RESEARCH PAPER

Cardio-metabolic parameters, Drugs usage patterns and cost variation study of drugs used among type II diabetes patients of a tertiary care teaching hospital in Navi Mumbai

Manjusha Dhande Borde[1*], Rajesh Kumar Suman[2], Sujata Gaikwad[1], Ipseeta Ray Mohanty[3]
[1]MGM Medial College, Vashi, Navi Mumbai, MGMIHS, India
Email: manjusha_dhande@yahoo.co.in
[2] Hind Institute of Medical Sciences, Lucknow, India
[3]MGM Medical College, Kamothe, Navi Mumbai, MGMIHS, India
Corresponding author*
Manjusha Dhande Borde
Assistant Professor, Department of Pharmacology, MGM Medial College, Vashi, Navi Mumbai, MGMIHS, India, Email: manjusha_dhande@yahoo.co.in

ABSTRACT
Type II Diabetes mellitus continues to rise in prevalence thought-out the globe, along with concomitant cardio-metabolic diseases. Large number of drugs available for treatment of diabetes. Therefore, screening of diabetic patients for cardiac as well as metabolic abnormality and patterns of drugs used may be the need of the hour. To screen the diabetic patients for metabolic abnormality, drug usage pattern and cost variation of prescribed drug. The Study was carried out at MGM Medical College & Hospital after obtaining approval of the Institutional Ethics Committee. Total 100 prescriptions were randomly analyzed. The data was collected in customized Proforma. For Cost variation study CIMS, MIMS, DRUG TODAY was used. Among total patients, Duration of the disease was found to be less than 5 years in 61.25 %, 25% (between 5-10 years) and 13.75% (more than 10 years). BMI was found to be ideal only among 56.25 % patients, 31.25% patients were found to be overweight and 12.5% were obese. The waist/hip ratio was found to be abnormal among 95% of the diabetic patients. Among diabetic patients, concomitant diseases encountered were hypertension (31.25%), dyslipidemia (5%), hypertension as well as dyslipidemia (7.5%). Total 226 Drug was prescribed and Average drug per prescription was 2.26. Among Total antidiabetic drugs, 90% were OHA (Oral Hypoglycemic drug) and 10% were Insulin. Metformin was common antidiabetic drug prescribed. Among Antidiabetic drug, Glimepiride (2mg) shows maximum price variation of 829.72%. Acarbose (25mg) shows least price variation of 83.12%. Metformin in common prescribed dose (500mg) shows price variation of 384.18%. Hypertension was the predominant co-morbidity present among diabetic patients. Metformin was common Oral antidiabetic drug prescribed. Glimepiride shows maximum price variation percentage.

Kew words: Diabetes, Cardiometabolic, Hypertension, Drug usage pattern, price variation
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INTRODUCTION

Diabetes mellitus (DM) has arisen as a major worldwide health concern in recent decades, with high morbidity and mortality rates and a rising economic burden.[1,2] The International Diabetes Federation (IDF) Atlas 2025 estimates that 589 million adults worldwide have diabetes, with 90% having Type II Diabetes mellitus (TIIDM), and that figure is expected to climb to 853 million by 2050. [3] Recent advances in both medical treatments and lifestyle modifications have modestly improved the life expectancy and quality of life for diabetic patients. Despite these advances, effective management remains challenging due to the need for individualized treatment regimens and the presence of various comorbidities.[4]

The World Health Organization (WHO) defines "drug utilization" as the process of marketing, distributing, prescribing, and using pharmaceuticals, as well as the effects on medical, social, and economic consequences. Drug usage studies provide useful insights into rational drug use, optimize healthcare resource allocation, and, ultimately, improve patients' quality of life.[5] The study of drug consumption or prescribing patterns is a component of medical audit, which tries to monitor, evaluate, and make required changes to prescribing procedures in order to promote rational and cost-effective pharmacotherapy. Research on antidiabetic drug utilization plays a crucial role in optimizing therapeutic strategies and ensuring effective regulation and rational use of medications.[6]

Understanding prescribing patterns in a tertiary care teaching hospital is crucial, as these institutions act as models for healthcare delivery and medical education. Systematic evaluation of such patterns enables the identification of practice gaps and facilitates targeted improvements through continuing medical education and policy reforms.[7,8] TIIDM continues to rise in prevalence thought-out the globe, along with concomitant cardio-metabolic diseases. Therefore, systematic screening of patients with diabetes for both cardiovascular and metabolic abnormalities is imperative. Concurrent evaluation of prescribing patterns is equally essential to ensure rational and evidence-based pharmacotherapy. The present study

was designed to assess metabolic abnormalities and analyze the drug utilization patterns among diabetic patients attending the outpatient department of Medicine in a tertiary care teaching hospital. Additionally, the study examines the cost variations of oral antidiabetic agents available in India, as significant price differences among various brands and formulations may adversely affect patient adherence and therapeutic outcomes, a matter of considerable relevance in pharmacoeconomic research.

