

EFFECTIVENESS OF ANTIDIABETIC DRUG USE IN TYPE II DIABETES MELLITUS PATIENTS AT BAUBAU CITY GENERAL HOSPITAL IN 2023

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ARTICLE INFORMATION

Received: 8 April 2026
Revised : 6 May 2026
Accepted: 12 June 2026
DOI:

KEYWORDS

Antidiabetic, blood glucose level, , effectiveness, Type II diabetes mellitus.

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A B S T R A C T

Background: Type II diabetes mellitus is a chronic, long-term disorder marked by elevated blood glucose levels, resulting from the body's inability to effectively utilize insulin or insufficient insulin production. Proper management is essential to maintain blood glucose within normal limits and to prevent severe complications. **Objective:** This study aimed to evaluate the effectiveness of oral antidiabetic drugs and combined insulin therapy in individuals with type II diabetes mellitus. **Sample/Subjects:** Data were collected from the medical records of patients with type II diabetes mellitus without complications who were admitted to Baubau City General Hospital in 2023. **Method:** This study used a descriptive retrospective approach with a quantitative method. Twenty-two patients satisfying the inclusion criteria were analyzed in terms of the percentage change in their random blood glucose. **Result:** The combination of Glaritus and Novorapid achieved the highest reduction of 66.02%, although it showed high variability across patients (SD ± 382.99). The combination of Novorapid and Levemir produced a 59.29% reduction with better stability (SD ± 155.24). Meanwhile, Metformin and Glibenclamide achieved a smaller reduction of 42.55% but with the highest stability (SD ± 77.30). The four-drug regimen (Metformin, Glimepiride, Novorapid, Levemir) resulted in a 55.60% reduction with moderate stability. **Conclusion:** The selection of antidiabetic therapy should be tailored to clinical goals. Insulin combinations are highly effective for rapid glucose reduction, while oral combinations provide greater stability. Therapy choice should consider the patient's individual needs to achieve optimal glycemic control.

INTRODUCTION

According to data from the International Diabetes Federation (IDF), in 2021 the number of people with diabetes worldwide reached approximately 537 million, within the age range of 20 to 79 years. The IDF data also indicated that Indonesia ranked as the country with the fifth-highest number of diabetes cases in the world, with 19.5 million cases reported in that year (IDF, 2021). The prevalence of diabetes mellitus in Southeast Sulawesi Province has been among the ten most common diseases in recent years, with type 2 diabetes cases being more prevalent than type 1 diabetes cases. From ranking 9th with 2,768 cases in 2014, diabetes mellitus rose to 5th place in 2015, with a total of 3,206 cases (Rini et al., 2023)

Diabetes mellitus is a heterogeneous condition characterized by elevated blood glucose levels, known as hyperglycemia. In healthy individuals, glucose from food enters the bloodstream and is regulated by the hormone insulin produced by the pancreas. However, in individuals with diabetes mellitus, the body's cells do not respond properly to insulin, or the pancreas ceases to produce insulin (Mustofa et al., 2021). Essentially, this disease arises because insulin is either insufficient or unable to function effectively, despite its vital role in maintaining blood glucose levels at around 60–120 mg/dl during fasting and below 200 mg/dl two hours before meals (Nurjaman, 2019). Historically, diabetes mellitus has been recognized since 1552 BC by the Egyptians, who identified the disease through symptoms such as frequent urination, weight loss, and pain. In 400 BC, an Indian physician named Sushruta described the disease as 'honey urine.' Later, in 200 BC, the term 'diabetes mellitus' began to be used (Riamah, 2022). This disease is often considered not dangerous, whereas in fact more than 50% of cardiovascular disease cases are directly related to diabetes, and data even show that every six seconds one person, or about ten people per minute, dies due to diabetes, making it one of the leading causes of death worldwide (Tandra, 2017).

