Hypoglycemia Incidence Among Patients With Type 2 Diabetes Mellitus Receiving Antidiabetic Therapy: A Retrospective Hospital-Based Study In South Kalimantan, Indonesia

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Abstract.
Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disease with an increasing prevalence. Antidiabetic drugs (OAD) are necessary for glycemic control, but they carry the risk of causing hypoglycemia. Objective: This study aimed to assess patient characteristics, OAD usage patterns including drug type, dosage, and regimen, hypoglycemic complaints, and side effect categories using the Naranjo Algorithm. Method: A descriptive, observational quantitative study with a retrospective, non-experimental design was conducted at Brigjend H. Hasan Basry Regional General Hospital (RSUD) Kandangan, utilizing medical record data and interviews. Samples were taken via total sampling from T2DM patients with hypoglycemia in 2025, followed by univariate analysis. Results: Of the 18 patients, 11 met the criteria, but only 7 underwent further analysis. The majority of patients who experienced hypoglycemia were over 60 years of age (85.7%) and female (85.7%), with hypertension being the most common comorbidity (57.1%). The pattern of oral antidiabetic (OAD) use was dominated by sulfonylurea monotherapy, specifically glimepiride at a dose of 2 mg once daily (42.8%). The most frequently reported primary complaint was weakness. Based on the Naranjo algorithm, most hypoglycemia cases fell into the Probable category (85.7%), while 14.3% fell into the Possible category. Conclusion: Type 2 diabetes patients with risk factors such as advanced age, female gender, comorbid hypertension, and the use of glimepiride constitute the group at highest risk for hypoglycemic events. Findings regarding incomplete data and misconceptions about medication instructions indicate a need for optimized patient and family education, as well as comprehensive therapy monitoring.

Keywords: *Hypoglycemia, type 2 diabetes mellitus, antidiabetic drugs, naranjo algorithm and adverse drug reactions..*

I. INTRODUCTION

Type 2 diabetes mellitus (DM) is a chronic metabolic disease characterized by hyperglycemia due to insulin resistance and pancreatic beta cell dysfunction, which is triggered by lifestyle, lack of physical activity, and an unhealthy diet (Murtiningsih, Pandelaki, & Sedli, 2021). The World Health Organization (WHO) estimated in 2022 that more than 346 million people worldwide have diabetes, while the International Diabetes Federation (IDF) reported 537 million adults with diabetes and 6.7 million deaths from the disease in 2021 (Hartono & Suryo Ediyono, 2024). In Indonesia, the prevalence of diabetes increased from 10.9% in 2018 to 11.7% in the 2023 Indonesian Health Survey (SKI) (Darmawanti, 2024), with South Kalimantan recording an increase in cases from 14,282 in 2021 to 15,930 in 2022 (Setiani, Tjomiadi, & Manto, 2024).

The use of antidiabetic drugs (ADDs) is necessary to control blood sugar levels, but irrational use can cause various side effects, one of which is hypoglycemia (Ananda, Kurniawati, & Yuandari, 2023). Hypoglycemia is a condition where blood glucose levels drop to <70 mg/dL accompanied by signs and symptoms, characterized by Whipple's triad (Perkeni, 2021; Mathew & Thoppil, 2022). This condition can occur acutely and be life-threatening. In the United States, the prevalence of treated hypoglycemia reaches 5.3-6.3%, predominantly in patients aged ≥65 years (Widyatama Putri, Rachmawati, & Cahyo Sepdianto, 2023), while the mortality rate due to hypoglycemia in type 2 DM patients in Indonesia averages 12.09% annually (Hasna, Dharmawati, & Narmawan, 2021). Sulfonylureas such as glimepiride, either as

monotherapy or in combination with metformin, have been reported to increase the risk of hypoglycemia (Khairinnisa, Yusmaini, & Hadiwiardjo, 2020).

Hypoglycemia is often underestimated because its symptoms are less specific, making it difficult to detect without continuous blood glucose monitoring, and it often recurs without the patient or healthcare provider realizing it (Putri, Novida, & Wardhani, 2021). A preliminary study at Brigjend H. Hasan Basry Kandangan Regional General Hospital (RSUD), recorded 362 outpatient visits with a diagnosis of type 2 diabetes during June-August 2025, and 18 patients experienced hypoglycemia throughout 2025. A study of the side effects of hypoglycemia in OAD use at this hospital has never been conducted before. Therefore, this study aims to examine patient characteristics, patterns of OAD use, distribution of hypoglycemia complaints, and categories of drug side effects based on the Naranjo Algorithm in patients with type 2 diabetes at RSUD Brigjend H. Hasan Basry Kandangan.

