International Journal of Research in Medical Sciences
Pal AD et al. Int J Res Med Sci. 2025 Mar;13(3):1051-1058
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20250666

Original Research Article

Study of the prescription pattern of antidiabetics in hypertension with diabetes patients in geriatric population at tertiary care centre: a retrospective observational study

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Received: 07 January 2025
Accepted: 03 February 2025

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ABSTRACT

Background: In India, the elderly population is particularly affected with diabetes and hypertension which is prevalent in this population, leading to complex health challenges, necessitating effective treatment strategies. This study aimed to analyze the prescription patterns of antidiabetic drugs in geriatric patients with type 2 diabetes (T2DM) and hypertension at a tertiary care center.
Methods: A retrospective, cross-sectional study was conducted at the government medical college, Chhatrapati Sambhaji Nagar, from March 2023 to March 2024. Prescriptions of patients aged 60 years and above, diagnosed with both diabetes and hypertension, were analyzed.
Results: A total of 649 prescriptions were reviewed, with 58.71% of patients being male and 41.29% female. The majority (72.73%) were in the 60-70 age group. Metformin was the most prescribed drug (49.10%), followed by sulfonylureas, particularly glimepiride (30.04%). Combination therapy was the most common treatment approach, with 69.65% of patients receiving two-drug regimens, and 12.02% on three-drug regimens. The most frequent combination was metformin + glimepiride (79.42%). A small proportion (0.92%) received more than three drugs. Generic prescriptions dominated (99.22%), and nearly 89.80% drugs were from the WHO-EML 2023. The average number of drugs per prescription was 1.96.
Conclusions: The study highlights metformin as the predominant treatment for elderly patients with diabetes and hypertension, with a strong preference for generic medications and combination therapies. These findings underscore the importance of ongoing evaluation of prescribing patterns to optimize treatment strategies for geriatric patients.

Keywords: Antidiabetics, Prescription patterns, Drug utilization studies, WHO-DUS indicators, Geriatric patients

INTRODUCTION

Diabetes mellitus (DM) has become a global health crisis, affecting approximately 537 million adults worldwide, with projections to reach 783 million by 2045. In India, the number of people with diabetes was 69.2 million in 2015 and is expected to increase to 123.5 million by 2040.[1,2] India, previously referred to as the 'diabetes capital of the world,' now ranks second to China in terms of diabetes prevalence.[3,4] Among the elderly population, the rate is even higher, with 24% of older adults affected. Diabetes in this population increases the risk of complications such as cardiovascular diseases, kidney failure, and neuropathy, placing a significant burden on individuals and their families.

Hypertension is a common comorbidity in diabetic patients, further complicating disease management. About 50% of diabetic patients in India also suffer from hypertension, which raises the risk of severe complications, including coronary artery disease, stroke, and kidney damage.[5] Hypertensive diabetic patients face

4-5 times higher mortality rates due to cardiovascular events.[6] Tight blood pressure control has been shown to reduce the risk of stroke, heart failure, and kidney disease, making effective management of both conditions essential for improving patient outcomes, particularly in elderly.[7]

As the elderly population grows globally, managing chronic conditions such as diabetes and hypertension becomes increasingly important. Older adults are particularly vulnerable to polypharmacy, with changes in drug metabolism affecting treatment outcomes. Available antidiabetic drugs include insulin secretagogues, biguanides like metformin, and newer agents like GLP-1 analogues and DPP-4 inhibitors.[8] However, polypharmacy in elderly patients often intensifies as diabetes progresses, posing risks due to age-related changes in drug metabolism. Older agents like sulfonylureas and metformin remain effective for managing these conditions despite these challenges.[9]

Given the rising prevalence of both diabetes and hypertension in the elderly, drug utilization studies are becoming increasingly important. These studies help evaluate the prescribing, dispensing, and usage of medications, focusing on their medical, social, and economic impact. The purpose of this study is to analyze the prescription patterns of antidiabetic drugs in hypertensive diabetic patients in the geriatric population at a tertiary care center in Maharashtra, providing insights into the optimization of treatment strategies and improving patient outcomes in this vulnerable group.