The majority of diabetes mellitus patients suffer from type II diabetes mellitus, commonly referred to as non-insulin-dependent diabetes, which results from the ineffective utilization of insulin

in the body; its symptoms are similar to those of type I diabetes, including excessive thirst, frequent urination, increased hunger, weight loss, blurred vision, and fatigue, although in many cases it may present with vague symptoms or even without symptoms at all (Nasif & Nursyafni, 2023). Type II diabetes mellitus is the most common form of diabetes worldwide, accounting for approximately 90–95% of all cases (Priyanto et al., 2022) and this condition occurs because of reduced sensitivity of body cells to insulin, so that the insulin produced cannot be optimally utilized, a state known as insulin resistance. The disease does not only occur due to genetic factors, but is also strongly influenced by unhealthy lifestyle habits such as overeating, lack of physical activity, and sedentary behavior, which ultimately increase obesity cases as one of the major risk factors for developing diabetes. As the number of type II diabetes mellitus patients continues to increase, the impact is not limited to individual health problems but also affects the overall quality of human resources, considering that complications from this disease often reduce patient productivity. Moreover, the economic burden also grows significantly due to increased costs of care and treatment, type II diabetes mellitus has become one of the major health problems for communities in various countries, including Indonesia (Kasmawati et al., 2023).

A previous study on the effectiveness of single and combination oral antidiabetic drugs in type 2 diabetes mellitus patients undergoing therapy at RSUD Kota Kendari was conducted by Wa Ode Masiani in 2024, focusing on evaluating treatment effectiveness by measuring the average percentage reduction in blood glucose levels before and after drug administration (Masiani et al., 2024). The study results revealed that among single oral antidiabetic drugs, Metformin was the most effective, with a blood glucose reduction of 35.06%, followed by Glibenclamide at 31.06%, Glimepiride at 27.75%, Gliclazide at 26.75%, Gliquidone at 24.75%, and Acarbose at 23.96%. For combination oral antidiabetic drugs, the findings showed that Metformin + Glimepiride achieved the most significant reduction in blood glucose levels at 38.58%, followed by Glimepiride + Acarbose at 31.05%, Metformin + Glibenclamide at 30.28%, Acarbose + Glibenclamide at 29.35%, Metformin + Acarbose at 28.17%, and Metformin + Gliclazide at 27.04%. This study emphasized that both single and combination oral antidiabetic drugs can reduce blood glucose levels, although their effectiveness varies depending on the type of drug or combination used, with Metformin consistently showing the best results both as a single agent and in combination. However, the study had several limitations, such as the inability to identify factors influencing blood glucose fluctuations, the absence of fasting blood glucose data collection, and the lack of direct assessment of patient health conditions, as the research relied solely on medical records from patients at RSUD Kota Kendari (Masiani et al., 2024).

Based on previous research data showing an increase in diabetes mellitus cases, as well as studies conducted on the effectiveness of single and combination oral antidiabetic drugs in Kendari City, the researcher is interested in conducting a similar study in their own region, namely at Baubau City General Hospital. This research focuses on the inpatient ward, as patients are under direct supervision of medical personnel. Therefore, the researcher carried out a study entitled, “Effectiveness of Antidiabetic Drug Use in Type II Diabetes Mellitus Patients at Baubau City General Hospital in 2023”.

METHODOLOGY

This study employed a retrospective descriptive design with a quantitative approach. The data used were secondary data obtained from the medical records of type II diabetes mellitus patients without complications who were hospitalized at Baubau City General Hospital. The study population included all type II diabetes mellitus patients admitted to the hospital from January to December 2023, totaling 106 patients. From this population, 22 patients were selected as the sample based on inclusion criteria, namely patients without complications, hospitalized for ≥ 4 days, and possessing complete medical records. Patients with complications or incomplete data were excluded from the sample. The study was conducted in the medical records department of Baubau City General Hospital in 2025, focusing on data from 2023. Data collection was carried out through a review of medical record documents using a data collection sheet as the research instrument. Data analysis was descriptive, performed by calculating the average change in blood glucose levels before and after therapy, complemented by the calculation of standard deviation (SD) and standard error (SE) to assess the consistency and accuracy of the mean results.

The formula for calculating the percentage reduction (Masiani et al., 2024) used in this study is as follows:

$$\frac{\text{Initial Value} - \text{Final Value}}{\text{Initial Value}} \times 100$$

The formulas for SD (Anita et al., 2023) and SE (Amaliana & Fernandes, 2019) were also used, as follows:

$$SD = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

$$SE = \frac{SD}{\sqrt{n}}$$

RESULTS AND DISCUSSION

Based on the results of the study conducted on 63 type 2 diabetes mellitus inpatients at Baubau City General Hospital in 2023, data were obtained on patient characteristics according to sex, age, length of hospitalization, and the drugs used.

