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Original Research Article

# Evaluation of Antidiabetic Medication Use in Type 2 Diabetes: A Hospital-Based Study in Central India

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**Conflict of interest: Nil**

**Abstract**

**Background:** Type 2 Diabetes Mellitus imposes a considerable strain on the Indian healthcare system, with rising prevalence, early age of onset, and complex pharmacological needs. Evaluating drug utilization patterns is critical to ensuring rational prescribing, improving glycemic control, and aligning with evidence-based treatment guidelines.

**Objective:** To analyze the prescribing patterns of antidiabetic medications in patients with T2DM at a tertiary care facility in Central India, with emphasis on drug used, combination therapy, and demographic data.

**Material and Methods:** A prospective exploratory study was performed from January 2022 to December 2024 at Index Medical College, Indore. A total of 408 T2DM patients (aged ≥20 years) attending the OPD were enrolled. Demographic data, comorbidities, and medication prescriptions were gathered via a structured case report form. Descriptive and inferential statistical analyses were performed using SPSS v30. A p-value < 0.05 was regarded as statistically significant.

**Results:** The mean chronological age of the study population was 45.74 ± 10.61years, with a significant male predominance (56.61%). The predominant age group was 41-50 years, comprising 39.95%. Metformin was the most commonly prescribed medication (40.75%), succeeded by glimepiride (21.66%), sitagliptin (10.47%), and dapagliflozin (7.17%). Combination therapy was more prevalent (60.54%) compared to monotherapy (39.46%), with dual therapy (48.04%) being significantly more common than triple therapy (12.5%). The most prescribed fixed-dose combination was metformin with glimepiride (19.12%). The Body Mass Index (BMI) and Glycated hemoglobin (HbA1c) values exhibited a positive connection (r = 0.997). indicating a relationship between obesity and poor glycemic control.

**Conclusion:** This study highlights a strong preference for metformin-based combination regimens, reflecting adherence to standard treatment protocols. The high prevalence of polypharmacy and significant associations with comorbidities underscore the need for periodic prescription audits and individualized therapy to ensure rational drug use and optimize patient outcomes.

**Keywords:** Type 2 Diabetes Mellitus, Drug Utilization, Prescribing Patterns, Combination Therapy, Polypharmacy.

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## Introduction

Type 2 Diabetes Mellitus (T2DM) is a progressive metabolic condition marked by persistent hyperglycemia resulting from inadequate insulin production and/or insulin resistance. It is associated with multisystem complications, particularly affecting cardiovascular, renal, and neurological systems, and is a primary factor in worldwide morbidity and mortality. India bears one of the highest burdens of T2DM worldwide, with a prevalence exceeding 14% among adults and

substantial regional variation in disease awareness and management strategies[1].

Rational pharmacotherapy is central to achieving optimal glycemic control and preventing complications. However, real-world evidence in India has revealed significant deviations from standard treatment guidelines, including irrational polypharmacy, low utilization of cost-effective generics, and inconsistent incorporation of newer agents with cardiovascular and renal benefits[2]. Inappropriate prescribing practices contribute to suboptimal outcomes, especially in resource-limited settings with high rates of comorbidities such as hypertension, dyslipidemia, and obesity[3]. Drug utilization studies (DUS) are essential for monitoring prescription patterns, evaluating adherence to clinical guidelines, and informing interventions to promote rational and cost-effective medication use[1]. In India, where therapeutic decision-making is often influenced by economic, demographic, and healthcare access disparities, DUS play a crucial role in guiding clinical practice and policy reforms[2].

The present study evaluated the prescribing trends of antidiabetic medications among patients with T2DM at a tertiary care hospital in Central India. The objective was to analyze drug class preferences, monotherapy versus combination regimens, and associations with demographic variables and comorbidities, with the goal of identifying areas for improving pharmacological care in diabetic patients.

## Material and Methods

**Study Design:** A prospective exploratory study was performed at the outpatient department of Index Medical College Hospital and Research Centre, Indore, Madhya Pradesh, India. The facility operated as a tertiary care teaching hospital, catering to a diverse population from urban, semi-urban, and rural areas in Central India. The research was carried out during 3 year duration from Jan 2022 to Dec 2024.