MATERIAL AND METHODS

Study Setting: The Study was carried out at MGM Medical College & Hospital, Kamothe.

Study design and ethical considerations: The observational, cross-sectional, prospective drug utilization study was conducted after the approval of the institutional ethics committee (IEC Document number: IEC/Pharm/445/2014).

Selection criteria: Inclusion Criteria Prescriptions of both the sexes (defined as age >60 years) diagnosed with DM since at least five years and started on either OHA or insulin that were selected for the study. Exclusion Criteria Patients with other coexistent causes of hyperglycemia (e.g., Cushing's syndrome, pancreatic cancer, or hormone-secreting tumors) were excluded from the study.

Study procedure data collection: The patients with type 2 DM attending the outpatient medicine department were enrolled after obtaining informed consent. Data were collected using a structured case record form, capturing prescription patterns and various influencing factors, including sociodemographic details, disease characteristics and glycemic control. Once the consultation was over, the desired information from the prescriptions were copied on the Proforma, and the patients were interviewed. After noting down the required parameters, prescriptions were returned to the patients. All the prescriptions were analyzed for nature of the medication prescribed, percentage of mono-therapy Vs combination therapy prescribed, percentage of fixed dose combination prescribed, number prescribed in generics. Each parameter was expressed in percentage.

Cost variations analysis: CIMS (current index of medical stores), IDR (Indian drug review), Drug today & MIMS (Monthly Index of Medical Specialties) were reviewed for the prices of drugs used in the management of diabetes mellitus. Cost of a particular drug (molecule or fixed dose combination) being manufactured by different companies, in the same strength, number and dosage form were compared. The difference in the maximum and minimum price of the same drug manufactured by different pharmaceutical companies and the percentage variation in price were calculated by using formula.

= Price of most expensive brand-Price of least expensive brandx100/Price of least expensive brand

RESULT

A total of 100 patients were analyzed for metabolic abnormality, drug usage pattern and cost variation of prescribed drug. The gender distribution showed that 37.5% of the participants were male, while 62.5% were female, indicating a higher proportion of female patients in the study population. Regarding age distribution, the majority of patients (62.5%) belonged to the 40–60 years age group, suggesting that middle-aged individuals constituted the largest segment of the sample. The figure 1 shows the percentage of patients diagnosed across three Body Mass Index (BMI) categories: ideal (<25), overweight (25–29.5), and obese (>30). The highest proportion of diagnosed patients was observed in the ideal BMI group (56.25%), followed by the overweight group (31.25%), while the obese group accounted for the lowest proportion (12.50%). These findings suggest that, within the studied sample, a greater proportion of diagnoses occurred among individuals with an ideal BMI compared to those who are overweight or obese. The figure 2 illustrates the glycemic control status of patients based on fasting blood sugar (FBS) and postprandial blood sugar (PPS) levels. For FBS, 45% of patients achieved controlled glucose levels, while a slightly higher proportion (55%) had uncontrolled FBS. In contrast, PPS levels show a more pronounced imbalance, with only 22.5% of patients demonstrating controlled values, compared to a substantial 77.5% with uncontrolled PPS. These findings indicate that overall glycemic control in the study population is suboptimal, particularly with respect to postprandial glucose levels. While nearly half of the patients maintain acceptable fasting glucose, a significant majority fail to achieve adequate control after meals. This suggests that postprandial hyperglycemia is a major concern in this group. The results highlight a need for improved strategies to manage postprandial hyperglycemia, including patient education on diet, optimization of pharmacotherapy, and closer monitoring of blood glucose fluctuations to achieve better overall glycemic control. A markedly higher proportion of patients were classified as having uncontrolled HbA1c levels (>7%), accounting for 80% of the sample, compared to only 20% with controlled HbA1c levels (<7%). (Fig 3) These findings suggest that poor glycemic control is highly prevalent among the studied population. The predominance of uncontrolled HbA1c levels may indicate inadequate disease management, suboptimal adherence to treatment, or limited access to effective healthcare interventions. In contrast, the relatively low proportion of patients achieving controlled HbA1c highlights potential gaps in diabetes management strategies.