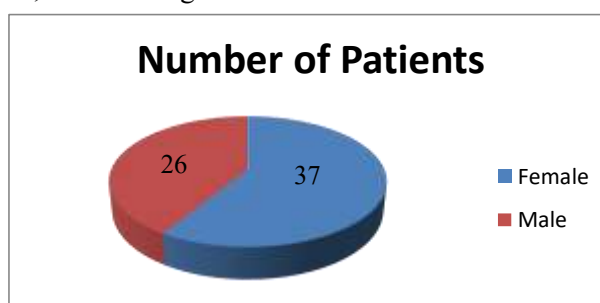


Figure 1. Distribution of Patients by Sex

Based on **Figure 1**, it can be seen that the majority of patients were female, totaling 37 individuals (58.70%), while male patients numbered 26 individuals (41.30%). These data indicate that the incidence of type 2 DM hospitalization was higher among females than males. This finding is consistent with the study by Puspita (2021), which reported that the prevalence of type 2 DM at Caruban General Hospital was higher in females than in males (Puspita et al., 2023). Females have a higher risk of developing diabetes mellitus compared to males, as unhealthy lifestyles are more frequently observed among women. In addition, many women are not engaged in occupational activities, resulting in lower levels of physical activity. Hormonal changes after menopause also contribute to easier accumulation of body fat (Rita, 2018).

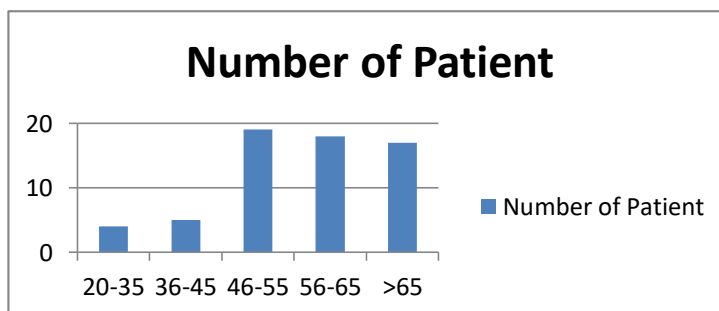


Figure 2. Distribution of Patients by Age

Based on **Figure 2**, the age distribution of patients shows that the age group with the highest number of hospitalizations was 46–55 years, with 19 patients (30.16%). This was followed by the 56–65 year group with 18 patients (28.57%) and those over 65 years with 17 patients (26.98%). Meanwhile, the 36–45 year and 20–35 year groups recorded the lowest proportions, at 7.94% and 6.35%, respectively. These data indicate that type 2 DM cases requiring hospitalization are more common in older adults and the elderly. The majority of type 2 diabetes mellitus cases generally occur in individuals aged 40 years and above. This is due to the tendency for insulin resistance to increase at this age, particularly among individuals with a family history of diabetes and obesity. In addition,

according to the World Health Organization (WHO), after the age of 30, blood glucose levels tend to gradually rise by approximately 1–2 mg/dL per year. This increase is also observed under fasting conditions, where blood glucose may rise by 5.6–13 mg/dL two hours after meals. This condition explains why the risk of type 2 diabetes mellitus increases with age (Arania et al., 2023).

Tablet 1. Length of Hospital Stay of Patients

Length of Stay (days)	Number of Patients	Percentage
2-3	17	27,00%
4-5	33	52,40%
6-7	10	15,90%
8-9	3	4,80%
Total	63	100%

Source: Processed secondary data, 2023

Based on **Table 1** regarding the length of hospital stay, it was found that the majority of patients, namely 33 patients (52.40%), were hospitalized for 4–5 days. A total of 17 patients (27.00%) were treated for 2–3 days, while 10 patients (15.90%) were hospitalized for 6–7 days, and only 3 patients (4.80%) for 8–9 days. Overall, 46 patients (73.02%) were hospitalized for 4 days or more, which met the criteria for analyzing the effectiveness of drug use.

Tablet 2. Antidiabetic Drugs Used in Type 2 DM Inpatients

Drug Name	Number of Patients	Percentage
Metformin	6	9,52%
Glimepirid	1	1,59%
Glaritus	2	3,17%
Levemir	1	1,59%
Novorapid	2	3,17%
Metformin + Glimepirid	5	7,94%
Glaritus + Novorapid	11	17,46%
Levemir + Novorapid	4	6,35%
Metformin + Glaritus	1	1,59%
Metformin + Levemir	1	1,59%
Metformin + Novorapid + Levemir	2	3,17%
Metformin + Glaritus + Novorapid	2	3,17%
Glimepirid + Novorapid + Levemir	1	1,59%
Metformin + Glimepirid + Levemir + Novorapid	3	4,76%
Metformin + Glimepirid + Novorapid + Glaritus	1	1,59%
Total	63	100%