**Study Objectives:** The main aim of the study was to assess the drug use patterns of antidiabetic drugs in adult patients with Type 2 Diabetes Mellitus. Secondary objectives included analyzing prescribing trends based on demographic variables and assessing adherence to rational drug use principles as outlined by World Health Organization (WHO).

**Study Population:** The study population comprised adult patients attending the outpatient department (OPD) who had been previously diagnosed with T2DM and were on active pharmacological management.

**Inclusion Criteria**

- Individuals aged 20 years or older.
- Diagnosis of Type 2 Diabetes Mellitus confirmed under American Diabetes Association (ADA) or WHO standards.
- On antidiabetic pharmacotherapy for at least three consecutive months before the date of enrollment.
- Provided voluntary, written informed consent for participation.

**Exclusion Criteria**

- Patients diagnosed with Type 1 Diabetes Mellitus, gestational diabetes, or other specific types of diabetes.
- Patients with acute medical illness, terminal disease, or requiring emergency care.
- Patients with cognitive impairment, psychiatric conditions, or language barriers that precluded informed consent or reliable history.
- Those unwilling or unable to comply with the study procedures.

**Sample Size and Sampling Technique:** Sample size was calculated by using formula $n= Z^2 X P X(1-P)/d^2$ . 10% accounts for dropouts or incomplete information was added to it. A total of 408 patients were recruited by convenience sampling. The sample size was sufficient to identify common prescribing trends based on regional outpatient volume and T2DM prevalence.

**Data Collection Tools and Procedure:** Patient data were collected at the time of consultation through direct patient interviews and medical record review using a pre-designed, pre-tested, structured Case Report Form (CRF). The CRF captured the following domains:

- Demographics: age, gender, residence, socioeconomic status, education level.
- Clinical profile: comorbidities, height, weight, body mass index (BMI), glycated hemoglobin (HbA1c).
- Prescription data: drug name, class, dose, frequency, route, formulation, and duration of therapy.
- Prescriptions were reviewed for completeness, rationality, and adherence to guidelines using the WHO Core Drug Use Indicators[i], which include:
- Mean quantity of medications per prescription.
- The percentage of prescriptions comprising fixed-dose combos.
- The percentage of prescriptions adhering to the essential medicines list.

**Statistical Analysis:** All data were input into Microsoft Excel and later analyzed using IBM SPSS Statistics for Windows, Version 30.0 (IBM Corp., Armonk, NY, USA).

Descriptive statistics (mean, standard deviation, frequency, and percentage) were employed to describe patient demographics and prescribing customs.

- The Chi-square test was utilized to ascertain relationships between categorical variables, including gender and therapy type (monotherapy versus combination therapy).
- Pearson's correlation coefficient was employed to evaluate the association between BMI and HbA1c levels.
- A one-way analysis of variance (ANOVA) was utilized to examine mean HbA1c levels across various BMI groups.
- A p-value of less than 0.05 was deemed statistically significant.

**Ethical Considerations:** The Institutional Ethics Committee of Malwanchal University approved the protocol on 23.11.2021 (MU/Research/EC/Ph.D./2021/93a), prior to the commencement of patient recruitment. Written informed consent was obtained from all participants after elucidating the study's goal, procedures, risks, and benefits in their native language. Participant anonymity and data confidentiality were rigorously upheld during the research process. This study aligned to the principles of the Declaration of Helsinki and subsequently followed to Good Clinical Practice guidelines as established by the International Council for Harmonisation[4,5].

## Results

**Demographic and Clinical Characteristics:** Among 408enrolled patients with Type 2 Diabetes Mellitus, the average age was 45.74 ± 10.61 years. The predominant age group was 41–50 years (n = 163; 39.95%), succeeded by 51–60 years (n = 108; 26.47%) and 31–40 years (n = 76; 18.63%). A statistically significant difference in age group distribution was observed ($p < 0.0001$), confirming the predominance of middle-aged patients in this study.