II. RESEARCH METHODS

This study was a descriptive, observational quantitative study with a retrospective, non-experimental design. It aimed to provide an overview of patient characteristics and patterns of antidiabetic medication use during hypoglycemia. The study was conducted at Brigjend H. Hasan Basry Kandangan Regional Hospital from May to July 2026 through medical record data review and direct interviews with patients or their accompanying families.

The study population was all type 2 DM patients recorded as having hypoglycemia at Brigjend H. Hasan Basry Kandangan Regional General Hospital in 2025 (18 patients). Samples were taken using a total sampling technique using inclusion criteria in the form of type 2 DM patients aged ≥18 years who were using oral antidiabetic drugs or insulin and had a history of hypoglycemia (blood sugar levels <70 mg/dL or symptoms according to Whipple's triad), and exclusion criteria in the form of patients with cognitive/psychiatric disorders that prevented the interview or refused to participate. Of the 18 patients identified, 11 patients met the inclusion criteria, but only 7 patients were successfully interviewed; 4 other patients could not be reached due to uncooperative conditions, had died, or were not found.

The research instruments included an informed consent form, a research explanation sheet, a medical record data observation sheet, and a Naranjo Algorithm questionnaire adopted from BPOM (2012) to assess the causality of drug side effects, with the following score categories: ≥9 Highly Probable, 5-8 Probable, 1-4 Possible, and 0 Doubtful. Primary data were obtained from patient interviews using the Naranjo questionnaire, while secondary data were obtained from medical records including age, gender, comorbidities, antidiabetic drug therapy (type, dose, usage rules), and related laboratory results. This study has obtained ethical approval (Ethical Clearance No. 002/EC/KEP/V/2026) from the Research Ethics Committee of Brigjend H. Hasan Basry Kandangan Regional General Hospital.

Data analysis was performed univariately to determine the frequency distribution and percentage of each variable, using the formula $P = (X/N) \times 100\%$, where P is the percentage, X is the number of respondents on a particular characteristic, and N is the total number of respondents. The data analyzed included patient characteristics (age, gender, comorbidities), OAD use patterns, distribution of hypoglycemia complaints, and distribution of Naranjo Algorithm categories.

III. RESULTS AND DISCUSSION

This study was conducted from May to July 2026 through medical record searches and in-person interviews. Of the 18 identified hypoglycemic patients, 7 were excluded due to not meeting the criteria (6 without type 2 diabetes and 1 without medication data), resulting in 11 samples. Of these 11 patients, only 7 were interviewed for the Naranjo Algorithm assessment, thus all analyses in this study used 7 samples.

Patient Age and Gender Characteristics

Age	Frequency (N)	Percentage (%)
18-59 years	1	14.3
> 60 years	6	85.7

Total	7	100

Source: Primary Data (2026)

Gender	Frequency (N)	Percentage (%)
Man	1	14.3
Woman	6	85.7
Total	7	100

Source: Primary Data (2026)

The age group most frequently experiencing hypoglycemia is those aged >60 years (85.7%). These results align with research by Pratama, Yuswar, & Nugraha (2023) which showed that patients aged >65 years tend to have a poorer quality of life related to diabetes management. The increased risk of hypoglycemia in the elderly is associated with decreased drug clearance due to impaired renal function, weakened counter-regulatory hormone responses, increased drug interactions, and decreased cognitive function, which collectively can increase the risk of hypoglycemia by 20-95% in patients aged >75 years (Borzì et al., 2016; Morales & Schneider, 2014).

Based on gender, female patients dominated hypoglycemia cases (85.7%). This finding aligns with Shufyani, Wahyuni, & Armal (2017), who stated that women are more susceptible to hypoglycemia because during menopause, insulin sensitivity decreases due to reduced estrogen and progesterone levels, leading to fat accumulation and changes in the body's lipid profile. In addition to hormonal factors, women also tend to visit health facilities more frequently, making hypoglycemia cases more easily detected.

Distribution of Patient Comorbidities

Comorbidities	Frequency (N)	Percentage (%)
Hypertension	4	57.1
Hypertension + Heart	3	42.9
Total	7	100

Source: Primary Data (2026)

Hypertension is the most common comorbidity (57.1%) in patients experiencing hypoglycemia. The American Diabetes Association (2021) emphasizes that the selection of antidiabetic therapy in patients with type 2 diabetes should consider the effects on cardiovascular comorbidities and the risk of hypoglycemia. These results are also consistent with a study by Tran, Thinkhamrop, Laohasiriwong, & Hurst (2015) in 55,797 patients with type 2 diabetes, which demonstrated that comorbid hypertension increases the risk of hypoglycemia. Gourdy, Darmon, Dievart, Halimi, & Guerci (2023) recommend selecting antidiabetic agents with a low risk of hypoglycemia, such as a combination of a GLP-1RA and an SGLT-2 in patients with hypertension or cardiovascular risk. Therefore, the presence of comorbidities should be a primary consideration in OAD selection.