A substantial majority of the participants (95%) were classified as having an abnormal waist-to-hip ratio, while only a small proportion (5%) fell within the normal range. The findings demonstrate a significant association between diabetes and abnormal fat distribution, highlighting the importance of waist-to-hip ratio as a valuable anthropometric indicator for the assessment and management of diabetic patients. (Fig 4)

The distribution of prescribed drug categories is illustrated in Figure 5. The analysis reveals that antidiabetic drugs constitute the largest proportion, accounting for 50% of the total prescriptions. This highlights that diabetes management was the primary focus of pharmacological treatment among the study population. The second most commonly prescribed category was antihypertensive drugs, representing 31.25% of the total. This indicates a high prevalence of hypertension as a comorbid condition among patients. Other drug categories, including hypolipidemic, and antithyroid medications, contributed relatively smaller proportions to the overall prescriptions. Each of these categories accounted for only a minor percentage, suggesting that while these conditions were present, they were less dominant compared to diabetes and hypertension. Overall, the prescribing pattern demonstrates a strong emphasis on managing diabetes and its associated comorbidities, particularly cardiovascular-related conditions. The high proportion of antidiabetic and antihypertensive drugs suggests a significant coexistence of diabetes and cardiovascular risk factors within the study population.

The figure presents the pattern of antidiabetic medications prescribed among the study population. The majority of

patients (90%) were treated with oral hypoglycemic agents (OHAs), while a very small proportion (10%) were on insulin therapy. The predominance of OHA use aligns with standard treatment guidelines, which recommend oral agents as the initial pharmacological approach for type II diabetes, reserving insulin for cases of poor glycemic control, advanced disease, or specific clinical indications. The findings indicate a strong reliance on oral hypoglycemic agents in the management of diabetes within the study population, with minimal use of insulin therapy.

A total of 226 drugs were prescribed across all patients, with an average of 2.26 drugs per prescription, reflecting a moderate level of polypharmacy. Out of the total medications prescribed, 152 (67.26%) were antidiabetic drugs, highlighting the primary focus on diabetes management among the study population. Among these, Metformin was identified as the most commonly prescribed antidiabetic drug, indicating its prominence as a first-line therapy. In terms of combination therapy, the most frequently prescribed fixed-dose combination was Glimepiride + Metformin, suggesting a common strategy for improving glycemic control through dual therapy. Overall, the findings suggest that diabetes management in the study population primarily relies on Metformin-based therapy, often combined with other agents, alongside treatment for associated comorbidities such as hypertension and dyslipidemia.

The present study demonstrated considerable variation in the prices of commonly prescribed antidiabetic drugs. Among the drugs evaluated, glimepiride 2 mg showed the highest percentage price variation (829.72%), followed by metformin 500 mg (384.18%), whereas acarbose 25 mg showed the least price variation (83.12%). The marked variation indicates substantial differences in the prices of different brands or formulations of the same antidiabetic drug and may have important implications for the affordability of long-term diabetes therapy.

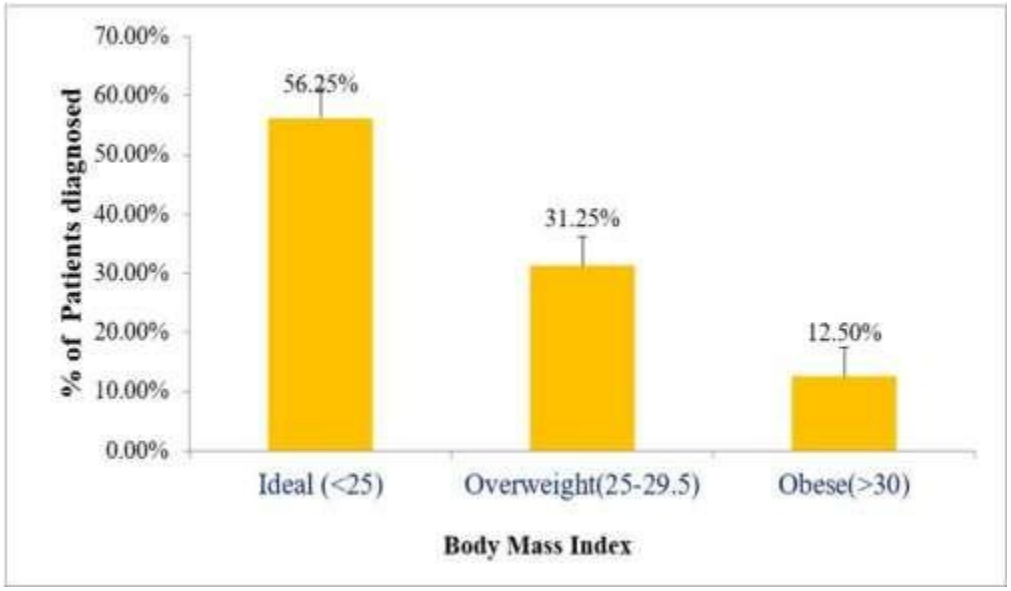

Figure 1: Distribution of patients according to body mass index (BMI).