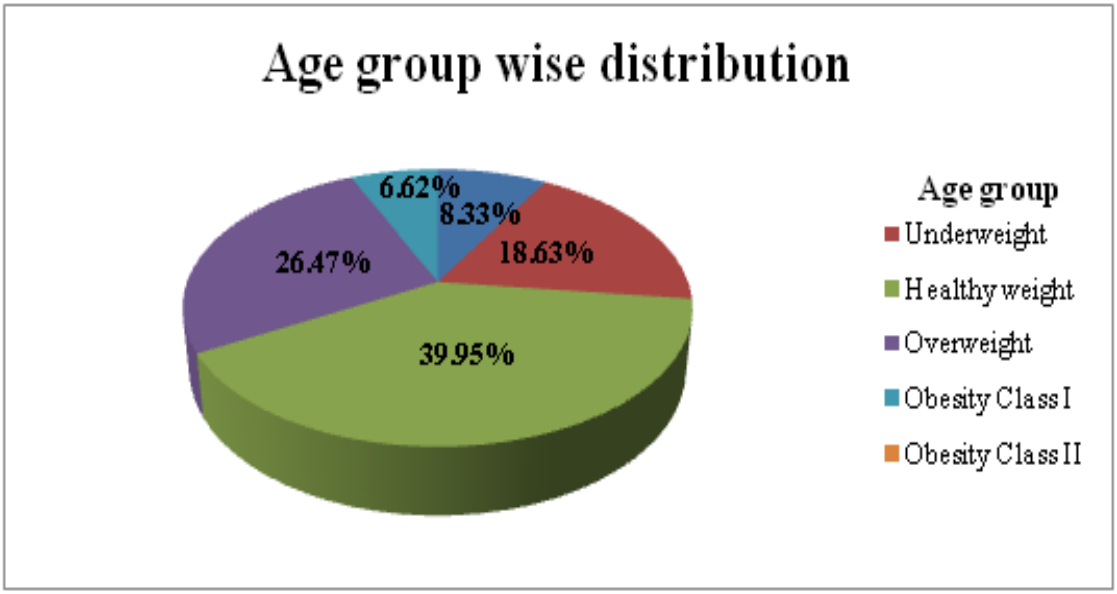


**Figure 1: Age-wise distribution of T2DM patients**

Figure 1 depicted the age distribution of the study population, highlighting the concentration of cases in the 41–60-year range, consistent with known T2DM epidemiology in India. A gender-wise breakdown revealed that 231 (56.61%) patients were male and 177 (43.38%) were female. The gender distribution was statistically significant ($p < 0.01$), suggesting a higher proportion of T2DM detection or reporting among males.

**Table 1: Gender-wise distribution of T2DM patients**

| Gender | No. of patients | Percentage | P value |
|---|---|---|---|
| Male | 231 | 56.61 % | <0.01 |
| Female | 177 | 43.38 % | |

Table 1 shows the gender distribution, where males constitute a significantly larger proportion of the study population, possibly due to higher health-seeking behavior or greater risk factor exposure in men.

**Patterns of Antidiabetic Therapy**

Among all prescriptions analyzed:

- 161 (39.46%) patients received monotherapy,
- 196 (48.04%) received dual drug therapy,
- 51 (12.5%) received triple drug therapy.

This distribution was statistically significant ($p < 0.0001$), indicating that dual therapy is the predominant prescribing pattern, potentially reflecting progressive disease or attempts at tighter glycemic control.

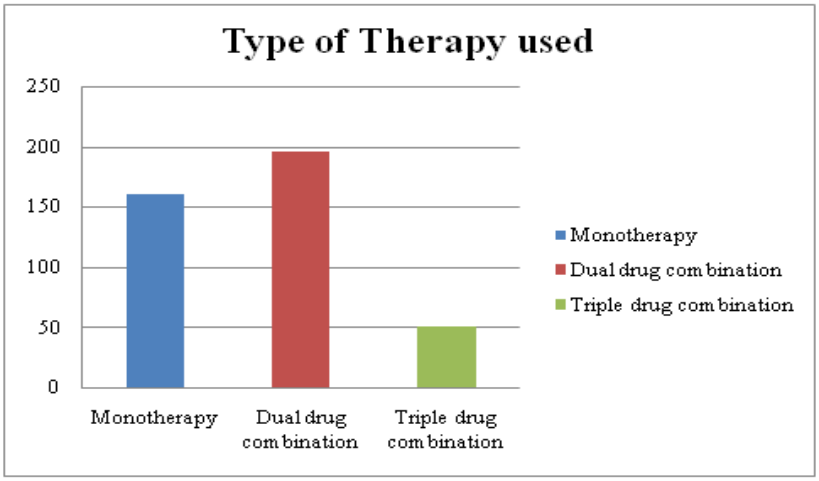


**Figure 2: Distribution of therapy types**

Figure 2 presented the relative proportions of patients on each regimen, demonstrating the shift away from monotherapy toward combination regimens in contemporary practice.

