.75%) and glibenclamide 5mg as many as 2 prescriptions (2.5%). The a-gluoxidase inhibitor group, namely acarbose 100 mg as many as 10 prescriptions (12.5%). And the insulin drug group, namely insulin Levemir 11 prescriptions (13.75%), Lantus as many as 4 prescriptions (5%), Glargine, Apidra and Novorapid each as many as 2 prescriptions (2.5%).

According to PERKENI, (2021) the first choice therapy guideline for type 2 DM patients when the HbA1c is checked <7%, then treatment begins with healthy lifestyle modifications and oral monotherapy such as metformin or Sulfonylurea or a-gluoxidase inhibitors or thiazolidinediones or DPP-4 inhibitors or GLP-1 receptor agonists or SGLT-2 inhibitors. The second stage if the HbA1c target is >7.5% with metformin monotherapy can be used with one of the Sulfonylurea, Thiazolidinediones, DPP-4 inhibitors, GLP-1 receptor agonists, SGLT-2 inhibitors, or insulin groups. The third stage of type 2 DM when the HbA1c examination is checked >9% accompanied by symptoms of metabolic decompensation, then combination therapy of insulin with other hypoglycemics is given (Soelistijo, 2021). Several studies conducted in various countries, namely Nigeria (19), Turkey (20), India (21), and Malaysia (22) found that >50% of type 2 DM patients with comorbidities and/or complications used metformin, either alone or in combination. Metformin is the main choice for the treatment of type 2 DM with comorbidities of dyslipidemia and macrovascular complications that can be used alone or in combination according to the patient's clinical condition and blood glucose examination parameters (HbA1c, fasting blood glucose (FBS), random blood glucose, and blood glucose 2 hours after glucose administration) based on the American Diabetes Association and the Indonesian Endocrinology Association therapy guidelines. (Soelistijo, 2021). Metformin can improve insulin sensitivity by reducing glucose production in the liver and improving glucose uptake in peripheral tissues (Soelistijo, 2021). In addition, metformin has advantages over other antidiabetics, namely it does not

affect weight gain, does not cause hypoglycemia side effects, and has a low selling price (Tanwar et al., 2021). The results of this study are almost the same as the study by Annisa *et al* ., (2021) that in the Biguanide group, metformin was given with a prescription of 60 (33.85%). The way metformin works is by reducing liver glucose production (gluconeogenesis), and improving peripheral glucose uptake (Kemenkes, 2020b).

Then the two most commonly prescribed type 2 DM drugs are the sulfonylurea group, which is 21 prescriptions (26.25%). Glimepiride 19 prescriptions and glibenclamide 2 prescriptions. Glimepiride is widely used because glimepiride can help lower blood sugar levels with a single low daily dose and this glimepiride drug rarely causes hypoglycemia in sufferers (Kurniawati *et al* ., 2021) . In the study by Malihah & Emelia (2022)), the same results were obtained with the most frequently used sulfonylurea group, namely Glimepiride 61 (62.88%).

The antidiabetic group that is often used in research is the a-glucosidase inhibitor group with the drug given being acarbose 100 mg as many as 10 prescriptions (12.5%). Research by Malihah & Emelia, (2022) obtained the results of the use of acarbose100 mg as many as 5 prescriptions (3.3%), acarbose is rarely prescribed because it has common side effects, namely diarrhea and excessive gas formation in the stomach (Malihah & Emelia, 2022) . Drugs that are included in the a-glucosidase inhibitor group are acarbose and miglitol. The mechanism of both is by inhibiting a-glucosidase so as to prevent the breakdown of sucrose and complex carbohydrates in the small intestine, thus slowing down and proving that a-glucosidase inhibitors are effective in controlling fasting glucose levels and postprandial glucose levels in diabetic patients (Malihah & Emelia, 2022) .

The last class of drugs used in the therapy of type 2 DM in this study was insulin with 21 prescriptions (26.25%). Insulin therapy is given to patients with HbA1C levels> 9.0% or patients who do not reach blood glucose targets when treated with oral drugs either as monotherapy or in combination. The target for insulin use is when random blood glucose is> 250 mg/dl (Soelistijo, 2021) . This study used insulin with a different working system and is often combined, namely fast-acting analog insulin and long-acting analog insulin. The fast-acting insulin used was Novorapid insulin with 2 prescriptions (2.5%) and Apidra with 2 prescriptions (2.5%) and the slow-acting analog insulin used was Levemir insulin with 11 prescriptions (13.75%), Lantus with 4 prescriptions (5%) and insulin glargine with 2 prescriptions (2.5%). Research from Annisa *et al* ., (2021) had almost the same results as insulin aspart with 26 prescriptions and insulin glargine with 13 prescriptions. Insulin glargine is a human insulin analog that has a long-acting period. The main function of insulin glargine is as a regulator of glucose metabolism, in addition, insulin has anabolic and anti-catabolic effects in several body tissues. Insulin aspart is a fast-acting insulin analog to lower blood glucose in humans. The onset of insulin aspart is 15-30 minutes (Malihah & Emelia, 2022) .