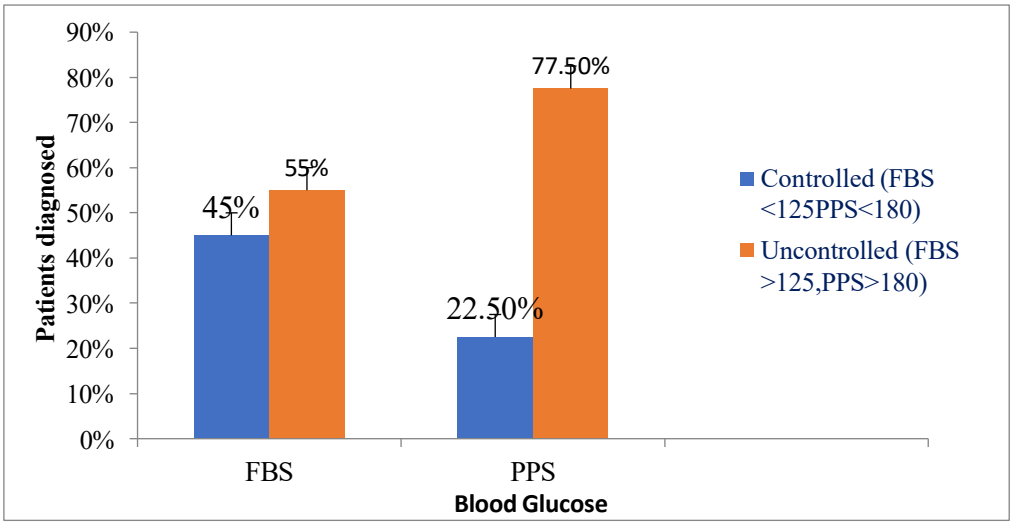

Figure 2: Distribution of patients according to blood glucose control status.

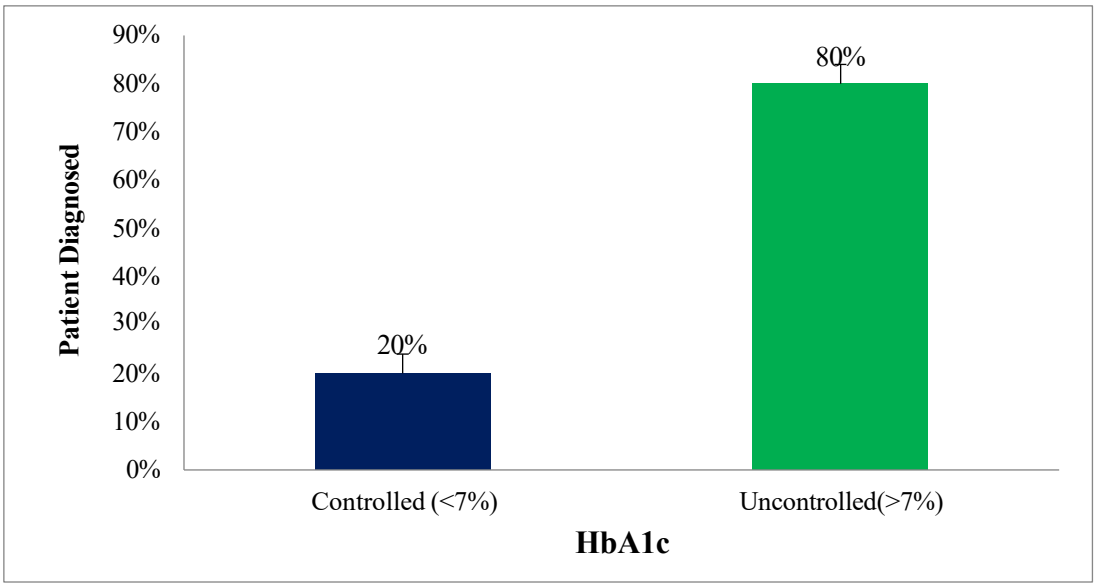

Figure 3: Distribution of patients according to glycemic control based on HbA1c levels.