**Drug Utilization Profile:** Metformin was the most commonly prescribed medication (n = 284; 40.75%), subsequent to glimepiride (n = 151; 21.66%), and sitagliptin (n = 73; 10.47%). Dapagliflozin (n = 50; 7.17%) and vildagliptin (n = 52; 7.46%) showed moderate usage, reflecting growing but cautious adoption of newer antidiabetic agents.

Insulin use was reported in 19 patients (2.73%), indicating its reserved use for patients with poor glycemic control or contraindications to oral agents.

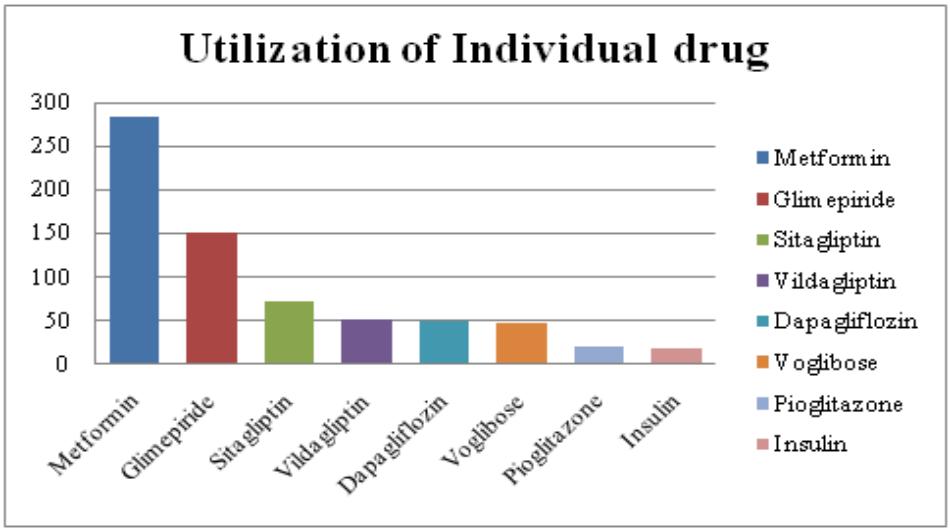


**Figure 3: Utilization of individual antidiabetic drugs**

Figure 3 showed the number of prescriptions for each antidiabetic drug. The dominance of metformin aligns with global and national guidelines recommending it as first-line therapy, while sulfonylureas (glimepiride) remain common due to cost and accessibility.

**HbA1c Levels Across BMI Categories:** To evaluate the effect of body weight on glycemic control, HbA1c values were analyzed across three BMI categories—Normal, Overweight, and Obese—utilizing a one-way ANOVA test.

The findings indicated a statistically significant difference between the groups ($F(2, 87) = 199.34$, $p < 0.001$).

**Table 2: Comparison of Mean HbA1c Levels Across BMI Categories**

| BMI Category | Mean HbA1c (%) | Standard Deviation (SD) | n |
|---|---|---|---|
| Normal | 6.21 | 0.31 | 30 |
| Overweight | 7.13 | 0.42 | 30 |
| Obese | 8.20 | 0.50 | 30 |

As shown in Table 2, mean HbA1c was:

- 6.21 ± 0.31% in patients with normal BMI,
- 7.13 ± 0.42% in overweight patients, and
- 8.20 ± 0.50% in obese patients.

This indicated that glycemic control worsened as adiposity increases.

**Discussion**

This observational study investigated prescribing patterns in patients with Type 2 Diabetes Mellitus within a tertiary care setting in Central India. The results demonstrate a strong preference for metformin-based combination therapy, a high burden of polypharmacy due to comorbidities, and an age-related increase in treatment intensity.