Fast-acting analog insulin and long-acting analog insulin. The fast-acting insulins used was Novorapid (generic name: insulin aspart) with 2 prescriptions (2.5%) and Apidra (generic name: insulin glulisine) with 2 prescriptions (2.5%). The slow-acting analog insulin used was Levemir (generic name: insulin detemir) with

11 prescriptions (13.75%), Lantus (generic name: insulin glargine) with 4 prescriptions (5%), and insulin glargine (generic name: insulin glargine) with 2 prescriptions (2.5%). Research from Annisa et al. (2021) had almost the same results as insulin aspart with 26 prescriptions and insulin glargine with 13 prescriptions. Insulin glargine is a human insulin analog that has a long-acting period. The main function of insulin glargine is as a regulator of glucose metabolism, in addition, insulin has an anabolic and anti-catabolic effects in several body tissues. Insulin aspart is a fast-acting insulin analog to lower blood glucose in humans. The onset of insulin aspart is 5-15 minutes(Drugs.com, 2023).

Several types of insulin have been given to patients with diabetes mellitus, namely insulin aspart, insulin glulisine, insulin glargine, and insulin premix. Insulin is given to patients with type 2 diabetes mellitus if the blood sugar target is not achieved with oral hypoglycemic drugs. Insulin aspart is a rapid-acting analog insulin to lower blood glucose in humans. The onset of insulin aspart is 15-30 minutes. Insulin detemir is a long-acting human analog insulin to provide a low, constant, and reproducible supply of plasma insulin for up to 24 hours. The onset of insulin detemir is 2 hours. Insulin glargine is a long-acting human analog insulin prepared to modify the chemical structure of insulin to allow slow release. The onset of insulin glargine is 4-5 hours. Antidiabetics used for the therapy of patients who meet the inclusion criteria are metformin, glibenclamide, glimepiride, acarbose, insulin aspart, insulin detemir, insulin glargine, and insulin premix. These drugs comply with the drug administration standards set by the Drug Information Handbook (DIH) (Lacy et al., 2011).

C. Type 2 DM Drug Usage Patterns Based on Treatment Therapy

Table 3. Pattern of use of DM type drugs based on treatment therapy

Types of Therapy	Amount of Drugs	Percentage (%)
Single Drug	11	12.2
Combination of 2 drugs	30	33.3
Combination of 3 Drugs	22	24.4
Combination of 4 Drugs	5	5.5
Single Insulin	3	3.3
Combination of 2 Insulins	6	6.6
Combination of Drugs and Insulin	13	14.4
Total	**90**	**100**

Table 3 shows the results of the pattern of use of type 2 DM drugs based on the treatment therapy given to inpatients with type 2 DM in one of the type C hospitals in Kediri city, namely for the type of Single drug therapy there are 11 prescriptions (12.2%), the category of combination therapy type 2 drugs as many as 30 prescriptions (33.3%), the category of combination therapy type 3 drugs as many as 22 prescriptions (24.4%), the type of combination therapy type 4 drugs as many as 5 prescriptions (5.5%). And for the pattern of use of type 2 DM drugs, the type of therapy using single insulin as many as 3 prescriptions (3.3%), the combination of 2

insulins as many as 6 prescriptions (6.6%) and the combination of drugs and insulin as many as 13 prescriptions (14.4%).