METHODS

This study was designed as a retrospective, cross-sectional, observational study conducted at the department of pharmacology, government medical college, Chhatrapati Sambhaji Nagar, in collaboration with the department of geriatrics. The aim of the study was to explore the prescription patterns of antidiabetic medications in geriatric patients who also have hypertension and T2DM. We specifically focused on patients aged 60 years and above, who were diagnosed with both hypertension and T2DM, and were receiving treatment for these conditions. Patients who either didn't meet the inclusion criteria or chose to withdraw from the study were not included.

Before starting the study, ethical approval was taken from the institutional ethics committee and a no objection certificate (NOC) was obtained from the head of the geriatrics department to ensure all necessary permissions were in place. The investigator made sure to explain the purpose and process of the study thoroughly to the HOD to ensure full understanding and support. The study will include all patients admitted to the Geriatrics Department at Government Medical College between March 2023 to March 2024. To ensure that the study meets statistical standards, we followed the world health organization (WHO) guidelines, which suggest at least 300 patient encounters for a robust prescription audit. In total, 649 prescriptions were reviewed for this study.

Prescription data was collected for each patient, with a specific focus on the antidiabetic drugs they were prescribed-looking at factors such as the class of drugs, dosage, and how their treatment was structured. If patients chose to withdraw or if their data was incomplete (such as missing age or registration number), their prescriptions were not included in the analysis. All patient information was recorded in a case record form (CRF). The data collected was kept confidential, and only anonymized study parameters were used in the analysis and final report.

The source documents used for the study included the CRFs from inpatient department (IPD) patients, records from the health management information system (HMIS), and documents from the medical records section of the geriatrics department. These documents were carefully reviewed to extract the necessary information according to the study's goals.

Data collected was analysed using Microsoft excel, and results were presented in percentages for categorical data.

This study is important because it sheds light on how antidiabetic drugs are being prescribed to older adults with both hypertension and T2DM. By understanding these prescription patterns, the study intends to help improve treatment strategies, optimize clinical outcomes, and ultimately better serve the geriatric population with these common chronic conditions.

RESULTS

In this retrospective observational study, a total of 649 patients were included (Table 1). The male population comprised 381 patients (58.71%), while 268 patients (41.29%) were female. Age-wise distribution revealed that the majority of patients were in the 60-70 years age group, with 472 patients (72.73%) in this range. The next largest group was the 71-80 years group, consisting of 154 patients (23.73%). Smaller proportions were found in the 81-90 years (19 patients, 2.93%) and >90 years (4 patients, 0.62%) age groups (Table 2). Gender distribution across age groups showed that males were more prevalent than females in the 60-70- and 71-80-years groups, while females outnumbered males in the >90 years age group.

Table 1: Gender distribution of patients.

Gender distribution	N	Percentage (%)
Male	381	58.71
Female	268	41.29
Total	649	

The most commonly prescribed antidiabetic drug was metformin (500/1000 mg), which accounted for 626 prescriptions (49.10%). The next most frequently prescribed drug class was sulfonylureas, particularly

glimepiride (1/2/4 mg), with 383 prescriptions (30.04%) (Table 3). Other notable drugs included α-glucosidase inhibitors (Voglibose 0.2/0.3 mg) in 39 prescriptions (3.06%), DPP4 inhibitors (Teneligliptin 20 mg and itagliptin 50/100 mg) in 75 prescriptions (5.88%), and SGLT2 inhibitors (Dapagliflozin 10/20 mg) in 41 prescriptions (3.22%). Insulin formulations, including insulin Degludec (13 prescriptions) and insulin Mixtard (7 prescriptions), were prescribed in smaller numbers.

Regarding treatment regimens, combination therapy was the most common approach. A total of 452 patients (69.65%) received a 2-drug combination, while 78 patients (12.02%) were prescribed 3-drug regimen. 113 patients (17.41%) received monotherapy, and 6 patients (0.92%) were on more than three antidiabetic drugs (Table 4).

For monotherapy, biguanides (metformin) were the most commonly prescribed class, with 96 patients (84.96%) receiving metformin. Among these, 65 patients (57.52%) were prescribed metformin 500 mg BD. Other monotherapy agents included SGLT2 Inhibitors, specifically dapagliflozin (10 mg), which was prescribed to 3 patients (2.65%), and insulin, which was used in 14 patients (12.39%), with crystalline insulin being the most common formulation (Table 5).

For two-drug regimens, the most commonly prescribed combination was biguanides + sulfonylureas, which was used for 359 patients (79.42%). The predominant combination was metformin 500 mg with glimepiride (1-4 mg). Other common combinations included biguanides + DPP4 Inhibitors (prescribed to 45 patients, 9.96%) and biguanides + SGLT2 inhibitors (prescribed to 26 patients, 5.75%) (Table 6).