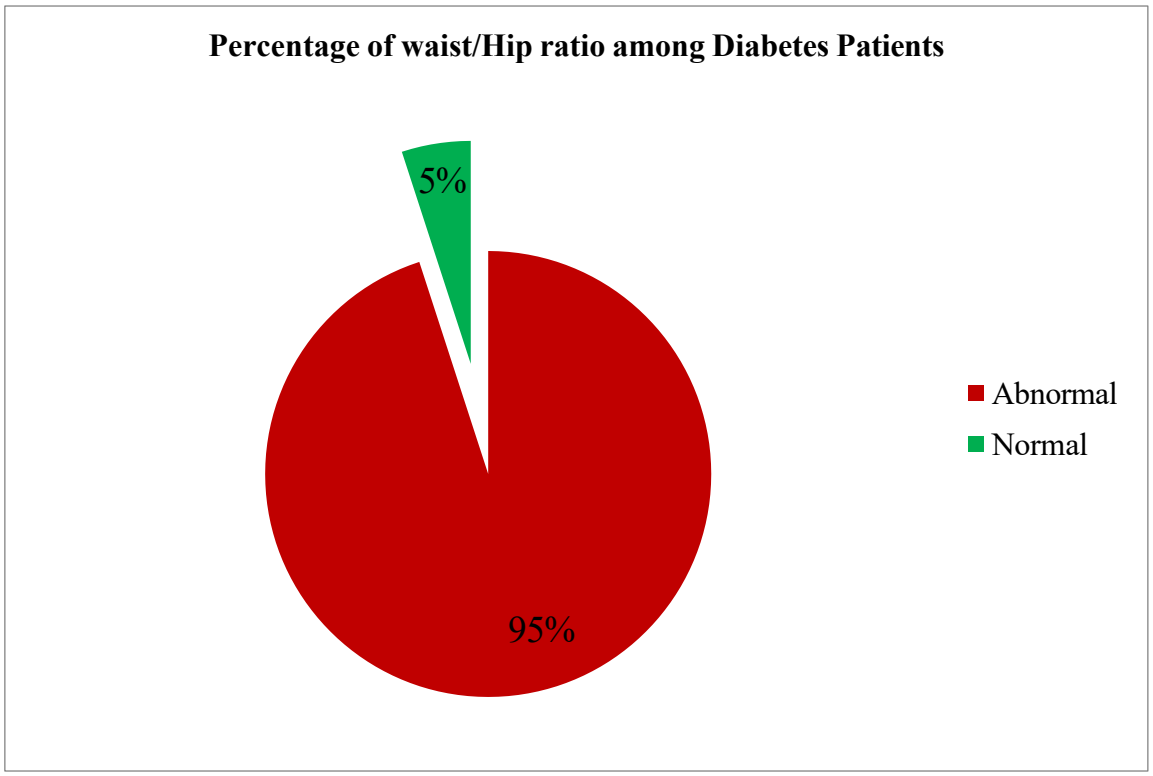

Figure 4: Distribution of patients according to waist-to-hip ratio.

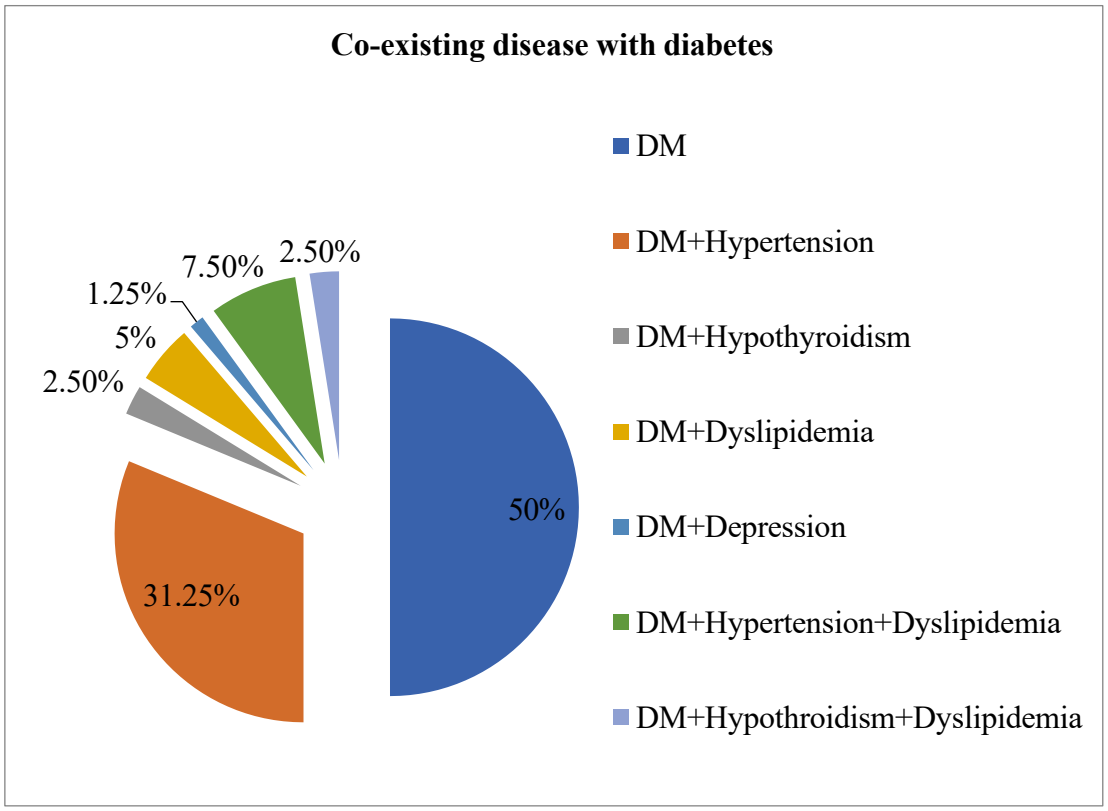

Figure 5: Distribution of patients according to co-existing disease with diabetes