Source: Processed secondary data, 2023

According to the data in **Table 2**, type II diabetes mellitus patients hospitalized at Baubau City General Hospital in 2023 received various types of antidiabetic therapy, either as monotherapy or in combination. The most frequently used monotherapy was Metformin, administered to 6 patients (9.52%), followed by Glaritus and Novorapid, each to 2 patients (3.17%), and Glimepiride and Levemir, each to 1 patient (1.59%). For combination therapy, the use of Glaritus and Novorapid was the most common, with 11 patients (17.46%), followed by Metformin and Glimepiride in 5 patients (7.94%), and Levemir and Novorapid in 4 patients (6.35%). A four-drug combination consisting of Metformin, Glimepiride, Levemir, and Novorapid was used in 3 patients (4.76%). Meanwhile, other combinations such as Metformin + Novorapid + Levemir, Metformin + Glaritus + Novorapid, and Metformin + Glimepiride + Novorapid + Glaritus were each administered to only 1–2 patients, with percentages ranging from 1.59% to 3.17%. In total, 63 patients were analyzed in this study.

The data on the use of antidiabetic drugs in type 2 diabetes mellitus patients in 2023 are presented as follows:

Tablet 3. Use of Metformin

	Initial Blood Glucose (mg/dL)	Blood Glucose After Treatment (mg/dL)	Blood Glucose Reduction
Metformin	203	143	60
	221	93	128
	259	227	32
	427	118	309
	290	313	-23

$\bar{X}$	280	178,8	SD	±128,17
$\% \bar{X}$	$\frac{280 - 178,8}{280} \times 100 = 36,14\%$		SE	±57,31

Source: Processed secondary data, 2023

Metformin is the primary drug recommended for patients with type 2 diabetes and is usually administered alongside lifestyle modifications, including dietary regulation and physical activity (Indarto et al., 2023). The use of Metformin as monotherapy resulted in a blood glucose reduction of 36.14%. This indicates that, on average, patients experienced a fairly good decrease. However, the SD value of 128.17 and the SE value of 57.31 indicating that the outcomes differ significantly from one patient to another. Some patients achieved a substantial reduction, while in others, blood glucose levels even increased. This implies that although Metformin is effective for some patients, its outcomes cannot be guaranteed to be stable for all patients.

Tabel 4. Use of Metformin and Glibenklamid

	Initial Blood Glucose (mg/dL)	Blood Glucose After Treatment (mg/dL)	Blood Glucose Reduction	
Metformin	290	129	161	
Glibenklamid	446	200	246	
	351	242	109	
	237	198	39	
	222	119	103	
$\bar{X}$	309,2	177,6	SD	$\bar{X}$
$\% \bar{X}$	$\frac{309,2 - 177,6}{309,2} \times 100 = 42,55\%$		SE	±34,58

Source: Processed secondary data, 2023

The combination of metformin and glibenclamide is administered to obese patients who still have insulin secretion. These two drugs work synergistically, with metformin contributing to weight reduction, while glibenclamide enhances insulin secretion (Puspita et al., 2023). Sulfonylurea drugs function by stimulating pancreatic β -cells to enhance insulin secretion. Their mechanism involves binding to the SUR1 receptor, a component of the K_{ATP} channel. This binding closes the potassium channels, triggers cell membrane depolarization, opens calcium channels, and ultimately promotes the release of insulin. (Amin et al., 2025). For the combination of metformin and glibenclamide, the reduction in blood glucose levels was greater, amounting to 42.55%. In addition, both the SD and SE values were lower compared to metformin monotherapy, with an SD of 77.30 and an SE of 34.58. This indicates that the outcomes among patients were more consistent. Thus, the combination of these two drugs was not only more effective but also more stable than metformin alone.