From the data in table 3, it can be seen that the most common treatment therapy used in type 2 DM patients in one of the type C hospitals in Kediri City in the period July-December 2024 was a combination of 2 types of drugs, with a total of 30 prescriptions. Furthermore, there was a combination of 3 types of drugs with 22 prescriptions, followed by the use of a combination of drugs and insulin with 13 prescriptions. Furthermore, there was a combination of a single drug with 11 prescriptions, then treatment with a combination of 2 insulins with 6 prescriptions. The combination of 4 drugs was recorded with 5 prescriptions, and the last was the use of a single insulin with 3 prescriptions. The combination of 2 types of type 2 DM drugs is most often used because according to PERKENI (2021) combination therapy of oral antihyperglycemic drugs, either separately or fixed dose combination, must use two types of drugs with different mechanisms of action [8]. The combination of drugs with insulin has 11 prescriptions because in certain circumstances if the target blood glucose level has not been achieved with 2 types of drugs, a combination of antihyperglycemic drugs with insulin can be given. A combination of 3 drugs with 22 prescriptions is used because in patients who are accompanied by clinical reasons and insulin is not possible to use, a combination of 3 oral drugs can be given (Soelistijo, 2021) . The use of a single oral drug is due to the initial therapy for the management of type 2 DM with HbA1c levels <7.5%, while in single insulin therapy, 3 prescriptions are given, this shows that there are 2 patients diagnosed with type 2 DM with an increase in HbA1c levels> 9% (Soelistijo, 2021) . Combination therapy of 2 insulins has 2 different types of insulin action with insulin with a fast-acting analog mechanism combined with a long-acting analog, so it will achieve the goal of therapy in type 2 DM patients which will reduce HbA1c levels (Malihah & Emelia, 2022).

D. Potential Interaction

Patients with type 2 diabetes mellitus and hypertension complications often use a variety of medications for their treatment. Using multiple medications can increase the risk of side effects and potentially lead to unwanted drug interactions. Potential drug interactions in patients with type 2 diabetes mellitus and hypertension complications are shown in Table 4.

Tabel 4. Potential Drug Interactions Based on Number of Patients

Interaction Events	Number of Patients (n=44)	Percentage (%)
Interaction Occurred	32	72.73
No Interaction Occurred	12	27.27

Based on Table 4, the analysis using Lexicomp, Stockley's Drug Interactions, and Medscape indicated that a greater proportion of patients experienced drug interactions (n = 32, 72.73%) compared to those who did not (n = 12, 27.27%). Murwati and Murtisiwi, (2021) reported similar findings, where among 170 patients with type 2 diabetes mellitus and hypertension complications, 106

patients (62%) had the potential for drug interactions, while 64 patients (38%) did not. Drug interactions may occur when a patient receives two or more medications, which can modify the efficacy or toxicity of one or more of the drugs involved. Meiliana *et al.,* (2023) explained that diabetes mellitus requires the use of multiple medications to prevent or manage its complications, leading patients to receive various types of drugs simultaneously.

E. Severity of Interaction

Potential drug interactions in patients with type 2 diabetes mellitus complicated by hypertension are divided into three groups based on the severity of the interaction: minor, moderate, and major. The severity of drug interactions is shown in Table 5.

Tablet 5. The severity of drug interactions

Severity Level	Number of Events (n=32)	Percentage (%)	P
Minor	4	12.5	
Moderat	25	78.13	0,0004
Major	3	9.37	

Table 5 indicates that patients with type 2 diabetes mellitus and hypertension encountered drug interactions most frequently at moderate severity (n=25, 78.13%), followed by minor severity (n=4, 12.5%), and major severity (n=3, 9.38%).

In this study, moderate drug interactions were predominant among patients with type 2 diabetes mellitus and comorbid hypertension. A moderate interaction is characterized as clinically relevant, necessitating careful monitoring, dosage modifications, or exploration of alternative treatments; however, it is typically not immediately life-threatening when properly addressed. Various standard combination therapies for cardiometabolic disorders exhibit the possibility of moderate interactions via both pharmacokinetic and pharmacodynamic pathways.

The predominant interactions arise from the concurrent administration of beta-blockers with insulin or sulfonylureas. Beta-blockers, particularly non-selective variants such as propranolol, can obscure adrenergic indicators of hypoglycemia, including tachycardia and tremors, while also postponing the restoration of normal blood glucose levels post-hypoglycemic event. This heightens vulnerability to severe hypoglycemia or unawareness of hypoglycemia. Both Medscape and Lexicomp highlight that this hazard is diminished with cardioselective beta-blockers like bisoprolol, yet vigilant glucose monitoring remains crucial, especially at the onset of treatment or during antidiabetic dosage alterations (Medscape, 2025a). The simultaneous use of metformin and bisoprolol may elevate the risk of hypoglycemia through a pharmacodynamic mechanism of moderate severity. This scenario calls for glucose monitoring or antidiabetic dose adjustments as needed (Medscape., 2025).