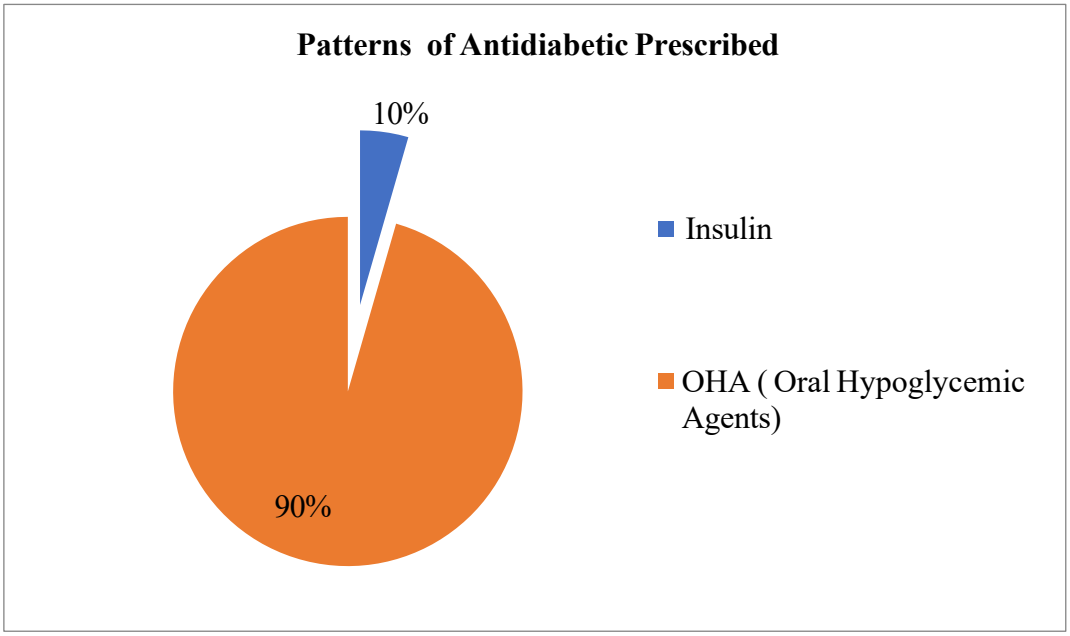

Figure 6: Pattern of antidiabetic medications

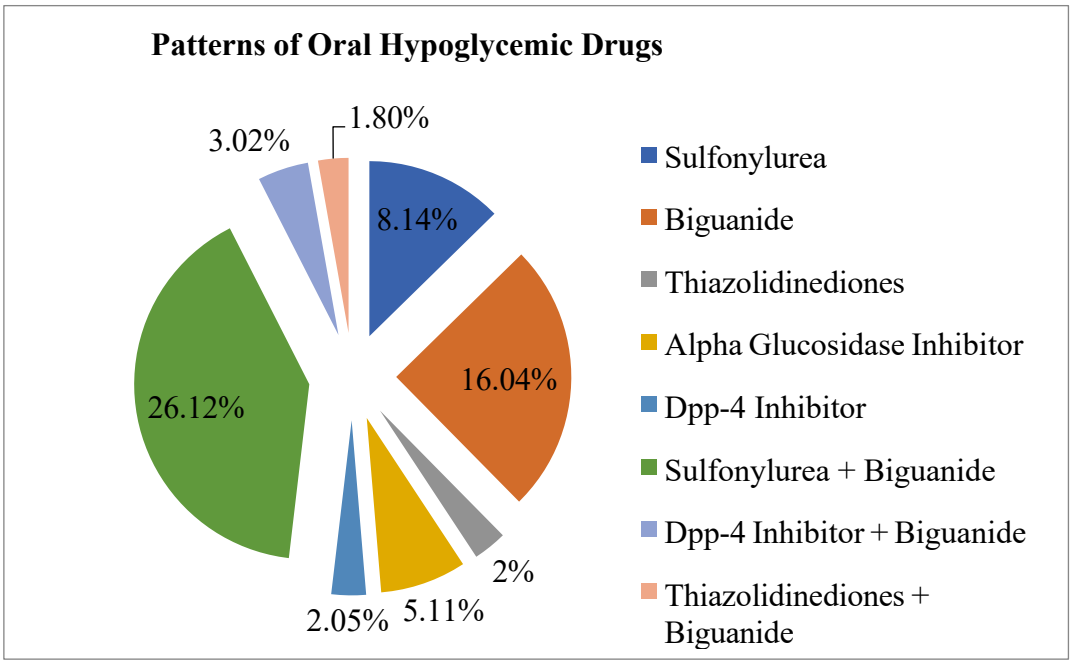

Figure 7: Pattern of Oral hypoglycemic medications

Table 1: Demographic Data of Diabetes Patients

Sr. No.	Particular	Results
1	Total Patients Sample	100
2	Male	37.5%
3	Female	92.5%
4	Maximum Patients (40-60 yrs)	62.50%
5	Total Drug Prescribed	226
6	Average drug per prescription	2.26
7	Antidiabetic Drug Prescribed	152(67.26%)
8	Most common antidiabetic drug Prescribed	Metformin
9	Most common fixed dose combination of Antidiabetic prescribed	Glimepiride + Metformin
10	Other drug Prescribed	Antihypertensive, Hypolipidemic, antiplatelet, Antithyroid etc

Table 2: Price Variation Among Commonly Prescribed Antidiabetic Drugs

Sr. No.	Antidiabetic drug	Strength	Price variation (%)	Interpretation
1	Glimepiride	2 mg	829.72	Maximum price variation
2	Metformin	500 mg	384.18	Common prescribed drug
3	Acarbose	25 mg	83.12	Least price variation

DISCUSSION

The present cross-sectional observational study provides a comprehensive evaluation of cardio-metabolic parameters and antidiabetic drug utilization patterns among 100 patients with type 2 diabetes mellitus (T2DM) attending a tertiary care teaching hospital. The study concluded that most patients had diabetes for less than 5 years, with a high prevalence of abnormal waist-to-hip ratio and associated hypertension. Oral hypoglycemic agents were predominantly prescribed, with metformin being the most commonly used drug. Significant price variation was observed among antidiabetic medicines, with glimepiride 2 mg showing the highest variation and acarbose 25 mg the lowest. These findings emphasize the need for rational and cost-effective prescribing to reduce the economic burden of long-term diabetes treatment.

Cardio-Metabolic parameters and their clinical implications: The increased risk of cardiovascular disease in T2DM patients is partly due to the abnormalities in the lipid profile accompanying T2DM. Various studies have

reported the association between HbA1c and one or more parameters of the lipid profile in T2DM patients, and some studies suggested HbA1c as a possible biomarker for recognizing the abnormal lipid profile of T2DM patients and for identifying the T2DM patients at risk of cardiovascular disease. [9,10] HbA1c ≥7% in the study indicates poor glycemic control in the majority of patients, consistent with median fasting plasma glucose of ≥125 mg/dL and post-prandial glucose of ≥180 mg/dL. The present study showed abnormal waist/Hip ration in 95% patients. This level of hyperglycemia is associated with elevated cardiovascular risk and mirrors findings from multiple tertiary care settings in India and globally. For instance, a 2023 study reported a strong positive correlation between HbA1c and adverse lipid profiles in T2DM patients, underscoring the atherogenic dyslipidemia commonly observed in uncontrolled diabetes. [11] Similarly, a 2025 comparative analysis of lipid metabolism in T1DM versus T2DM patients at a tertiary hospital demonstrated that T2DM individuals exhibited higher rates of obesity (63.6%), abnormal triglycerides, and low HDL-C, directly linked to longer disease duration and poorer HbA1c control. [12]