In terms of three-drug regimens, the most frequently used combination was biguanides + sulfonylureas + α-glucosidase inhibitors, prescribed to 27 patients (34.62%). The second most common three-drug regimen was biguanides + sulfonylureas + DPP4 Inhibitors, given to 23 patients (29.49%) (Table 7).

A small proportion of patients (6, 0.92%) received more than three antidiabetic drugs. These regimens typically included Insulin combined with oral agents such as metformin and glimepiride (Table 8).

Regarding drug prescriptions, an overwhelming majority of drugs were prescribed by their generic names. 99.22% of prescriptions (1265 prescriptions) were for generic drugs, while only 0.78% (10 prescriptions) were for brand-name drugs (Table 10).

Finally, the WHO-DUS prescribing indicators (Table 9) showed that 649 prescriptions were analysed, with a total of 1275 drugs prescribed. On average, 1.96 drugs were prescribed per encounter. Almost all drugs were prescribed using their generic names (99.22%), and 84.15% of the prescribed drugs were from the national essential drug list of India 2022. A total of 6% of encounters involved the prescription of injections.

Table 2: Age-wise gender distribution.

Age group (in years)	N	Percentage (%)	Male, N (%)	Female, N (%)
60-70	472	72.73	274 (42.22)	198 (30.51)
71-80	154	23.73	95 (14.64)	59 (9.09)
81-90	19	2.93	12 (1.85)	7 (1.08)
>90	4	0.62	0 (0.00)	4 (0.62)
Total	649		381 (58.71)	268 (41.29)

Table 3: Most prescribed antidiabetics.

Drug class	Drug name	N	Percentage (%)
Sulfonylureas	Tab. glimepiride 1/2/4 mg	383	30.04
	Tab. glipizide 5 mg	19	1.49
	Tab. gliclazide 60 mg	28	2.20
Biguanides	Tab. metformin 500/1000 mg	626	49.10
Thiazolidinediones	Tab. pioglitazone 15 mg	2	0.16
α-glucosidase inhibitors	Tab. voglibose 0.2/0.3 mg	39	3.06
DPP4 inhibitors	Tab. teneligliptin 20 mg	38	2.98
	Tab. sitagliptin 50/100 mg	37	2.90
	Tab. vildagliptin 50 mg	14	1.10
SGLT2 inhibitors	Tab. dapagliflozin 10/20 mg	41	3.22
	Tab. canagliflozin 100 mg	9	0.71
Insulin	Insulin Degludec	13	1.02
	Insulin Actrapid	3	0.24
	Insulin Mixtard	7	0.55
	Inj. crystalline insulin	16	1.25
Total		1275	

Table 4: Treatment approaches for antidiabetics.

Therapy type	N	Percentage (%)
Monotherapy	113	17.41
2 drug	452	69.65
3 drug	78	12.02
>3 drug	6	0.92
Total	649	

Table 5: Monotherapy drug classes for antidiabetics.

Monotherapy class	N	%	Drug name	N	%
Biguanides	96	84.96	Tab. metformin 500 mg OD	14	12.39
			Tab. metformin 500 mg BD	65	57.52
			Tab. metformin 500 mg TDS	15	13.27
			Tab. metformin 1000 mg BD	2	1.77
SGLT2 inhibitors	3	2.65	Tab. dapagliflozin 10 mg OD	3	2.65
Insulin	14	12.39	Inj. crystalline insulin	6	5.31
			Insulin Degludec	3	2.65
			Insulin Mixtard	5	4.42
Total	113				

Table 6: Combination therapy for antidiabetics.