Tabel 5. Use of Glaritus and Novorapid

	Initial Blood Glucose (mg/dL)	Blood Glucose After Treatment (mg/dL)	Blood Glucose Reduction	
Glaritus	622	138	484	
Novorapid	1198	233	965	
	600	255	345	
	267	230	37	
	149	108	41	
$\bar{X}$	567,2	192,8	SD	±382,99
$\% \bar{X}$	$\frac{567,2 - 192,8}{567,2} \times 100 = 66,02\%$		SE	±171,30

Source: Processed secondary data, 2023

The combination of Glargine and NovoRapid shows the highest effectiveness, with a reduction in blood glucose levels of 66.02%. However, the SD and SE values are very high (382.99 and 171.30), indicating that the results are inconsistent among patients. Some patients experience a significant decrease in blood glucose, while others only show slight changes. Therefore, although this combination is effective, the outcomes for each patient may vary. The use of insulin from the early stages of type II diabetes treatment is considered more effective than oral therapy, as it provides broader clinical benefits. Insulin can reduce the toxic effects of high glucose levels, thereby improving β -cell function, protecting the inner lining of blood vessels from damage, reducing inflammation,

decreasing cell death, improving blood lipid profiles, and offering other advantages related to the prevention of complications. The use of a combination of two types of insulin can also provide better blood glucose control, as it meets both basal and prandial insulin needs, maintains glucose stability, and simultaneously lowers the risk of hypoglycemia and excessive weight gain. Meanwhile, combination therapy with two antidiabetic drugs can be administered if, within three months of using a single oral antidiabetic therapy, the patient's blood glucose levels do not improve (Tuloli et al., 2024).

Insulin is administered via subcutaneous injection (under the skin), with common injection sites including the abdomen, buttocks, thighs, and upper arms. Rotating injection sites is important to prevent lipohypertrophy, which is the enlargement of fat cells under the skin that can make the injection area fatty. This condition can affect insulin absorption, so rotating injection sites helps maintain optimal absorption rates while preventing changes to the skin at the injection area. The administration of two types of insulin is also done via subcutaneous injections into fatty tissue, but at different sites, for example, the abdomen or thighs (Afifah, 2019).

Tabel 6. Use of Novorapid and Levemir

	Initial Blood Glucose (mg/dL)	Blood Glucose After Treatment (mg/dL)	Blood Glucose Reduction	
Novorapid	341	205	136	
Levemir	532	273	259	
	733	258	475	
	576	152	424	
$\bar{X}$	545,5	222	SD	±155,24
$\% \bar{X}$	$\frac{545,5 - 22}{545,5} \times 100 = 59,29\%$		SE	±77,62

Source: Processed secondary data, 2023

The combination of NovoRapid and Levemir also results in a significant reduction of 59.29%, but with less variation in outcomes compared to the previous combination. The SD is 155.24 and the SE is 77.62, indicating that the results are more stable and reliable. This therapy still provides a high level of reduction while carrying a lower risk of variability in patient response

Metformin + Glimepirid + Novorapid + Levemir

Tabel 7. Use of Metformin + Glimepirid + Novorapid + Levemir

	Initial Blood Glucose (mg/dL)	Blood Glucose After Treatment (mg/dL)	Blood Glucose Reduction	
Metformin	438	102	336	
Glimepirid	213	110	103	
Novorapid	403	256	147	
Levemir				
$\bar{X}$	351,3	156	SD	±123,98
$\% \bar{X}$	$\frac{351,3 - 156}{351,3} \times 100 = 55,60\%$		SE	±71,59

Source: Processed secondary data, 2023

Finally, the combination of four drugs—Metformin, Glimepiride, NovoRapid, and Levemir—produces a blood glucose reduction of 55.60%. The SD and SE are at moderate levels, 123.98 and 71.59, respectively, indicating that this combination is quite effective and yields fairly consistent results among patients. This combination can be a good option when the therapeutic goal is to achieve a significant reduction while maintaining consistency across patients.

CONCLUSION

Based on the study results, the combination of Glargine and NovoRapid provides the largest reduction in blood glucose levels, with a decrease of 66.02%, but it is less consistent among patients. The combination of Metformin and Glibenclamide results in a more moderate yet stable reduction, while the combination of Novorapid and Levemir or the four-drug combination offers a balance between effectiveness and stability. The choice of therapy should be tailored to the treatment goals, whether prioritizing rapid blood glucose reduction or maintaining stability.

The limitation of this study lies in the inability to identify the factors influencing fluctuations in patients' random blood glucose levels. In addition, the researcher did not collect fasting blood glucose data and could not directly assess the patients' health conditions, as this study relied solely on medical record data from patients at Baubau City General Hospital.

ACKNOWLEDGMENTS

The researcher expresses sincere gratitude to both parents for their unwavering prayers and support, as well as to the supervisor for the guidance and direction provided throughout the completion of this study. Appreciation is also extended to all lecturers of the Diploma Three Pharmacy Study Program at Politeknik Baubau for their knowledge and support, and to the medical records staff at RSUD Kota Baubau who assisted in the collection of research data.

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