Another prospective observational study highlighted the effectiveness of early induction of triple-drug therapy involving glimepiride, metformin, and pioglitazone in newly diagnosed T2DM patients. The study reported significant reductions in glycated hemoglobin (HbA1c), fasting plasma glucose, and low-density lipoprotein (LDL) levels over a year, emphasizing the advantage of combination therapy in managing advanced glycemic control while minimizing hypoglycemia risks.[13] Further investigating drug utilization patterns, a cross-sectional study in South India demonstrated a high prevalence of dyslipidemia among T2DM patients, where 69% exhibited deranged lipid profiles. Statins were the most prescribed hypolipidemic drugs, and the findings established a significant correlation between increased body mass index (BMI) and dyslipidemia, alongside the critical role of pharmacotherapy in controlling lipid abnormalities. [14] Diabetes with Hypertension and Diabetes with dyslipidemia were prevalent comorbidities in our study, aligning with the well-documented clustering of cardio-metabolic risk factors in T2DM. A Tanzanian tertiary hospital study reported high prevalence of dyslipidemia among diabetic outpatients, with abnormal lipid profiles correlating significantly with BMI and blood pressure elevations. In the present study, higher BMI (>25 kg/m² in ~43%) were associated with worse cardio-metabolic indices, reinforcing the bidirectional relationship between insulin resistance, central obesity, and cardiovascular risk. These parameters collectively amplify the 2–4-fold increased risk of major adverse cardiovascular events in T2DM, as emphasized in the 2025 American Diabetes Association (ADA) Standards of Care. [15]

Drug Utilization Patterns and Comparison with Literature The average number of drugs prescribed per prescription was 2.26, which exceeded the WHO-recommended range of 1.6–1.8 drugs per encounter, indicating a tendency toward polypharmacy. However, this value was lower than that reported in some previous Indian tertiary-care studies, where an average of 4–5 drugs per prescription has been documented. It is important to interpret the average number of drugs in relation to the clinical profile of the study population, because patients with diabetes frequently have comorbidities requiring additional medications. WHO has identified the average number of medicines per encounter as an important indicator for assessing prescribing practices and potential polypharmacy.