Antidiabetic Drug (OAD) Use Patterns

Drug Class	Types of OAD	How to use	N	(%)
Sulfonylureas	Glimepiride 2 mg	1x a day	3	42.8
Sulfonylureas	Glimepiride 1 mg	2x a day	1	14.3
Biguanids	Metformin 500 mg	2x a day	1	14.3
Biguanids	Metformin 500 mg	Unknown	1	14.3
Biguanide + Sulfonylurea	Metformin 500 mg + Glimepiride 2 mg	2x a day / 1x a day	1	14.3

Source: Primary Data (2026)

The pattern of OAD use was dominated by sulfonylurea monotherapy, namely glimepiride at a dose of 2 mg once daily (42.8%). Misperceptions regarding the dosage regimen were also found in patients, with one patient taking metformin 500 mg three times daily because he thought it was the same as paracetamol. Khairinnisa et al. (2020) stated that the use of sulfonylureas such as glimepiride, either alone or in combination with metformin, increases the risk of hypoglycemia. Perkeni (2021) emphasized that sulfonylureas need to be used with caution in high-risk patients such as the elderly and patients with impaired liver or kidney function, because decreased drug clearance in the elderly can prolong the duration

of action of the drug, thereby increasing the risk of hypoglycemia if the patient is late in eating (Morales & Schneider, 2014). Misperceptions of the dosage regimen also exacerbate the risk of this side effect.

Distribution of Hypoglycemia Complaints

Complaint	Frequency (N)	Percentage (%)
Weak	7	100
Decreased appetite	4	57.1
Dizzy	2	28.6
Stomach pain	2	28.6
Blurred vision	1	14.3
Nauseous	1	14.3

Source: Primary Data (2026)

The most common complaint experienced by patients was weakness (100%), followed by decreased appetite (57.1%). These symptoms align with the Perkeni (2021) classification, which divides hypoglycemia symptoms into neurogenic/autonomic symptoms (sweating, trembling) and neuroglycopenic symptoms (weakness, dizziness, blurred vision), which occur when the brain's glucose supply is reduced.

Naranjo Algorithm Category

Drug	Score	Category
Metformin 500 mg + Glimepiride 2 mg	7	Probable
Glimepiride 2 mg	5	Probable
Glimepiride 2 mg	6	Probable
Metformin 500 mg	7	Probable
Glimepiride 1 mg	4	Possible
Metformin 500 mg	5	Probable
Glimepiride 2 mg	5	Probable

Source: Primary Data (2026)

Category	Score	(N)	(%)
Highly Probable	≥ 9	0	0
Maybe (Probable)	5-8	6	85.7
Quite Possible	1-4	1	14.3
Doubtful	0	0	0
Total	-	7	100

Source: Primary Data (2026)

Assessment using the Naranjo Algorithm showed that most patients (85.7%) had a Probable causal relationship between OAD use and hypoglycemia, while 14.3% were in the Moderately Possible category. These results indicate a fairly strong relationship between drug consumption and hypoglycemia, supported by clinical findings such as the onset of side effects after drug administration, improvement after drug discontinuation, and the absence of clear alternative causes. These findings are consistent with research by Fitriyani & Supadmi (2012) at PKU Muhammadiyah Hospital Yogyakarta and Isnani & Muliyani (2018) at Dr. H. Moch. Ansari Saleh Hospital Banjarmasin, which also reported the dominance of the probable category in antidiabetic side effects. Research by Meshram, Bhalsinge, Rajbhoj, & Maheshwari (2022) at a tertiary hospital in Bhopal, India, also confirmed that most adverse drug reactions (ADRs) in type 2 diabetes patients fall into the probable category.

Overall, these findings indicate that elderly, female, type 2 diabetes patients with comorbid hypertension, and those taking glimepiride, a sulfonylurea, are a group that requires special attention in therapeutic monitoring. The incomplete medical record data and patient misperceptions regarding medication use found in this study emphasize the importance of ongoing patient and family education, dose adjustments in elderly patients, and more comprehensive medical record documentation to support pharmacovigilance efforts in hospitals.

IV. CONCLUSION

The characteristics of type 2 DM patients experiencing hypoglycemia were dominated by age >60 years (85.7%), female gender (85.7%), and comorbid hypertension (57.1%). The pattern of OAD use was

dominated by glimepiride 2 mg monotherapy once daily (42.8%), with findings of misperception of the usage rules in one patient. The most common complaint was weakness (100%), and based on the Naranjo Algorithm, most hypoglycemia events were categorized as Probable (85.7%) and the rest were categorized as Possible (14.3%), indicating a link between OAD use and hypoglycemia events. Healthcare professionals are advised to increase therapeutic monitoring in elderly patients with comorbidities and sulfonylurea use, while further research is recommended to use a larger sample size and a wider range of variables.

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