Drugs class	N	%	Drug 1	Drug 2	N	%
Insulin + biguanides	14	3.10	Inj. crystalline insulin	Tab. metformin 500 mg	10	2.21
			Insulin Degludec	Tab. metformin 500 mg	4	0.88
Biguanides + sulfonylureas	359	79.42	Tab. metformin 500 mg	Tab. gliclazide 60 mg	23	5.09
			Tab. metformin 500 mg	Tab. glipizide 5 mg	14	3.10
			Tab. metformin 500 mg	Tab. glimepiride 1 mg	209	46.24
			Tab. metformin 500 mg	Tab. glimepiride 2 mg	81	17.92
			Tab. metformin 500 mg	Tab. glimepiride 4 mg	24	5.31
			Tab. metformin 1000 mg	Tab. glimepiride 2 mg	6	1.33
			Tab. metformin 1000 mg	Tab. glimepiride 4 mg	2	0.44
Biguanides + DPP4 inhibitors	45	9.96	Tab. metformin 500 mg	Tab. teneligliptin 20 mg	20	4.42
			Tab. metformin 1000 mg	Tab. teneligliptin 20 mg	3	0.66
			Tab. metformin 500 mg	Tab. sitagliptin 50 mg	22	4.87
Biguanides + SGLT2 inhibitors	26	5.75	Tab. metformin 500 mg	Tab. canagliflozin 100 mg	6	1.33
			Tab. metformin 500 mg	Tab. dapagliflozin 10 mg	18	3.98
			Tab. metformin 500 mg	Tab. dapagliflozin 20 mg	2	0.44
Biguanides + α-glucosidase inhibitors	6	1.33	Tab. metformin 500 mg	Tab. voglibose 0.3 mg	6	1.33
DPP4 inhibitors + SGLT2 inhibitors	2	0.44	Tab. teneligliptin 20 mg	Tab. dapagliflozin 10 mg	2	0.44
Total	452					

The above combinations were noted for 2-drug therapy in antidiabetics.

Table 7: Three-drug therapy for antidiabetics.

Drugs class	N	%	Drug 1	Drug 2	Drug 3	N	%
Biguanides + sulfonylureas + α-glucosidase inhibitors	27	34.62	Tab. metformin 500 mg	Tab. glimepiride 1 mg	Tab. voglibose 0.2 mg	9	11.54
			Tab. metformin 500 mg	Tab. glimepiride 1 mg	Tab. voglibose 0.3 mg	3	3.85
			Tab. metformin 500 mg	Tab. glimepiride 2 mg	Tab. voglibose 0.2 mg	6	7.69
			Tab. metformin 500 mg	Tab. glimepiride 2 mg	Tab. voglibose 0.3 mg	2	2.56
			Tab. metformin 500 mg	Tab. glimepiride 4 mg	Tab. voglibose 0.2 mg	2	2.56
			Tab. metformin 500 mg	Tab. glipizide 5 mg	Tab. voglibose 0.2 mg	5	6.41
Biguanides + sulfonylureas + DPP4 inhibitors	23	29.49	Tab. metformin 500 mg	Tab. glimepiride 1 mg	Tab. teneligliptin 20 mg	8	10.26
			Tab. metformin 500 mg	Tab. glimepiride 1 mg	Tab. sitagliptin 50 mg	4	5.13
			Tab. metformin 500 mg	Tab. glimepiride 2 mg	Tab. sitagliptin 50 mg	2	2.56
			Tab. metformin 500 mg	Tab. glimepiride 1 mg	Tab. vildagliptin 50 mg	7	8.97
			Tab. metformin 500 mg	Tab. gliclazide 60 mg	Tab. sitagliptin 50 mg	2	2.56

Continued.

Drugs class	N	%	Drug 1	Drug 2	Drug 3	N	%
Biguanides + sulfonylureas + SGLT2 inhibitors	8	10.26	Tab. metformin 500 mg	Tab. glimepiride 1 mg	Tab. dapagliflozin 10 mg	2	2.56
			Tab. metformin 500 mg	Tab. glimepiride 1 mg	Tab. dapagliflozin 10 mg	2	2.56
			Tab. metformin 500 mg	Tab. glimepiride 2 mg	Tab. dapagliflozin 10 mg	4	5.13
Biguanides + sulfonylureas + thiazolidinedio -nes	2	2.56	Tab. metformin 500 mg	Tab. glimepiride 1 mg	Tab. pioglitazone 15 mg	2	2.56
Biguanides + SGLT2 + DPP4 inhibitors	4	5.13	Tab. metformin 500 mg	Tab. dapagliflozin 10 mg	Tab. sitagliptin 50 mg	2	2.56
			Tab. metformin 500 mg	Tab. dapagliflozin 10 mg	Tab. vildagliptin 50 mg	2	2.56
Biguanides + SGLT2 inhibitors + α-glucosidase inhibitors	2	2.56	Tab. metformin 500 mg	Tab. dapagliflozin 20 mg	Tab. voglibose 0.2 mg	2	2.56
Biguanides + DPP4 inhibitors + α-glucosidase inhibitors	2	2.56	Tab. metformin 500 mg	Tab. teneligliptin 20 mg	Tab. voglibose 0.2 mg	2	2.56
SGLT2 inhibitors + DPP4 inhibitors + α-glucosidase inhibitors	2	2.56	Tab. dapagliflozin 10 mg	Tab. sitagliptin 100 mg	Tab. voglibose 0.3 mg	2	2.56
Insulin + biguanides +DPP4 inhibitors	5	6.41	Insulin Mixtard	Tab. metformin 500 mg	Tab. vildagliptin 50 mg	2	2.56
			Insulin Actrapid	Tab. metformin 500 mg	Tab. teneligliptin 20 mg	3	3.85
Insulin + biguanides + sulfonylureas	3	3.85	Insulin Degludec	Tab. metformin 500 mg	Tab. glimepiride 1 mg	3	3.85
Total	78					78	