Another observed drug interaction is between metformin and amlodipine. Amlodipine may reduce the effectiveness of metformin, leading to hyperglycemia. This interaction occurs through a pharmacodynamic mechanism with moderate

severity. Therefore, it is recommended to monitor blood glucose levels regularly when these two drugs are administered together (Zulfa, 2021). In addition, spacing the administration of metformin and amlodipine is advised to minimize potential interaction effects (Indrawan & Yulianti, 2024)

The second most common drug interaction identified was the combination of metformin and ramipril, with five reported cases. Concomitant use of these agents can enhance the effects of metformin through a moderate pharmacodynamic mechanism. As a result, regular monitoring of blood glucose levels is required (Medscape., 2025).

Minor interactions refer to drug interactions of low clinical significance, which usually do not cause serious adverse effects but still warrant monitoring. In this study, a minor interaction was observed between an ACE inhibitor (captopril) and a thiazide diuretic (hydrochlorothiazide). According to Medscape and Lexicomp, this combination may have additive blood pressure–lowering effects, potentially leading to orthostatic hypotension, particularly at the initiation of therapy or during dose escalation (Medscape, 2025b). Nonetheless, this regimen remains widely used in clinical practice due to its synergistic benefits in controlling blood pressure among hypertensive patients with type 2 diabetes. To minimize adverse outcomes, gradual dose titration and close monitoring of blood pressure are recommended, especially in elderly patients or those with a history of hypotension (Sormin & Qoonitah, 2021).

Minor interactions may also occur when metformin is administered concurrently with furosemide. The concomitant use of these drugs can increase the effects of metformin and potentially trigger lactic acidosis through a moderate pharmacokinetic mechanism (Medscape., 2025). Furosemide may elevate plasma concentrations of metformin, leading to hypoglycemia, while metformin can reduce furosemide levels (Ameilia & Sumiwi, 2023). Both drugs are excreted via the renal tubules and compete for the same tubular transport system, which may further increase metformin accumulation. Under such circumstances, regular monitoring of blood glucose is essential, and separating the administration time of metformin and furosemide is recommended to minimize the risk of hypoglycemia (Nurlaelah *et al*, 2015)).

This finding is in line with research by Caruana *et al.*, (2024), who reported that minor drug interactions are common among patients with diabetes and hypertension, though they rarely result in clinical consequences that necessitate changes in therapy.

In contrast, major interactions are associated with more severe clinical outcomes. This study identified three cases of major interactions with the potential to cause serious harm. One example is the interaction between simvastatin and amlodipine. According to Medscape, amlodipine inhibits simvastatin metabolism via the CYP3A4 pathway, resulting in elevated plasma concentrations of simvastatin (Medscape., 2025). Consequently, the risk of myopathy and rhabdomyolysis significantly increases, particularly at doses exceeding 20 mg per day. Lexicomp recommends limiting the simvastatin dose or considering

alternatives such as pravastatin or rosuvastatin, which undergo minimal CYP3A4 metabolism (Lexicomp, 2025a).

Another notable major interaction involves combining an ACE inhibitor or ARB (losartan) with spironolactone or other potassium-sparing diuretics. Both drug classes elevate serum potassium levels by inhibiting the renin-angiotensin-aldosterone system. When used together, the risk of severe hyperkalemia rises, potentially leading to life-threatening arrhythmias (Lexicomp, 2025b). Lexicomp advises avoiding this combination unless absolutely necessary, and if used, it should be accompanied by close monitoring of serum potassium and renal function (Lexicomp, 2025a).

These results align with the findings of Murwati dan Murtisiwi, (2021), who reported that major interactions in diabetic patients with hypertension often involve combinations of antihypertensive agents with lipid-lowering drugs or insulin. Although less frequent, major interactions warrant greater attention due to their potentially serious impact on patient safety.

Conclusion

Based on the analysis of research data and discussion, conclusions were drawn regarding the pattern of drug use in hospitalized patients with type 2 diabetes mellitus at a type C hospital in Kediri City during the period of July–December 2024. The study found that five classes of drugs were utilized in therapeutic management. The Biguanide group was the most frequently used (35%), followed by Sulfonylureas (26.25%), Insulin (26.25%), and α-glucosidase inhibitors (12.5%). The incidence of drug interactions was categorized as minor (12.5%), moderate (78.13%), and major (9.38%). Patients with type 2 diabetes mellitus and hypertension complications experienced drug interactions more frequently (n = 32, 72.73%) compared to those without drug interactions (n = 12, 27.17%). In terms of severity, moderate interactions were the most common (n = 25, 78.13%), followed by minor interactions (n = 4, 12.5%) and major interactions (n = 3, 9.38%).

Declaration of Competing Interest

The author has no commercial or financial relationships to disclose that could be perceived as a potential conflict of interest regarding this study.

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