In the present study, insulin was prescribed in 10% of cases, whereas oral antidiabetic drugs accounted for 90% of prescriptions, demonstrating a clear preference for oral therapy. Metformin was the most frequently prescribed antidiabetic drug (26.12%) and was commonly used as monotherapy. Its predominant use may be attributed to its established position as a first-line therapy for type 2 diabetes mellitus, owing to its efficacy, safety profile, affordability, and favorable effect on glycemic control. Among combination therapies, glimepiride + metformin was the most frequently prescribed dual-drug regimen, reflecting the common use of combination therapy when glycemic control is not adequately achieved with monotherapy. The predominance of glimepiride–metformin should also be interpreted in the context of evolving diabetes treatment recommendations. Although sulfonylureas remain effective and relatively inexpensive, newer agents such as SGLT2 inhibitors and GLP-1 receptor agonists may be preferred in patients with established cardiovascular disease, heart failure, chronic kidney disease, or specific weight-management needs because of their demonstrated cardiorenal and metabolic benefits. Thus, the prescribing pattern observed in the study may reflect local factors such as affordability, availability, physician preference, familiarity with established therapies, and patient characteristics. [16,17]

Cost Variations: The present study demonstrated considerable variation in the prices of commonly prescribed antidiabetic drugs. Among the drugs evaluated, glimepiride 2 mg showed the highest percentage price variation (829.72%), followed by metformin 500 mg (384.18%), whereas acarbose 25 mg showed the least price variation (83.12%). The marked variation indicates substantial differences in the prices of different brands or formulations of the same antidiabetic drug and may have important implications for the affordability of long-term diabetes therapy. The highest price variation was observed with glimepiride 2 mg. This finding suggests that patients may pay considerably different prices depending on the brand prescribed or purchased. Similar wide variations in the cost of glimepiride have been reported in previous studies conducted in India. Karoli et al. reported a very high percentage cost variation for glimepiride among antidiabetic medicines, highlighting the potential economic benefit of substituting expensive branded preparations with less expensive alternatives.[18] Metformin 500 mg demonstrated a high price variation of 384.18%. Metformin is widely used and is considered a first-line pharmacological treatment for type 2 diabetes mellitus; therefore, differences in its price may have a substantial cumulative effect on patients requiring lifelong treatment. Current Indian recommendations emphasize that the choice of oral antidiabetic therapy should consider efficacy, safety, comorbidities, and cost. [19] In contrast, acarbose 25 mg showed the lowest price variation in the present study (83.12%). Although this variation was considerably lower than that observed for glimepiride and metformin, it still represents a meaningful difference in the cost of treatment. Recent Indian data have shown that alpha-glucosidase inhibitors such as acarbose and voglibose can also have differences between generic and branded prices, although the magnitude may vary according to the formulation and market studied. [20] Overall, the present findings demonstrate that substantial inter-brand price variation exists among commonly prescribed antidiabetic drugs, particularly

glimepiride and metformin. This emphasizes the need for greater awareness among prescribers and patients regarding available price alternatives and supports the promotion of rational generic prescribing as one strategy for reducing the economic burden of diabetes management.

Strengths, Limitations, and Future Directions Strengths include a sample size, simultaneous assessment of clinical parameters and real-world tertiary hospital data. Main limitation of the study is that it is a single center and cross-sectional study, follow-up of patients was not carried out for glycemic control which may be circumvented by planning future multicenter and prospective studies. Future research should incorporate prospective, multi-center. Implementation strategies such as physician education, electronic decision-support tools, and subsidized access to cardioprotective drugs could bridge the evidence–practice gap. Multidisciplinary cardio-metabolic clinics integrating lifestyle counseling, regular audits, and patient education are urgently needed to improve outcomes.

CONCLUSION

Hypertension was the predominant co-morbidity present among diabetic patients. Metformin was common Oral antidiabetic drug prescribed. Glimepiride shows maximum price variation percentage. Acarbose shows least price variation. By analyzing these cost differences, the study seeks to highlight the financial barriers faced by patients and promote more cost-effective prescribing practices. This is particularly relevant in India, where the affordability of long-term diabetes management is a critical factor in improving patient outcomes and reducing the burden of diabetes complications.

CONFLICT OF INTEREST

The Authors Declare there is no Conflict of Interest

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