Details of different classes of drugs used in three-drug therapy for antidiabetics include.

Table 8: More than three-drug therapy for antidiabetics.

Drug 1	Drug 2	Drug 3	Drug 4	N
Insulin Degludec	Tab. metformin 500 mg	Tab. gliclazide 60 mg	Tab. vildagliptin 50 mg	3
Tab. metformin 500 mg	Tab. glimepiride 2 mg	Tab. sitagliptin 50 mg	Tab. canagliflozin 100 mg	3
Total				6

Details of different classes of drugs used in three-drug therapy for antidiabetics.

Table 9: WHO-DUS prescribing indicators.

Prescribing indicators	Counts and percentages
Total number of prescriptions analysed	649
Total number of drugs prescribed	1275
The average number of drugs per encounter	1.96
Percentage of drugs prescribed by generic name	99.22%
Percentage of drugs prescribed from essential drug list (India 2022)	84.15%
Percentage of drugs prescribed from essential drug list (WHO 2023)	89.80%
Percentage of encounters with an injection prescribed	6%

Table 10: Drugs prescribed by generic and brand names.

Type of prescription	N	Percentages (%)
Generic	1265	99.22
Brand	10	0.78
Total	1275	

DISCUSSION

In this study, we found that majority of patients with diabetes and hypertension were male (58.71%), which is consistent with findings of studies by Dalal et al and Daivasikamani et al where males comprised 57% and 60%, respectively.[10,11] This male predominance is likely due to higher incidence of these conditions among men, particularly in elderly. However, David et al reported that females had higher rates of both conditions.[12] Similarly, in our study, the most affected age group was 60-70 years (72.73%), a finding consistent with trends reported by Barret-Connor et al and Geldsetzer et al who also identified this age group as the most affected by diabetes and hypertension.[13,14] Results suggest that diabetes and hypertension are particularly prevalent in aging population, which warrants targeted interventions for this demographic.

In terms of treatment patterns, metformin was the most commonly prescribed medication, comprising 49.10% of all prescriptions. This is consistent with the findings of studies by Gaviria-Mendoza et al and Overbeek et al where metformin was the first-line treatment in the majority of patients with T2DM.[15,16] Metformin remains a gold standard due to its efficacy in lowering blood glucose levels, minimal risk of hypoglycaemia, and its beneficial effects on weight, making it particularly suitable for elderly patients.[17] However, it was also noted that sulfonylureas, specifically glimepiride, were prescribed in 30.04% of cases. This aligns with the findings of Overbeek et al, Allyhiani et al, Dashputra et al who found a similar preference for sulfonylureas in managing diabetes in older patients.[16,18,19] The use of Sulfonylureas, despite their higher risk of hypoglycaemia, may reflect a reliance on these drugs due to their long-standing use and effectiveness, especially when blood glucose control is suboptimal with metformin alone.

Interestingly, we also found that DPP4 inhibitors (such as sitagliptin and teneligliptin) and SGLT2 inhibitors (like dapagliflozin) were prescribed to a lesser extent (5.88% and 3.22%, respectively). These medications have gained popularity in recent years due to their additional benefits, including cardio protection and renal protection, which are especially important in elderly patients who are more likely to have comorbidities such as cardiovascular disease and renal dysfunction.[20-22] While the lower prescription rates may reflect the relative novelty of these drugs, it may also indicate hesitancy to switch from established therapies like metformin and sulfonylureas.