The demographic characteristics revealed that T2DM predominantly affects middle-aged adults, particularly those between 41 and 60 years, consistent with data from the ICMR-INDIAB study which showed similar age clustering across Indian states[2]. Male predominance in this study (56.61%) is also in line with national trends and may reflect differences in healthcare-seeking behavior or metabolic risk exposure between genders[6, 7].

Metformin was the most frequently prescribed drug (40.75%), reinforcing its role as the first-line therapy recommended by both national and international guidelines for its safety, cost-effectiveness, and cardiovascular benefits[8]. Its dominance was also reported in the Chennai Urban Population Study and other Indian studies, which found metformin use ranging from 45% to 60% among diabetic patients[9].

The frequent use of glimepiride (21.66%) reflects persistent reliance on sulfonylureas in Indian practice, likely due to affordability and clinical familiarity. Although newer agents such as Dipeptidyl Peptidase-4(DPP-4) inhibitors (e.g., sitagliptin) and sodium-glucose transport-2 (SGLT-2) inhibitors (e.g., dapagliflozin) showed moderate use (10.47% and 7.17%, respectively), their uptake was lower compared to global patterns. For example, studies from Europe and the USA report SGLT-2 inhibitor use exceeding 25–30%, supported by cardiovascular outcome trial (CVOT) evidence[10].

Our findings also indicated that dual therapy was the most common treatment regimen (48.04%), followed by monotherapy (39.46%) and triple therapy (12.5%). This is consistent with evolving clinical practices promoting early combination therapy to achieve glycemic targets efficiently. The study supported this approach by demonstrating the long-term durability of early dual therapy over monotherapy[11].

Importantly, we observed a statistically significant association between therapy complexity and age group ($p < 0.001$), with older patients more likely to receive combination therapies. This trend reflects longer disease duration, worsening β-cell function, and the presence of comorbidities. Such age-related intensification of therapy has also been reported in North Indian studies evaluating guideline adherence[12].

Polypharmacy was seen in 34% of patients, primarily due to coexisting hypertension, dyslipidemia, and microvascular complications. Although necessary in many cases, polypharmacy increases the risk of drug interactions, non-adherence, and financial burden. This is particularly important in elderly or low-income populations, where appropriate medication review and deprescribing are essential for safe diabetes care[13].

A significant finding was the strong positive correlation between BMI and HbA1c ($r = 0.997$). This aligns with well-established evidence linking obesity with insulin resistance and poor glycemic control. Our results support lifestyle-based interventions in conjunction with pharmacotherapy, especially for overweight and obese patients[14].

Overall, the prescribing patterns identified in this study reflect both adherence to standard practices and gaps that require attention—especially the limited use of newer agents with proven cardiovascular and renal benefits. Cost, accessibility, and physician training are critical areas that must be addressed to ensure equitable and guideline-based diabetes care across all patient populations.

**Conclusion**

This study highlights critical trends in the pharmacological management of Type 2 Diabetes Mellitus in a tertiary care centre in India. Metformin-based regimens remain the cornerstone of therapy, while dual combination treatments are increasingly favored. However, the low uptake of newer antidiabetic agents and significant prevalence of polypharmacy suggest a need for

policy interventions to improve rational drug use. The positive correlation between BMI and HbA1c reinforces the importance of weight management in diabetes care. The findings underscore the necessity for individualized, evidence-based treatment protocols that consider patient-specific factors such as age, BMI, and comorbidities.

Regular prescription audits, adherence to treatment guidelines, and continuous education for healthcare providers are essential to optimize diabetes care and improve long-term outcomes in the Indian population.

**Acknowledgement:** We sincerely thank all the study participants for their valuable time and efforts.

**Ethical Considerations:** The protocol was approved by the Institutional Ethics Committee of Malwanchal University on 23.11.2021 (MU/Research/EC/Ph.D./2021/93a). Written informed consent was obtained from all participants. Confidentiality was maintained. The study conformed to the Declaration of Helsinki (2013) and ICH-GCP guidelines.

**Data Access:** The datasets generated and analyzed during the current study are not publicly available due to institutional regulations and confidentiality agreements with the participating patients. All data were anonymized prior to analysis to ensure participant privacy and compliance with ethical standards.

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**Conflicts of interest:** The authors declare that there is no conflict of interest.

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