Regarding treatment regimens, we found that combination therapy was the most common approach, with 69.65% of patients receiving a two-drug regimen. This aligns with findings by Karki et al and Rani and Reddy where combination therapy was favored for its superior blood sugar control.[23-24] Among 2 drug regimens, combination of metformin + sulfonylureas (mostly glimepiride) was the most common (79.42%), followed by metformin + DPP4 inhibitors (9.96%) and metformin + SGLT2 inhibitors (5.75%).[24,25] Use of 2 drug combinations reflects a balanced approach, aiming to enhance efficacy while minimizing risks of side effects such as hypoglycaemia.[26]

Notably, 3-drug combinations were used in 12.02% of patients, with the most common being a combination of biguanides + sulfonylureas + α-glucosidase inhibitors (34.62%), followed by biguanides + sulfonylureas + DPP4 inhibitors (29.49%). This reflects the complexity of managing older patients with diabetes and hypertension, where multiple medications are often necessary to achieve optimal control. The increased use of combination therapies aligns with clinical guidelines recommending multi-drug regimens for elderly patients with poorly controlled diabetes, as seen in studies by Mudaliar and Henry and Downes et al.[26,27]

We also observed that only 0.92% of patients were prescribed more than three drugs, a finding consistent with studies by Naser et al which suggest that polypharmacy is less common but may occur in cases where diabetes is poorly controlled or in patients with multiple comorbidities.[28,29] Relatively low proportion of patients on more than three drugs may reflect an effort to minimize polypharmacy, which is particularly important in elderly patients at risk for drug interactions and side effects.

Regarding prescribing practices, generic medications were overwhelmingly favored, comprising 99.22% of all prescriptions, with only 0.78% of drugs prescribed by brand name. This finding aligns with the study by Chen et al and Malani et al where generic prescribing was found to be predominant, likely reflecting efforts to reduce healthcare costs, especially in a population of elderly patients who may have limited financial resources.[30-31] The high proportion of generic prescriptions may also be attributed to the increased availability of generics and the evidence supporting their equivalence in terms of safety and efficacy compared to branded medications.

Finally, our study used the WHO-DUS parameters to assess the quality of prescribing, and the average number of drugs per prescription was found to be 1.88, which is in line with the findings of Mandal et al (2.18 drugs per prescription).[25] This indicates a tendency toward rational polypharmacy in managing elderly patients with diabetes and hypertension. A small percentage of prescriptions involved injectables (6%), which is consistent with findings from studies by Singla et al.[32] Use of WHO-EML drugs was found to be 89.80%, which is more than what reported by Malani et al (72.3%).[33] In our study, national-EML India 2022 drugs accounted for 84.15%, suggesting some variability in prescribing practices, particularly in use of essential medicines in geriatric care.[31,34]

Limitations

Although these insights are valuable, it is important to recognize several limitations. As a retrospective study, the

data rely on the accuracy of medical records and may be subject to inherent biases. Furthermore, this study was conducted at a single tertiary care center, which limits its generalizability to other settings or populations. Future prospective studies could explore the long-term outcomes of the prescribed antidiabetic regimens, particularly in terms of glycaemic control, cardiovascular events, and renal function in elderly patients. Moreover, exploring the impact of individualized treatment regimens and patient-specific factors, such as frailty and polypharmacy, will be critical in refining treatment strategies for this vulnerable cohort.

CONCLUSION

Metformin was the most commonly prescribed medication for elderly patients with diabetes and hypertension. The prescribing patterns were aligned with the WHO-DUS prescribing indicators, with the majority of prescriptions being for generic drugs. These prescriptions were also consistent with the NLEM and WHO-EML guidelines. The use of combination therapies was widespread, reflecting the need for tailored treatment approaches in this patient group. These findings highlight the importance of continuing to monitor and evaluate prescribing practices. Future studies, such as drug utilization studies, can further improve our understanding of prescribing trends and help optimize treatment strategies for elderly patients with chronic conditions like diabetes and hypertension.

ACKNOWLEDGEMENTS

Authors would like to thank the head of department of geriatrics, government medical college, Chhatrapati Sambhaji Nagar.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Pal AD, Baig MS, Rao SV. Study of the prescription pattern of antidiabetics in hypertension with diabetes patients in geriatric population at tertiary care centre: a retrospective observational study. Int J Res Med Sci 2025;13:1051-8.